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Radio transmission and reception;  
Part 5: Satellite access Radio Frequency (RF) and performance  
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# Foreword

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

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

Version x.y.z

where:

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

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.

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## 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, "Unwanted emissions in the spurious domain"
- [16] 3GPP TS 38.214: "NR; Physical layer procedures for data".
- [17] 3GPP TS 38.211: "NR; Physical channels and modulation".
- [18] 3GPP TR 38.811: "Study on New Radio (NR) to support non-terrestrial networks".

- [19] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".
- [20] EN 303 978, Satellite Earth Stations and Systems (SES); Harmonised Standard for Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in geostationary orbit, operating in the 27,5 GHz to 30,0 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU, v2.1.2, 2016-10.
- [21] EN 301 459, Satellite Earth Stations and Systems (SES); Harmonised Standard for Satellite Interactive Terminals (SIT) and Satellite User Terminals (SUT) transmitting towards satellites in geostationary orbit, operating in the 29,5 GHz to 30,0 GHz frequency bands covering the essential requirements of article 3.2 of the Directive 2014/53/EU, v2.1.1, 2016-05.
- [22] IEEE Std 149: "IEEE Standard Test Procedures for Antennas", IEEE.

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## 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].

**"Carrier-off" state:** radio state in which the NTN VSAT may transmit but does not transmit any carrier.

NOTE: "NTN VSAT may transmit" means that all the conditions for transmission are satisfied (e.g. in a state where transmissions are permitted, no failure detected, and the NTN VSAT is correctly pointed towards the satellite).

NOTE: The existence of a "Carrier-off" radio state depends on the system of transmission used. For NTN VSATs designed for continuous transmission mode there may be no "Carrier-off" state.

**"Carrier-on" state:** Radio state in which the NTN VSAT may transmit and transmits a carrier.

**Co-polarized transmission:** when the DUT transmission antenna polarization is aligned with test antenna polarization.

**Cross-polarized transmission:** when the DUT transmission antenna polarization is aligned with the tangent of the test antenna polarization.

**Emissions disables state:** Radio state in which the ESOMP is not emitting (e.g. before system monitoring pass, before the control channel is received, when a failure is detected, when an ESOMP is commanded to disable, and when the ESOMP is in a location requiring cessation of emissions).

**Enhanced channel raster:** channel raster with a 10 kHz granularity in bands with a 100 kHz channel raster.

**Feeder link:** A radio link from an earth station at a given location to a space station, or vice versa, conveying information for a space radiocommunication service other than for the fixed-satellite service. The given location may be at a specified fixed point, or at any fixed point within specified areas.

**Fixed Satellite Service:** A radiocommunication service between earth stations at given positions, when one or more satellites are used; the given position may be a specified fixed point or any fixed point within specified areas; in some cases this service includes satellite-to-satellite links, which may also be operated in the inter-satellite service; the fixed-satellite service may also include feeder links for other space radiocommunication services.

**Fixed VSAT:** VSAT used in FSS system at given position; the given position may be a specified fixed point or any fixed point within specified areas.

NOTE: Mobile VSAT is excluded from this definition.

**Geostationary-Satellite Orbit:** The orbit of a geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator.

**Geostationary satellite:** A geosynchronous satellite whose circular and direct orbit lies in the plane of the Earth's equator and which thus remains fixed relative to the Earth; by extension, a geosynchronous satellite which remains approximately fixed relative to the Earth.

**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.

**Geosynchronous satellite:** An earth satellite whose period of revolution is equal to the period of rotation of the Earth about its axis.

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

**Mobile VSAT:** VSAT on moving platform, and which can be further declined in three types: airborne, maritime or land based.

NOTE: Mobile VSAT can be also referred to as ESIM or ESOMP.

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

**NTN VSAT:** a UE operating in FR2-NTN which could be a Fixed VSAT or a Mobile VSAT.

**Plane perpendicular to the GSO arc:** The plane that is perpendicular to the “plane tangent to the GSO arc,” as defined below, and includes a line between the [earth station](#) in question and the GSO [space station](#) that it is communicating with (FCC 47 CFR 25.103).

**Plane tangent to the GSO arc:** The plane defined by the location of an [earth station](#)'s transmitting antenna and a line in the equatorial plane that is tangent to the GSO arc at the location of the GSO [space station](#) that the [earth station](#) is communicating with (FCC 47 CFR 25.103).

**Satellite:** A space-borne vehicle embarking a transparent 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:** node providing NR user plane and control plane protocol terminations towards NTN satellite capable UE, and connected via the NG interface to the 5GC. It encompasses a transparent payload on board a NTN platform, with satellite-gateway and gNB functions.

**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:

|                                        |                                                                                                                                       |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| $\Delta F_{\text{Global}}$             | Granularity of the global frequency raster                                                                                            |
| $\Delta F_{\text{Raster}}$             | Band dependent channel raster granularity                                                                                             |
| $BW_{\text{Channel}}$                  | Channel bandwidth                                                                                                                     |
| $BW_{\text{interferer}}$               | Bandwidth of the interferer                                                                                                           |
| $F_{\text{DL\_low}}$                   | The lowest frequency of the downlink <i>operating band</i>                                                                            |
| $F_{\text{DL\_high}}$                  | The highest frequency of the downlink <i>operating band</i>                                                                           |
| $F_{\text{UL\_low}}$                   | The lowest frequency of the uplink <i>operating band</i>                                                                              |
| $F_{\text{UL\_high}}$                  | The highest frequency of the uplink <i>operating band</i>                                                                             |
| $F_{\text{Interferer}}$                | Frequency of the interferer                                                                                                           |
| $F_{\text{Interferer}}(\text{offset})$ | Frequency offset of the interferer (between the center frequency of the interferer and the carrier frequency of the carrier measured) |
| $F_{\text{loffset}}$                   | Frequency offset of the interferer (between the center frequency of the interferer and the closest edge of the carrier measured)      |
| $F_{\text{OOB}}$                       | The boundary between the NR out of band emission and spurious emission domains                                                        |
| $F_{\text{REF}}$                       | RF reference frequency                                                                                                                |
| $F_{\text{REF-Offs}}$                  | Offset used for calculating $F_{\text{REF}}$                                                                                          |
| $F_{\text{uw}}(\text{offset})$         | The frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer  |
| $N_{\text{RB}}$                        | Transmission bandwidth configuration, expressed in units of resource blocks                                                           |

|                         |                                                                                                                      |
|-------------------------|----------------------------------------------------------------------------------------------------------------------|
| $N_{\text{REF}}$        | NR Absolute Radio Frequency Channel Number (NR-ARFCN)                                                                |
| $N_{\text{REF-Offs}}$   | Offset used for calculating $N_{\text{REF}}$                                                                         |
| $P_{\text{Interferer}}$ | Modulated mean power of the interferer                                                                               |
| PUType                  | Minimum UE type peak EIPR (i.e. no tolerance) as specified in sub-clause 9.2.1                                       |
| $P_{\text{UW}}$         | Power of an unwanted DL signal                                                                                       |
| $\theta$                | Angle in degrees from a line from the earth station antenna to the assigned orbital location of the target satellite |
| TRPmax                  | The maximum TRP for the NTN VSAT as specified in sub-clause 9.2.1                                                    |

### 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                   |
| MOP        | Maximum Output Power                                                   |
| MPR        | Allowed maximum power reduction                                        |
| MSD        | Maximum Sensitivity Degradation                                        |
| NGEO       | Non-Geostationary Earth Orbiting                                       |
| NGSO       | Non-Geostationary-Satellite Orbit                                      |
| 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 NTN frequency ranges**

| Frequency range designation                                                                                                                   | Corresponding frequency range |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| FR1-NTN (Note 1)                                                                                                                              | 410 MHz – 7125 MHz            |
| FR2-NTN (Note 2)                                                                                                                              | 17300 MHz – 30000 MHz         |
| NOTE 1: NTN bands within this frequency range are regarded as a FR1 band when references from other specifications.                           |                               |
| NOTE 2: NTN bands within this frequency range are regarded as a FR2-1 band when references from other specifications unless otherwise stated. |                               |

## 5.2 Operating bands

### 5.2.1 General

NTN satellite covers FR1-NTN 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**

| NTN satellite operating band                                            | Uplink (UL) operating band<br>Satellite Access Node receive / UE transmit<br>$F_{UL,low} - F_{UL,high}$ | Downlink (DL) operating band<br>Satellite Access Node transmit / UE receive<br>$F_{DL,low} - F_{DL,high}$ | Duplex mode |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------|
| n256                                                                    | 1980MHz – 2010 MHz                                                                                      | 2170 MHz – 2200 MHz                                                                                       | FDD         |
| n255                                                                    | 1626.5 MHz – 1660.5 MHz                                                                                 | 1525 MHz – 1559 MHz                                                                                       | FDD         |
| n254                                                                    | 1610 – 1626.5 MHz                                                                                       | 2483.5 – 2500 MHz                                                                                         | FDD         |
| n253                                                                    | 1668 – 1675 MHz                                                                                         | 1518 – 1525 MHz                                                                                           | FDD         |
| n252                                                                    | 2000 – 2020 MHz                                                                                         | 2180 – 2200 MHz                                                                                           | FDD         |
| n251                                                                    | 1626.5 – 1660.5 MHz                                                                                     | 1518 – 1559 MHz                                                                                           | FDD         |
| n250                                                                    | 1668 – 1675 MHz                                                                                         | 1518 – 1559 MHz                                                                                           | FDD         |
| NOTE 1: NTN satellite bands are numbered in descending order from n256. |                                                                                                         |                                                                                                           |             |
| NOTE 2: FFS                                                             |                                                                                                         |                                                                                                           |             |
| NOTE 3: FFS                                                             |                                                                                                         |                                                                                                           |             |
| NOTE 4: Operating band n200 is a reserved value.                        |                                                                                                         |                                                                                                           |             |

## 5.2.3 Operating bands with radiated requirements

NTN satellite is designed to operate in the operating bands defined in Table 5.2.3-1.

**Table 5.2.3-1: Satellite operating bands in FR2-NTN**

| Satellite operating band                                                                                                                                                                | Uplink (UL) operating band<br>SAN receive / UE transmit<br>$F_{UL,low} - F_{UL,high}$ | Downlink (DL) operating band<br>SAN transmit / UE receive<br>$F_{DL,low} - F_{DL,high}$ | Duplex mode |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------|
| n512(Note 1)                                                                                                                                                                            | 27500 MHz - 30000 MHz                                                                 | 17300 MHz - 20200 MHz                                                                   | FDD         |
| n511(Note 2)                                                                                                                                                                            | 28350 MHz - 30000 MHz                                                                 | 17300 MHz - 20200 MHz                                                                   | FDD         |
| n510(Note 3)                                                                                                                                                                            | 27500 MHz - 28350 MHz                                                                 | 17300 MHz - 20200 MHz                                                                   | FDD         |
| NOTE 1: This band is applicable in the countries subject to CEPT ECC Decision(05)01 and ECC Decision (13)01.                                                                            |                                                                                       |                                                                                         |             |
| NOTE 2: This band is applicable in the USA subject to FCC 47 CFR part 25.                                                                                                               |                                                                                       |                                                                                         |             |
| NOTE 3: This band is applicable for Earth Station operations in the USA subject to FCC 47 CFR part 25. FCC rules currently do not include ESIM operations in this band (47 CFR 25.202). |                                                                                       |                                                                                         |             |

## 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.

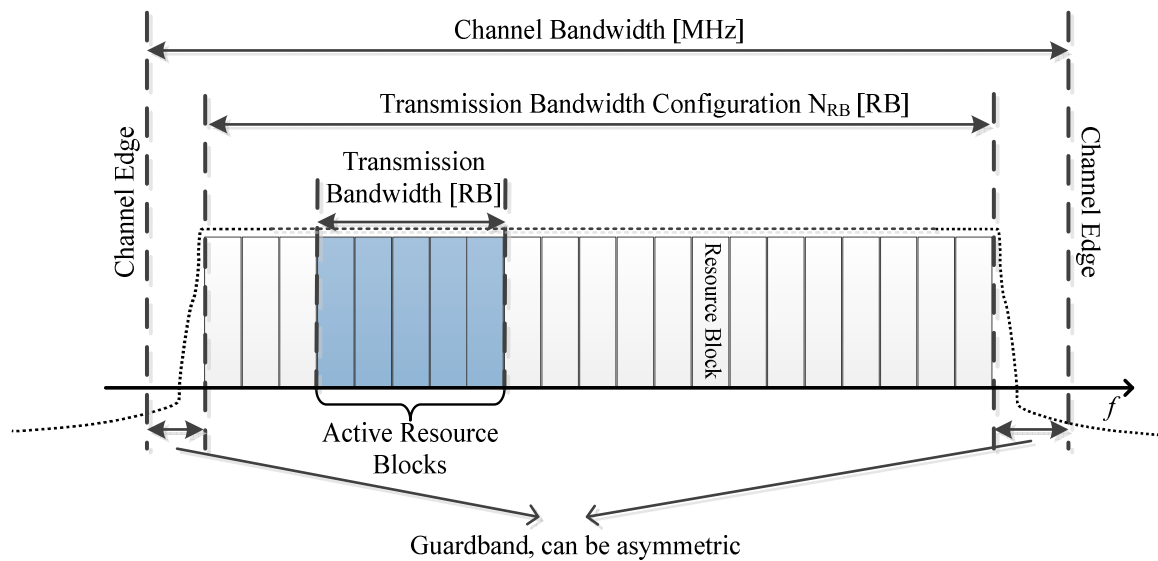


**Figure 5.3.1-1: Definition of the channel bandwidth and the maximum transmission bandwidth configuration for one channel**

### 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 for FR1-NTN and table 5.3.2-2 for FR2-NTN.

**Table 5.3.2-1: Maximum transmission bandwidth configuration  $N_{RB}$  for FR1-NTN**

| SCS (kHz) | 3 MHz    | 5 MHz    | 10 MHz   | 15 MHz   | 20 MHz   |
|-----------|----------|----------|----------|----------|----------|
|           | $N_{RB}$ | $N_{RB}$ | $N_{RB}$ | $N_{RB}$ | $N_{RB}$ |
| 15        | 15       | 25       | 52       | 79       | 106      |
| 30        | N/A      | 11       | 24       | 38       | 51       |
| 60        | N/A      | N/A      | 11       | 18       | 24       |

**Table 5.3.2-2: Maximum transmission bandwidth configuration  $N_{RB}$  for FR2-NTN**

| SCS (kHz) | 50 MHz   | 100 MHz  | 200 MHz  | 400 MHz  |
|-----------|----------|----------|----------|----------|
|           | $N_{RB}$ | $N_{RB}$ | $N_{RB}$ | $N_{RB}$ |
| 60        | 66       | 132      | 264      | N/A      |
| 120       | 32       | 66       | 132      | 264      |

### 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 for FR1-NTN and in table 5.3.3-2 for FR2-NTN.

**Table 5.3.3-1: Minimum guardband for each UE channel bandwidth and SCS (kHz) for FR1-NTN**

| SCS (kHz) | 3 MHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
|-----------|-------|-------|--------|--------|--------|
| 15        | 142.5 | 242.5 | 312.5  | 382.5  | 452.5  |
| 30        | N/A   | 505   | 665    | 645    | 805    |
| 60        | N/A   | N/A   | 1,010  | 990    | 1,330  |

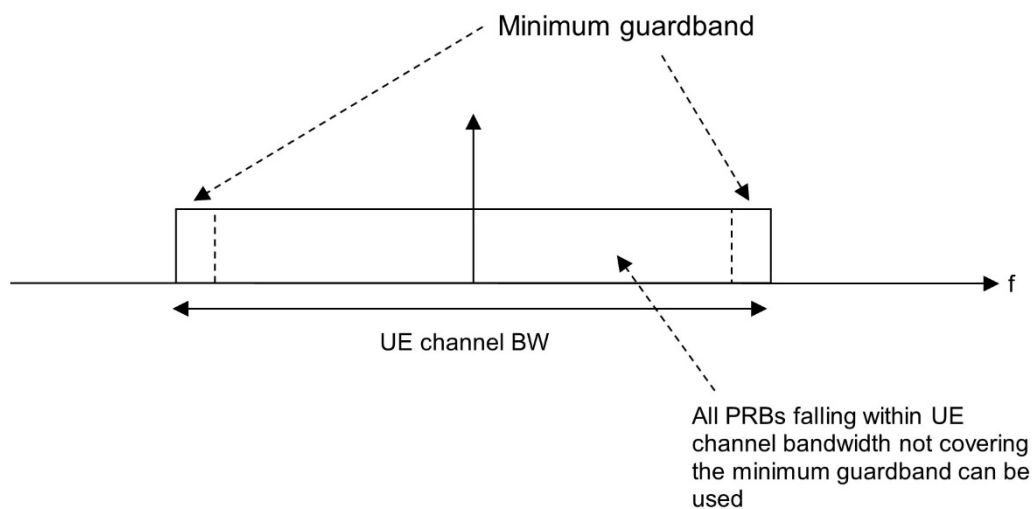
**Table 5.3.3-2: Minimum guardband for each UE channel bandwidth and SCS (kHz) for FR2-NTN**

| SCS (kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
|-----------|--------|---------|---------|---------|
| 60        | 1210   | 2450    | 4930    | N/A     |
| 120       | 1900   | 2420    | 4900    | 9860    |

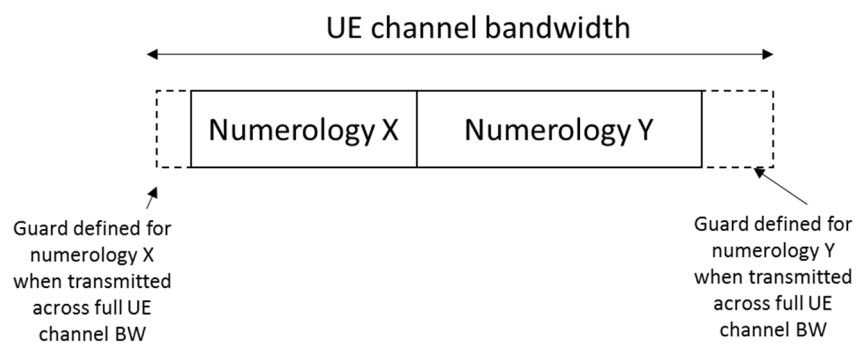
NOTE: The minimum guardbands have been calculated using the following equation:  $(BW_{\text{Channel}} \times 1,000 \text{ (kHz)} - N_{\text{RB}} \times \text{SCS} \times 12) / 2 - \text{SCS}/2$ , where  $N_{\text{RB}}$  are from Table 5.3.2-1 and Table 5.3.2-2.

**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 UE channel 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 for FR1-NTN refers to NR RB alignments as specified in 3GPP TS 38.101-1 [5] clause 5.3.4.

The RB alignment for FR2-NTN refers to NR RB alignments as specified in 3GPP TS 38.101-2 [15] 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 for FR1-NTN and table 5.3.5-2 for FR2-NTN. The transmission bandwidth configuration in Table 5.3.2-1 and Table 5.3.2-2 shall be supported for each of the specified channel bandwidths. The channel bandwidths are specified for both the TX and RX path. For UE that implement both FR1-NTN and FR2-NTN bands for the same RF frequencies, simultaneous operation is not supported.

**Table 5.3.5-1: Channel bandwidths for each NTN satellite band in FR1-NTN**

| NTN satellite band | SCS (kHz) | UE Channel bandwidth (MHz) |   |                 |                 |                 |
|--------------------|-----------|----------------------------|---|-----------------|-----------------|-----------------|
|                    |           | 3                          | 5 | 10              | 15              | 20              |
| n256               | 15        | 3 <sup>1</sup>             | 5 | 10              | 15              | 20              |
|                    | 30        |                            |   | 10              | 15              | 20              |
|                    | 60        |                            |   | 10              | 15              | 20              |
| n255               | 15        | 3 <sup>1</sup>             | 5 | 10              | 15              | 20              |
|                    | 30        |                            |   | 10              | 15              | 20              |
|                    | 60        |                            |   | 10              | 15              | 20              |
| n254               | 15        | 3 <sup>1</sup>             | 5 | 10              | 15              |                 |
|                    | 30        |                            |   | 10              | 15              |                 |
|                    | 60        |                            |   | 10              | 15              |                 |
| n253               | 15        |                            | 5 |                 |                 |                 |
|                    | 30        |                            |   |                 |                 |                 |
|                    | 60        |                            |   |                 |                 |                 |
| n252               | 15        |                            | 5 | 10              | 15              | 20              |
|                    | 30        |                            |   | 10              | 15              | 20              |
|                    | 60        |                            |   | 10              | 15              | 20              |
| n251               | 15        |                            | 5 | 10              | 15              | 20              |
|                    | 30        |                            |   | 10              | 15              | 20              |
|                    | 60        |                            |   | 10              | 15              | 20              |
| n250               | 15        |                            | 5 | 10 <sup>3</sup> | 15 <sup>3</sup> | 20 <sup>3</sup> |
|                    | 30        |                            |   | 10 <sup>3</sup> | 15 <sup>3</sup> | 20 <sup>3</sup> |
|                    | 60        |                            |   | 10 <sup>3</sup> | 15 <sup>3</sup> | 20 <sup>3</sup> |

NOTE 1: This UE channel bandwidth is optional in Rel-19.  
NOTE 3: This UE channel bandwidth is applicable only to downlink

**Table 5.3.5-2: Channel bandwidths for each NTN satellite band in FR2-NTN**

| NTN satellite band | SCS (kHz) | UE channel bandwidth (MHz) |     |                  |                  |
|--------------------|-----------|----------------------------|-----|------------------|------------------|
|                    |           | 50                         | 100 | 200              | 400              |
| n512               | 60        | 50                         | 100 | 200 <sup>1</sup> |                  |
|                    | 120       | 50                         | 100 | 200 <sup>1</sup> | 400 <sup>1</sup> |
| n511               | 60        | 50                         | 100 | 200 <sup>1</sup> |                  |
|                    | 120       | 50                         | 100 | 200 <sup>1</sup> | 400 <sup>1</sup> |
| n510               | 60        | 50                         | 100 | 200 <sup>1</sup> |                  |
|                    | 120       | 50                         | 100 | 200 <sup>1</sup> | 400 <sup>1</sup> |

NOTE 1: This UE channel bandwidth is optional in Rel-18.

### 5.3.6 Asymmetric channel bandwidths

The UE channel bandwidth can be asymmetric in downlink and uplink. In asymmetric channel bandwidth operation, the narrower carrier shall be confined within the frequency range of the wider channel bandwidth.

In FDD, the confinement is defined as a maximum deviation to the Tx-Rx carrier center frequency separation (defined in table 5.4.4-1) as following:

$$\Delta F_{\text{TX-RX}} = | (BW_{\text{DL}} - BW_{\text{UL}}) / 2 |$$

The operating bands and supported asymmetric channel bandwidth combinations are defined in table 5.3.6-1.

**Table 5.3.6-1: FDD asymmetric UL and DL channel bandwidth combinations**

| NR Band                                                                                                                                                | Channel bandwidths for UL (MHz) | Channel bandwidths for DL (MHz) | Asymmetric channel bandwidth combination set |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------|----------------------------------------------|
| n254                                                                                                                                                   | 3                               | 5,10,15                         | 1                                            |
|                                                                                                                                                        | 5                               | 10,15                           | 0                                            |
|                                                                                                                                                        | 10                              | 15                              | 0                                            |
| n252                                                                                                                                                   | 5                               | 10,15, 20                       | 0                                            |
|                                                                                                                                                        | 10                              | 15, 20                          | 0                                            |
|                                                                                                                                                        | 15                              | 20                              | 0                                            |
| n251                                                                                                                                                   | 5                               | 10, 15, 20                      | 0                                            |
|                                                                                                                                                        | 10                              | 15, 20                          | 0                                            |
|                                                                                                                                                        | 15                              | 20                              | 0                                            |
| n250                                                                                                                                                   | 5                               | 10, 15, 20                      | 0                                            |
| NOTE 1: The assignment of the paired UL and DL channels are subject to a TX-RX separation as specified in clause 5.4.4.                                |                                 |                                 |                                              |
| NOTE 2: As indicated in TS38.306 [11], it is mandatory for UEs to support asymmetric channel BCS0 if there is an asymmetric BCS0 defined for the band. |                                 |                                 |                                              |

## 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 in FR1-NTN refers to the NR channel spacing as specified in TS 38.101-1 [5] clause 5.4.1.1.

The channel spacing for adjacent NTN satellite carriers in FR2-NTN refers to the NR channel spacing as specified in 3GPP TS 38.101-2 [19] 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  $F_{\text{REF}}$ . 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  $\Delta F_{\text{Global}}$ .

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  $F_{\text{REF}}$  in MHz is given by the following equation, where  $F_{\text{REF-Offs}}$  and  $N_{\text{REF-Offs}}$  are given in Table 5.4.2.1-1 and  $N_{\text{REF}}$  is the NR-ARFCN.

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

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

| Frequency range (MHz) | $\Delta F_{\text{Global}}$ (kHz) | $F_{\text{REF-Offs}}$ (MHz) | $N_{\text{REF-Offs}}$ | Range of $N_{\text{REF}}$ |
|-----------------------|----------------------------------|-----------------------------|-----------------------|---------------------------|
| 0 – 3000              | 5                                | 0                           | 0                     | 0 – 599999                |
| 3000 – 24250          | 15                               | 3000                        | 600000                | 600000 – 2016666          |
| 24250 – 30000         | 60                               | 24250.08                    | 2016667               | 2016667 – 2112499         |

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  $\Delta F_{\text{Raster}}$ , which may be equal to or larger than  $\Delta F_{\text{Global}}$ .

For the uplink of FDD FR1 NTN bands defined in Table 5.2.2-1 except bands n247, n248

$F_{\text{REF}}, \text{shift} = F_{\text{REF}} + \Delta \text{shift}$ ,  $\Delta \text{shift} = 0$  kHz or 7.5 kHz.

where  $\Delta \text{shift}$  is signalled by the network in higher layer parameter frequencyShift7p5kHz [7].

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 in FR1-NTN refers to the NR requirements specified in 3GPP TS 38.101-1 [5] clause 5.4.2.2.

The mapping between the RF reference frequency on the channel raster and the corresponding resource element for FR2-NTN refers to the NR requirements specified in 3GPP TS 38.101-2 [19] 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,  $\Delta F_{\text{Raster}} = 20 \times \Delta F_{\text{Global}}$ . In this case every 20<sup>th</sup> 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 in FR1-NTN**

| NTN satellite operating band                                                                                                                                                 | $\Delta F_{\text{Raster}}$ (kHz) | Uplink Range of $N_{\text{REF}}$ (First – <Step size> – Last) | Downlink Range of $N_{\text{REF}}$ (First – <Step size> – Last) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------|
| n256                                                                                                                                                                         | 100                              | 396000 – <20> – 402000                                        | 434000 – <20> – 440000                                          |
| n255                                                                                                                                                                         | 100                              | 325300 – <20> – 332100                                        | 305000 – <20> – 311800                                          |
| n254                                                                                                                                                                         | 100                              | 322000 – <20> – 325300                                        | 496700 – <20> – 500000                                          |
| n253                                                                                                                                                                         | 100                              | 333600 – <20> – 335000                                        | 303600 – <20> – 305000                                          |
| n252                                                                                                                                                                         | 100                              | 400000 – <20> – 404000                                        | 436000 – <20> – 440000                                          |
| n251                                                                                                                                                                         | 100                              | 325300 – <20> – 332100                                        | 303600 – <20> – 311800                                          |
| n250                                                                                                                                                                         | 100                              | 333600 – <20> – 335000                                        | 303600 – <20> – 311800                                          |
| 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. |                                  |                                                               |                                                                 |

For NTN operating bands with 100 kHz channel raster, Enhanced channel raster is defined with  $\Delta F_{\text{Raster}} = 2 \times \Delta F_{\text{Global}}$ . In this case every 2<sup>th</sup> 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 5.4.2.3-2 is given as <2>.

**Table 5.4.2.3-2: Applicable NR-ARFCN per operating band in FR1-NTN for enhanced channel raster**

| NTN satellite operating band                                                                                                                                                                                                                                                                                                                                                                  | $\Delta F_{\text{Raster}}$ (kHz) | Uplink Range of $N_{\text{REF}}$ (First – <Step size> – Last) | Downlink Range of $N_{\text{REF}}$ (First – <Step size> – Last) | Mandatory support |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------|-------------------|
| n256                                                                                                                                                                                                                                                                                                                                                                                          | 10                               | 396000 – <2> – 402000                                         | 434000 – <2> – 440000                                           | Yes               |
| n255                                                                                                                                                                                                                                                                                                                                                                                          | 10                               | 325300 – <2> – 332100                                         | 305000 – <2> – 311800                                           | Yes               |
| n254                                                                                                                                                                                                                                                                                                                                                                                          | 10                               | 322000 – <2> – 325300                                         | 496700 – <2> – 500000                                           | Yes               |
| n253                                                                                                                                                                                                                                                                                                                                                                                          | 10                               | 333600 – <2> – 335000                                         | 303600 – <2> – 305000                                           | Yes               |
| n252                                                                                                                                                                                                                                                                                                                                                                                          | 10                               | 400000 – <2> – 404000                                         | 436000 – <2> – 440000                                           | Yes               |
| n251                                                                                                                                                                                                                                                                                                                                                                                          | 10                               | 325300 – <2> – 332100                                         | 303600 – <2> – 311800                                           | Yes               |
| n250                                                                                                                                                                                                                                                                                                                                                                                          | 10                               | 333600 – <2> – 335000                                         | 303600 – <2> – 311800                                           | Yes               |
| 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. These channel numbers shall also be such that the minimum guard band for each channel bandwidth and SCS specified in Table 5.3.3-1 are met for carriers located at the upper or lower edge of an operating band. |                                  |                                                               |                                                                 |                   |

For FR2-NTN satellite operating bands,  $\Delta F_{\text{Raster}} = I_1 \times \Delta F_{\text{Global}}$  for UL channel and  $\Delta F_{\text{Raster}} = I_2 \times \Delta F_{\text{Global}}$  for DL channel, where  $(I_1, I_2) \in \{(1,4) \text{ or } (2,8)\}$ . But  $(I_1, I_2) = (2,8)$  only applies under the condition that 120kHz SCS is configured in the channel and SSB SCS is equal to or larger than 120kHz. In this case, every  $I_1^{\text{th}}$  NR-ARFCN for UL channel and  $I_2^{\text{th}}$  NR-ARFCN for DL channel are applicable for the UL and DL channel raster correspondingly within the operating band and the  $\langle (UL\_step\ size, DL\_step\ size) \rangle$  for the UL and DL channel raster in Table 5.4.2.3-3 is given as  $\langle (I_1, I_2) \rangle$  for FR2-NTN.

**Table 5.4.2.3-3: Applicable NR-ARFCN per operating band in FR2-NTN**

| SAN operating band | $\Delta F_{\text{Raster}}$ (kHz) | Uplink range of $N_{\text{REF}}$ (First – <Step size> – Last) | Downlink range of $N_{\text{REF}}$ (First – <Step size> – Last) |
|--------------------|----------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------|
| n512               | 60                               | 2070833 – <1> – 2112499                                       | 1553336 – <4> – 1746664                                         |
|                    | 120                              | 2070833 – <2> – 2112499                                       | 1553336 – <8> – 1746664                                         |
| n511               | 60                               | 2084999 – <1> – 2112499                                       | 1553336 – <4> – 1746664                                         |
|                    | 120                              | 2084999 – <2> – 2112499                                       | 1553336 – <8> – 1746664                                         |
| n510               | 60                               | 2070833 – <1> – 2084999                                       | 1553336 – <4> – 1746664                                         |
|                    | 120                              | 2070833 – <2> – 2084999                                       | 1553336 – <8> – 1746664                                         |

## 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  $SS_{\text{REF}}$  with corresponding number GSCN. The parameters defining the  $SS_{\text{REF}}$  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  $SS_{\text{REF}}$  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.

The synchronization raster and the corresponding SS block do not cover all possible RF channel bandwidth and locations on Enhanced channel raster.

**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 – 3000 MHz    | $N * 1200 \text{ kHz} + M * 50 \text{ kHz}$ ,<br>$N=1:2499$ , $M \in \{1,3,5\}^1$ | $3N + (M-3)/2$ | 2 – 7498      |
| 3000 – 24250    | $3000 \text{ MHz} + N * 1.44 \text{ MHz}$ ,<br>$N = 0:14756$                      | $7499 + N$     | 7499 – 22255  |

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 in FR1-NTN refers to 3GPP TS 38.101-1 [5] clause 5.4.3.2.

The mapping between the synchronization raster and the corresponding resource element of the SS block in FR2-NTN refers to 3GPP TS 38.101-2 [19] 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 and table 5.4.3.3-2. The distance between applicable GSCN entries is given by the <Step size> indicated in Table 5.4.3.3-1 for FR1-NTN and table 5.4.3.3-2 for FR2-NTN.

**Table 5.4.3.3-1: Applicable SS raster entries per operating band (FR1-NTN)**

| NTN satellite operating band | SS Block SCS | SS Block pattern <sup>1</sup> | Range of GSCN<br>(First – <Step size> – Last) |
|------------------------------|--------------|-------------------------------|-----------------------------------------------|
| n256                         | 15 kHz       | Case A                        | 5429 – <1> – 5494                             |
| n255                         | 15 kHz       | Case A                        | 3818 – <1> – 3892                             |
|                              | 30 kHz       | Case B                        | 3824 – <1> – 3886                             |
| n254                         | 15 kHz       | Case A                        | 6215 – <1> – 6244                             |
|                              | 30 kHz       | Case C                        | 6220 – <1> – 6238                             |
| n253                         | 15 kHz       | Case A                        | 3800 – <1> – 3807                             |
| n252                         | 15 kHz       | Case A                        | 5456 – <1> – 5494                             |
| n251                         | 15 kHz       | Case A                        | 3800 – <1> – 3892                             |
|                              | 30 kHz       | Case B                        | 3806 – <1> – 3886                             |
| n250                         | 15 kHz       | Case A                        | 3800 – <1> – 3892                             |
|                              | 30 kHz       | Case B                        | 3806 – <1> – 3886                             |

NOTE 1: SS Block pattern is defined in clause 4.1 in 3GPP TS 38.213 [7].

**Table 5.4.3.3-2: Applicable SS raster entries per operating band (FR2-NTN)**

| SAN operating band | SS Block SCS | SS Block pattern<br>(NOTE) | Range of GSCN<br>(First – <Step size> – Last) |
|--------------------|--------------|----------------------------|-----------------------------------------------|
| n512               | 120 kHz      | Case D                     | 17448 – <12> – 19428                          |
|                    | 240 kHz      | Case E                     | 17472 – <24> – 19416                          |
| n511               | 120 kHz      | Case D                     | 17448 – <12> – 19428                          |
|                    | 240 kHz      | Case E                     | 17472 – <24> – 19416                          |
| n510               | 120 kHz      | Case D                     | 17448 – <12> – 19428                          |
|                    | 240 kHz      | Case E                     | 17472 – <24> – 19416                          |

NOTE: SS Block pattern is defined in section 4.1 in 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 for FR1-NTN.

**Table 5.4.4-1: UE TX-RX frequency separation (FR1-NTN)**

| NTN Satellite Operating Band                                                                                                                                               | TX – RX<br>carrier centre frequency<br>separation           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| n256                                                                                                                                                                       | 190 MHz <sup>1</sup><br>165 to 215 MHz <sup>2</sup>         |
| n255                                                                                                                                                                       | -101.5 MHz <sup>1</sup><br>-72.5 to -130.5 MHz <sup>2</sup> |
| n254                                                                                                                                                                       | 873.5 MHz <sup>1</sup><br>862 – 885 MHz <sup>2</sup>        |
| n253                                                                                                                                                                       | -150 MHz <sup>1</sup><br>-148 to -152 MHz <sup>2</sup>      |
| n252                                                                                                                                                                       | 180 MHz <sup>1</sup><br>165 to 195 MHz <sup>2</sup>         |
| n251                                                                                                                                                                       | -108.5 MHz <sup>1</sup><br>-72.5 to -137.5 MHz <sup>2</sup> |
| n250                                                                                                                                                                       | -150 MHz <sup>1</sup><br>-114 to -152 MHz <sup>2</sup>      |
| NOTE 1: Default Tx-Rx separation                                                                                                                                           |                                                             |
| NOTE 2: The verification of flexible Tx-Rx frequency separation<br>within this range is limited to reference sensitivity.<br>Further details are specified in clause 7.3.2 |                                                             |

## 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 <sup>1</sup>   | 1@1            | 1@9             |
|                   |          | CP    | 2@0            | 2@9             | 1@0           | 1@10           | 11@0       | 5@2 <sup>1</sup>   | 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 <sup>1</sup> | 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 <sup>1</sup> | 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  $\text{ceil}(N_{RB}/2) - 1$  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

#### 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.

This test case applies to all types of NR Power Class 2 and Power Class 1 UE release 19 and forward that support satellite access operation and don't support Tx diversity.

### 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 1 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|---------------|----------------|---------------|----------------|
| n256                                                                                                                                                                                                                  | 31            | +2/-3          | 26            | +2/-3          | 23            | ±2             |
| n255                                                                                                                                                                                                                  | 31            | +2/-3          | 26            | +2/-3          | 23            | ±2             |
| n254                                                                                                                                                                                                                  |               |                |               |                | 23            | ±2             |
| n252                                                                                                                                                                                                                  |               |                |               |                | 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.                                                                                                                                                 |               |                |               |                |               |                |
| NOTE 3: Generally, PC1 UE are not targeted for smartphone form factor in this version of the specification.                                                                                                           |               |                |               |                |               |                |
| NOTE 4: When a UE supports both 3MHz channel bandwidth and higher than default power class, the UE shall apply all requirements for power class PC3 for 3 MHz channel bandwidth in this version of the specification. |               |                |               |                |               |                |

The UE shall meet the following additional requirements for maximum mean transmission power density specified in Table 6.2.1-2 when NS is signaled and when the configured channel overlaps with any portion of the specified frequency range.

**Table 6.2.1-2: Additional requirements for transmit power density**

| NR Band                                                                                                 | NS value | Channel bandwidth (MHz) | Frequency range (MHz) | Maximum power density | Measurement method           |
|---------------------------------------------------------------------------------------------------------|----------|-------------------------|-----------------------|-----------------------|------------------------------|
| n254                                                                                                    | NS_04N   | 5                       | 1610 - 1618.25        | 27dBm/4kHz            | Mean spectral limit (note 2) |
|                                                                                                         | NS_05N   | 5                       | 1618.25 - 1626.5      |                       |                              |
|                                                                                                         |          | 10, 15                  | 1610 – 1626.5         |                       |                              |
|                                                                                                         | NS_11N   | 5                       | 1610 - 1618.25        | 15dBm/4kHz            | Peak spectral limit (note 2) |
|                                                                                                         | NS_12N   | 5                       | 1618.25 - 1626.5      |                       |                              |
|                                                                                                         |          | 10, 15                  | 1610 – 1626.5         |                       |                              |
| NOTE 1: The EIRP requirement in regulation is converted to conducted requirement using a 0 dBi antenna. |          |                         |                       |                       |                              |
| NOTE 2: Indicated limit is applied to any frequency of the 1610-1626.5MHz band where a UE can operate.  |          |                         |                       |                       |                              |

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 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 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 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<sub>UMAX</sub> 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. TDD symbols with transient periods are not under test.

#### 6.2.1.4.3 Message contents

##### 6.2.1.4.3.0 General

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

**Table 6.2.1.4.3.0-1: PUSCH-Config**

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

##### 6.2.1.4.3.1 Void

##### 6.2.1.4.3.2 Void

#### 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, Power Class 2 and Power Class 1.

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

| NR satellite band | Class 1 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) |
|-------------------|---------------|----------------|---------------|----------------|---------------|----------------|
| n256              | 31            | +2+TT /-3-TT   | 26            | +2+TT /-3-TT   | 23            | ±(2+TT)        |
| n255              | 31            | +2+TT /-3-TT   | 26            | +2+TT /-3-TT   | 23            | ±(2+TT)        |
| n254              |               |                |               |                | 23            | ±(2+TT)        |
| n252              |               |                |               |                | 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  
 NOTE 4: Generally, PC1 UE are not targeted for smartphone form factor in this version of the specification.  
 NOTE 5: When a UE supports both 3MHz channel bandwidth and higher than default power class, the UE shall apply all requirements for power class PC3 for 3 MHz channel bandwidth in this version of the specification.

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

|                        | $f \leq 3.0\text{GHz}$ |
|------------------------|------------------------|
| $BW \leq 30\text{MHz}$ | 0.7 dB                 |

#### 6.2.1\_1 UE maximum output power: maximum power density

Editor's Note:

- MU and TT definition made under the assumption the UE will not exceed the maximum output power defined for its power class in Table 6.2.1.3-1.

##### 6.2.1\_1.1 Test purpose

Same as in 6.2.1.1.

##### 6.2.1\_1.2 Test applicability

Same as in 6.2.1.2.

##### 6.2.1\_1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2.1.3.

## 6.2.1\_1.4 Test description

### 6.2.1\_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 6.2.1\_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\_1.4.1-1: Test Configuration Table for transmit power density measurements**

| 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 for NS_04N and NS_11N<br>Mid range, High range for NS_05N and NS_12N |                      |                        |
| 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                                                                    | Modulation (NOTE 2)  | RB allocation (NOTE 1) |
| 1                                                                                       |                                                                                           | DFT-s-OFDM Pi/2 BPSK | Inner 1RB Left         |
| 2                                                                                       |                                                                                           | DFT-s-OFDM Pi/2 BPSK | Inner 1RB Right        |
| 3                                                                                       |                                                                                           | DFT-s-OFDM QPSK      | Inner 1RB Left         |
| 4                                                                                       |                                                                                           | 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\_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 38.508-1 [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 6.2.1\_1.4.3.

### 6.2.1\_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\_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 each 4 kHz interval within 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. TDD symbols with transient periods are not under test.
4. Derive mean or peak values of all 4 kHz intervals within the channel bandwidth (depending on the network signaled value) of the radio access mode. These values will correspond to transmit EIRP mean or peak density values respectively.
5. Repeat steps 1, 2, 3 and 4 for all applicable network signalled values.

### 6.2.1\_1.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and 5.4 with additional exceptions described in 6.2.1.4.3 and the ones described in 6.2.3.4.3 associated to each applicable network signalled value used in maximum power density measurements.

### 6.2.1\_1.5 Test requirement

Mean and peak transmit power density values derived in step 4 shall be within the range prescribed by the additional requirements for transmit power density in Table 6.2.1\_1.5-1 and tolerances in Table 6.2.1\_1.5-2.

**Table 6.2.1\_1.5-1: Transmit power density test requirement**

| NR Band                                                                                                 | NS value | Channel bandwidth (MHz) | Frequency range (MHz) | Maximum power density | Measurement method           |
|---------------------------------------------------------------------------------------------------------|----------|-------------------------|-----------------------|-----------------------|------------------------------|
| n254                                                                                                    | NS_04N   | 5                       | 1610 - 1618.25        | 27dBm/4kHz + TT       | Mean spectral limit (note 2) |
|                                                                                                         | NS_05N   | 5                       | 1618.25 - 1626.5      |                       |                              |
|                                                                                                         |          | 10, 15                  | 1610 – 1626.5         |                       |                              |
|                                                                                                         | NS_11N   | 5                       | 1610 - 1618.25        | 15dBm/4kHz +TT        | Peak spectral limit (note 2) |
|                                                                                                         | NS_12N   | 5                       | 1618.25 - 1626.5      |                       |                              |
|                                                                                                         |          | 10, 15                  | 1610 – 1626.5         |                       |                              |
| NOTE 1: The EIRP requirement in regulation is converted to conducted requirement using a 0 dBi antenna. |          |                         |                       |                       |                              |
| NOTE 2: Indicated limit is applied to any frequency of the 1610-1626.5MHz band where a UE can operate.  |          |                         |                       |                       |                              |

**Table 6.2.1\_1.5-2: Test tolerance (transmit power density test requirement)**

| NR Band | NS value | Channel bandwidth (MHz) | Frequency range (MHz) | Test Tolerance (dB) |
|---------|----------|-------------------------|-----------------------|---------------------|
| n254    | NS_04N   | 5                       | 1610 - 1618.25        | 0.7                 |
|         | NS_05N   | 5                       | 1618.25 - 1626.5      |                     |
|         |          | 10, 15                  | 1610 – 1626.5         |                     |
|         | NS_11N   | 5                       | 1610 - 1618.25        | 0.7                 |
|         | NS_12N   | 5                       | 1618.25 - 1626.5      |                     |
|         |          | 10, 15                  | 1610 – 1626.5         |                     |

## 6.2.1\_2 UE maximum output power for UEs supporting 2Tx Tx Diversity

### 6.2.1\_2.1 Test purpose

Same as 6.2.1.1.

### 6.2.1\_2.2 Test applicability

This test case applies to all types of NR Power Class 2 UE release 19 and forward that support satellite access operation and 2Tx Tx Diversity.

### 6.2.1\_2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2.1.3.

### 6.2.1\_2.4 Test description

#### 6.2.1\_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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.2.1\_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 6.2.1\_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] 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        |
| 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.3.1.1.2 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\_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 38.508-1 [12] table 5.6.2.1\_2-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and table 5.6.2.1\_2-3 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 6.2.1\_2.4.3.

#### 6.2.1\_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 6.2.1\_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 starting from the first TPC command in this step for the UE to reach  $P_{UMAX}$  level.
3. Measure the sum of the mean power of the UE at each antenna connector 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\_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 6.2.1\_2.4.3-1: PUSCH-Config**

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

#### 6.2.1\_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 6.2.1\_2.5-1 for Power Class 2.

**Table 6.2.1\_2.5-1: Maximum Output Power test requirement for Power Class 2**

| NR satellite band                                                                                                                                                                                                     | Class 2 (dBm) | Tolerance (dB) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|
| n256                                                                                                                                                                                                                  | 26            | +2+TT /-3-TT   |
| n255                                                                                                                                                                                                                  | 26            | +2+TT /-3-TT   |
| NOTE 1: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance                                                                                                                  |               |                |
| NOTE 2: When a UE supports both 3MHz channel bandwidth and higher than default power class, the UE shall apply all requirements for power class PC3 for 3 MHz channel bandwidth in this version of the specification. |               |                |
| NOTE 3: TT for each frequency and channel bandwidth is specified in Table 6.2.1_2.5-2.                                                                                                                                |               |                |

**Table 6.2.1\_2.5-2: Test Tolerance (UE maximum output power)**

|                        |                        |
|------------------------|------------------------|
|                        | $f \leq 3.0\text{GHz}$ |
| $BW \leq 30\text{MHz}$ | 0.7 dB                 |

#### 6.2.1\_3 UE maximum output power for UEs supporting 4Tx Tx Diversity

Editor's Note:

- No test points are defined for Power Class 1 UEs with 4Tx since there is no configuration satisfying MPR=0dB requirements in TS 38.101-5. Testing with minimum MPR has been covered in 6.2.2\_2.

### 6.2.1\_3.1 Test purpose

Same as in 6.2.1.1.

### 6.2.1\_3.2 Test applicability

This test case applies to all types of NR Power Class 1 UE release 19 and forward that support satellite access operation and 4Tx Tx Diversity.

Note: No test points are defined for Power Class 1 UEs with 4Tx since there is no configuration satisfying MPR=0 dB requirements in TS 38.101-5.

## 6.2.2 UE maximum output power reduction

### 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.

This test case applies to all types of NR Power Class 2 and Power Class 1 UE release 19 and forward that support satellite access operation and don't support Tx diversity.

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 and 2, the allowed maximum power reduction (MPR) is defined in Table 6.2.2.3-1, Table 6.2.2.3-2 respectively for channel bandwidths  $\leq 100$  MHz. The  $\Delta$ MPR is set to zero. For UE power class 2 with 2Tx, the allowed maximum power reduction (MPR) is defined as Table 6.2.2.3-3. For UE power class 1 with 1Tx, the allowed maximum power reduction (MPR) is defined in Table 6.2.2.3-4. And for UE power class 1 with 4Tx, the allowed maximum power reduction (MPR) is defined as Table 6.2.2.3-5.

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                  | $\leq 0.5$          |                      | 0                    |
|            | Pi/2 BPSK w Pi/2 BPSK DMRS | $\leq 0.5$          | 0                    |                      |
|            | QPSK                       | $\leq 1$            |                      | 0                    |
|            | 16 QAM                     | $\leq 2$            |                      | $\leq 1$             |
|            | 64 QAM                     | $\leq 2.5$          |                      |                      |
| CP-OFDM    | QPSK                       | $\leq 3$            |                      | $\leq 1.5$           |
|            | 16 QAM                     | $\leq 3$            |                      | $\leq 2$             |
|            | 64 QAM                     | $\leq 3.5$          |                      |                      |

**Table 6.2.2.3-2: Maximum power reduction (MPR) for power class 2**

| Modulation |           | MPR (dB)            |                      |                      |
|------------|-----------|---------------------|----------------------|----------------------|
|            |           | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | $\leq 3.5$          | $\leq 0.5$           | 0                    |
|            | QPSK      | $\leq 3.5$          | $\leq 1$             | 0                    |
|            | 16 QAM    | $\leq 3.5$          | $\leq 2$             | $\leq 1$             |
|            | 64 QAM    | $\leq 3.5$          | $\leq 2.5$           |                      |
| CP-OFDM    | QPSK      | $\leq 3.5$          | $\leq 3$             | $\leq 1.5$           |
|            | 16 QAM    | $\leq 3.5$          | $\leq 3$             | $\leq 2$             |
|            | 64 QAM    | $\leq 3.5$          |                      |                      |

**Table 6.2.2.3-3: Maximum power reduction (MPR) for power class 2 with 2Tx**

| Modulation |           | MPR (dB)            |                      |                      |
|------------|-----------|---------------------|----------------------|----------------------|
|            |           | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | $\leq 3.5$          | $\leq 1$             | 0                    |
|            | QPSK      | $\leq 3.5$          | $\leq 2$             | 0.5                  |
|            | 16 QAM    | $\leq 3.5$          | $\leq 2.5$           | $\leq 1.5$           |
|            | 64 QAM    | $\leq 3.5$          | $\leq 3$             |                      |
| CP-OFDM    | QPSK      | $\leq 4.0$          | $\leq 3.5$           | $\leq 2$             |
|            | 16 QAM    | $\leq 4.0$          | $\leq 3.5$           | $\leq 2.5$           |
|            | 64 QAM    | $\leq 4.5$          |                      |                      |

**Table 6.2.2.3-4: Maximum power reduction (MPR) for power class 1 with 1Tx**

| Modulation |           | MPR (dB)            |                      |                      |
|------------|-----------|---------------------|----------------------|----------------------|
|            |           | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | $\leq 10.0$         | $\leq 0.5$           | $\leq 0$             |
|            | QPSK      | $\leq 10.5$         | $\leq 1.0$           | $\leq 0$             |
|            | 16 QAM    | $\leq 10.5$         | $\leq 2.0$           | $\leq 1.0$           |
|            | 64 QAM    | $\leq 10.5$         | $\leq 2.5$           |                      |
| CP-OFDM    | QPSK      | $\leq 11.0$         | $\leq 3$             | $\leq 1.5$           |
|            | 16 QAM    | $\leq 11.0$         | $\leq 3$             | $\leq 2.0$           |
|            | 64 QAM    | $\leq 11.0$         | $\leq 3.5$           |                      |

**Table 6.2.2.3-5: Maximum power reduction (MPR) for power class 1 with 4Tx**

| Modulation |           | MPR (dB)            |                      |                      |
|------------|-----------|---------------------|----------------------|----------------------|
|            |           | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | $\leq 10.0$         | $\leq 2.0$           | $\leq 0.5$           |
|            | QPSK      | $\leq 10.5$         | $\leq 2.5$           | $\leq 0.5$           |
|            | 16 QAM    | $\leq 10.5$         | $\leq 3.5$           | $\leq 1.5$           |
|            | 64 QAM    | $\leq 10.5$         | $\leq 4.0$           | $\leq 3.5$           |
| CP-OFDM    | QPSK      | $\leq 11.0$         | $\leq 4.5$           | $\leq 2.0$           |
|            | 16 QAM    | $\leq 11.0$         | $\leq 4.5$           | $\leq 2.5$           |
|            | 64 QAM    | $\leq 11.0$         | $\leq 5.0$           | $\leq 5.0$           |

NOTE 1: This table is targeted to devices with 15 dB or above antenna isolation.

The definitions for Edge, Outer and Inner RB allocations defined in clause 6.2.2 of 3GPP TS 38.101-1 [5] shall apply to NTN UE, except for PC1 NTN UE.

For PC1 NTN UE, RB allocation is an Edge RB allocation if

$$L_{CRB} \leq L_{CRB,edge} \text{ AND } (RB_{start} \leq RB_{start,edge} \text{ OR } RB_{start} \geq N_{RB} - RB_{start,edge} - L_{CRB}),$$

where

$$L_{CRB,edge} = 8 \text{ and } RB_{start,edge} = 0.$$

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

|                                                                                                             |         |                                                 | 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                  |                |                        |
|                                                                                                             |         | N/A for Maximum Power Reduction (MPR) test case | Modulation (NOTE 2)                   |                | RB allocation (NOTE 1) |
| 1                                                                                                           | Default |                                                 | 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                                                                                                          | Default |                                                 | CP-OFDM QPSK                          | Inner Full     |                        |
| 17                                                                                                          | Low     |                                                 | CP-OFDM QPSK                          | Edge_1RB_Left  |                        |
| 18                                                                                                          | High    |                                                 | CP-OFDM QPSK                          | Edge_1RB_Right |                        |
| 19                                                                                                          | Default |                                                 | CP-OFDM QPSK                          | Outer Full     |                        |
| 20                                                                                                          | Default |                                                 | CP-OFDM 16 QAM                        | Inner Full     |                        |
| 21                                                                                                          | Low     |                                                 | CP-OFDM 16 QAM                        | Edge_1RB_Left  |                        |
| 22                                                                                                          | High    |                                                 | CP-OFDM 16 QAM                        | Edge_1RB_Right |                        |
| 23                                                                                                          | Default |                                                 | CP-OFDM 16 QAM                        | Outer Full     |                        |
| 24                                                                                                          | Low     |                                                 | CP-OFDM 64 QAM                        | Edge_1RB_Left  |                        |
| 25                                                                                                          | High    |                                                 | CP-OFDM 64 QAM                        | Edge_1RB_Right |                        |
| 26                                                                                                          | Default |                                                 | CP-OFDM 64 QAM                        | Outer Full     |                        |
| 27 <sup>3</sup>                                                                                             | Low     |                                                 | DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS | Edge_1RB_Left  |                        |
| 28 <sup>3</sup>                                                                                             | High    |                                                 | DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS | Edge_1RB_Right |                        |
| 29 <sup>3</sup>                                                                                             | 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 <i>lowPAPR-DMRS-PUSCHwithPrecoding-r16</i> . |         |                                                 |                                       |                |                        |

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 38.508-1 [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 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  $P_{\text{UMAX}}$  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: Void**

**Table 6.2.2.4.3-2: DMRS-UplinkConfig Test ID 27 - 29 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 to Table 6.2.2.5-1b and 6.2.2.5-2.

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

| Test ID | P <sub>PowerClass</sub> (dBm) | $\Delta P_{PowerClass}$ (dB) | MPR (dB) | $\Delta T_{C,c}$ (dB) | P <sub>CMAX_L,f,c</sub> (dBm) | T(P <sub>CMAX_L,f,c</sub> ) (dB) | T <sub>L,c</sub> (dB) | Upper limit (dBm) | Lower limit (dBm) |
|---------|-------------------------------|------------------------------|----------|-----------------------|-------------------------------|----------------------------------|-----------------------|-------------------|-------------------|
| 1       | 23                            | 0                            | 0        | N/A                   | 23.0                          | 2.0                              | 2                     | 25.0 + TT         | 21.0 - TT         |
| 2       | 23                            | 0                            | 0.5      | N/A                   | 22.5                          | 2.0                              | 2                     | 25.0 + TT         | 20.5 - TT         |
| 3       | 23                            | 0                            | 0.5      | N/A                   | 22.5                          | 2.0                              | 2                     | 25.0 + TT         | 20.5 - TT         |
| 4       | 23                            | 0                            | 0.5      | N/A                   | 22.5                          | 2.0                              | 2                     | 25.0 + TT         | 20.5 - TT         |
| 5       | 23                            | 0                            | 0        | N/A                   | 23.0                          | 2.0                              | 2                     | 25.0 + TT         | 21.0 - TT         |
| 6       | 23                            | 0                            | 1        | N/A                   | 22.0                          | 2.0                              | 2                     | 25.0 + TT         | 20.0 - TT         |
| 7       | 23                            | 0                            | 1        | N/A                   | 22.0                          | 2.0                              | 2                     | 25.0 + TT         | 20.0 - TT         |
| 8       | 23                            | 0                            | 1        | N/A                   | 22.0                          | 2.0                              | 2                     | 25.0 + TT         | 20.0 - TT         |
| 9       | 23                            | 0                            | 1        | N/A                   | 22.0                          | 2.0                              | 2                     | 25.0 + TT         | 20.0 - TT         |
| 10      | 23                            | 0                            | 2        | N/A                   | 21.0                          | 2.0                              | 2                     | 25.0 + TT         | 19.0 - TT         |
| 11      | 23                            | 0                            | 2        | N/A                   | 21.0                          | 2.0                              | 2                     | 25.0 + TT         | 19.0 - TT         |
| 12      | 23                            | 0                            | 2        | N/A                   | 21.0                          | 2.0                              | 2                     | 25.0 + TT         | 19.0 - TT         |
| 13      | 23                            | 0                            | 2.5      | N/A                   | 20.5                          | 2.5                              | 2                     | 25.0 + TT         | 18.0 - TT         |
| 14      | 23                            | 0                            | 2.5      | N/A                   | 20.5                          | 2.5                              | 2                     | 25.0 + TT         | 18.0 - TT         |
| 15      | 23                            | 0                            | 2.5      | N/A                   | 20.5                          | 2.5                              | 2                     | 25.0 + TT         | 18.0 - TT         |
| 16      | 23                            | 0                            | 1.5      | N/A                   | 21.5                          | 2.0                              | 2                     | 25.0 + TT         | 19.5 - TT         |
| 17      | 23                            | 0                            | 3        | N/A                   | 20.0                          | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 18      | 23                            | 0                            | 3        | N/A                   | 20.0                          | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 19      | 23                            | 0                            | 3        | N/A                   | 20.0                          | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 20      | 23                            | 0                            | 2        | N/A                   | 21.0                          | 2.0                              | 2                     | 25.0 + TT         | 19.0 - TT         |
| 21      | 23                            | 0                            | 3        | N/A                   | 20.0                          | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 22      | 23                            | 0                            | 3        | N/A                   | 20.0                          | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 23      | 23                            | 0                            | 3        | N/A                   | 20.0                          | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 24      | 23                            | 0                            | 3.5      | N/A                   | 19.5                          | 3.5                              | 2                     | 25.0 + TT         | 16.0 - TT         |
| 25      | 23                            | 0                            | 3.5      | N/A                   | 19.5                          | 3.5                              | 2                     | 25.0 + TT         | 16.0 - TT         |
| 26      | 23                            | 0                            | 3.5      | N/A                   | 19.5                          | 3.5                              | 2                     | 25.0 + TT         | 16.0 - TT         |
| 27      | 23                            | 0                            | 0.5      | N/A                   | 22.5                          | 2.0                              | 2                     | 25.0 + TT         | 20.5 - TT         |
| 28      | 23                            | 0                            | 0.5      | N/A                   | 22.5                          | 2.0                              | 2                     | 25.0 + TT         | 20.5 - TT         |
| 29      | 23                            | 0                            | 0        | N/A                   | 23                            | 2.0                              | 2                     | 25.0 + TT         | 21.0 - TT         |

NOTE 1: P<sub>PowerClass</sub> 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 6.2.2.5-1a: UE Power Class test requirements for Power Class 2

| Test ID | $P_{\text{PowerClass}}$ (dBm) | $\Delta P_{\text{PowerClass}}$ (dB) | MPR (dB) | $P_{\text{CMAX\_L,f,c}}$ (dBm) | $T(P_{\text{CMAX\_L,f,c}})$ (dB) | $T_{\text{L,c}}$ (dB) | Upper limit (dBm) | Lower limit (dBm) |
|---------|-------------------------------|-------------------------------------|----------|--------------------------------|----------------------------------|-----------------------|-------------------|-------------------|
| 1       | 26                            | 0                                   | 0        | 26.0                           | 2.0                              | 3                     | 28.0 + TT         | 23.0 - TT         |
| 2       | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 3       | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 4       | 26                            | 0                                   | 0.5      | 25.5                           | 2.0                              | 3                     | 28.0 + TT         | 22.5 - TT         |
| 5       | 26                            | 0                                   | 0        | 26.0                           | 2.0                              | 3                     | 28.0 + TT         | 23.0 - TT         |
| 6       | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 7       | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 8       | 26                            | 0                                   | 1        | 25.0                           | 2.0                              | 3                     | 28.0 + TT         | 22.0 - TT         |
| 9       | 26                            | 0                                   | 1        | 25.0                           | 2.0                              | 3                     | 28.0 + TT         | 22.0 - TT         |
| 10      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 11      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 12      | 26                            | 0                                   | 2        | 24.0                           | 2.0                              | 3                     | 28.0 + TT         | 21.0 - TT         |
| 13      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 14      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 15      | 26                            | 0                                   | 2.5      | 23.5                           | 2.0                              | 3                     | 28.0 + TT         | 20.5 - TT         |
| 16      | 26                            | 0                                   | 1.5      | 24.5                           | 2.0                              | 3                     | 28.0 + TT         | 21.5 - TT         |
| 17      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 18      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 19      | 26                            | 0                                   | 3        | 23.0                           | 2.0                              | 3                     | 28.0 + TT         | 20.0 - TT         |
| 20      | 26                            | 0                                   | 2        | 24.0                           | 2.0                              | 3                     | 28.0 + TT         | 21.0 - TT         |
| 21      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 22      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 23      | 26                            | 0                                   | 3        | 23.0                           | 2.0                              | 3                     | 28.0 + TT         | 20.0 - TT         |
| 24      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 25      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |
| 26      | 26                            | 0                                   | 3.5      | 22.5                           | 2.0                              | 3                     | 28.0 + TT         | 19.5 - TT         |

NOTE 1:  $P_{\text{PowerClass}}$  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 6.2.2.5-5.

Table 6.2.2.5-1b: UE Power Class test requirements for Power Class 1

| Test ID | $P_{\text{PowerClass}}$ (dBm) | $\Delta P_{\text{PowerClass}}$ (dB) | MPR (dB) | $P_{\text{CMAX\_L,f,c}}$ (dBm) | $T(P_{\text{CMAX\_L,f,c}})$ (dB) | $T_{\text{L,c}}$ (dB) | Upper limit (dBm) | Lower limit (dBm) |
|---------|-------------------------------|-------------------------------------|----------|--------------------------------|----------------------------------|-----------------------|-------------------|-------------------|
| 1       | 31                            | 0                                   | 0        | 31                             | 2                                | 3                     | 33.0 + TT         | 28.0 - TT         |
| 2       | 31                            | 0                                   | 10       | 21                             | 2                                | 3                     | 33.0 + TT         | 18.0 - TT         |
| 3       | 31                            | 0                                   | 10       | 21                             | 2                                | 3                     | 33.0 + TT         | 18.0 - TT         |
| 4       | 31                            | 0                                   | 0.5      | 30.5                           | 2                                | 3                     | 33.0 + TT         | 27.5 - TT         |
| 5       | 31                            | 0                                   | 0        | 31                             | 2                                | 3                     | 33.0 + TT         | 28.0 - TT         |
| 6       | 31                            | 0                                   | 10.5     | 20.5                           | 2.5                              | 3                     | 33.0 + TT         | 17.5 - TT         |
| 7       | 31                            | 0                                   | 10.5     | 20.5                           | 2.5                              | 3                     | 33.0 + TT         | 17.5 - TT         |
| 8       | 31                            | 0                                   | 1        | 30                             | 2                                | 3                     | 33.0 + TT         | 27.0 - TT         |
| 9       | 31                            | 0                                   | 1        | 30                             | 2                                | 3                     | 33.0 + TT         | 27.0 - TT         |
| 10      | 31                            | 0                                   | 10.5     | 20.5                           | 2.5                              | 3                     | 33.0 + TT         | 17.5 - TT         |
| 11      | 31                            | 0                                   | 10.5     | 20.5                           | 2.5                              | 3                     | 33.0 + TT         | 17.5 - TT         |
| 12      | 31                            | 0                                   | 2        | 29                             | 2                                | 3                     | 33.0 + TT         | 26.0 - TT         |
| 13      | 31                            | 0                                   | 10.5     | 20.5                           | 2.5                              | 3                     | 33.0 + TT         | 17.5 - TT         |
| 14      | 31                            | 0                                   | 10.5     | 20.5                           | 2.5                              | 3                     | 33.0 + TT         | 17.5 - TT         |
| 15      | 31                            | 0                                   | 2.5      | 28.5                           | 2                                | 3                     | 33.0 + TT         | 25.5 - TT         |
| 16      | 31                            | 0                                   | 1.5      | 29.5                           | 2                                | 3                     | 33.0 + TT         | 26.5 - TT         |
| 17      | 31                            | 0                                   | 11       | 20                             | 2.5                              | 3                     | 33.0 + TT         | 17.0 - TT         |
| 18      | 31                            | 0                                   | 11       | 20                             | 2.5                              | 3                     | 33.0 + TT         | 17.0 - TT         |
| 19      | 31                            | 0                                   | 3        | 28                             | 2                                | 3                     | 33.0 + TT         | 25.0 - TT         |
| 20      | 31                            | 0                                   | 2        | 29                             | 2                                | 3                     | 33.0 + TT         | 26.0 - TT         |
| 21      | 31                            | 0                                   | 11       | 20                             | 2.5                              | 3                     | 33.0 + TT         | 17.0 - TT         |
| 22      | 31                            | 0                                   | 11       | 20                             | 2.5                              | 3                     | 33.0 + TT         | 17.0 - TT         |
| 23      | 31                            | 0                                   | 3        | 28                             | 2                                | 3                     | 33.0 + TT         | 25.0 - TT         |
| 24      | 31                            | 0                                   | 11       | 20                             | 2.5                              | 3                     | 33.0 + TT         | 17.0 - TT         |
| 25      | 31                            | 0                                   | 11       | 20                             | 2.5                              | 3                     | 33.0 + TT         | 17.0 - TT         |
| 26      | 31                            | 0                                   | 3.5      | 27.5                           | 2                                | 3                     | 33.0 + TT         | 24.5 - TT         |

NOTE 1:  $P_{\text{PowerClass}}$  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 6.2.2.5-5.

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

|                               |                        |
|-------------------------------|------------------------|
|                               | $f \leq 3.0\text{GHz}$ |
| $\text{BW} \leq 30\text{MHz}$ | 0.7 dB                 |

## 6.2.2\_1 UE maximum output power reduction for UEs supporting 2Tx Tx Diversity

### 6.2.2\_1.1 Test purpose

Same as 6.2.2.1.

### 6.2.2\_1.2 Test applicability

The requirements of this test apply to all types of NR Power Class 2 UE release 19 and forward that support satellite access operation and 2Tx Tx Diversity.

NOTE: Test execution is not necessary if TS 38.521-5 clause 6.5.2.4.1\_1 is executed.

### 6.2.2\_1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2.2.3

## 6.2.2\_1.4 Test description

### 6.2.2\_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, 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\_1.4.1-1. 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\_1.4.1-1: Test Configuration Table for power class 2 with 2Tx**

|                                                                                         |         |                                                 | 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               |                        |
|                                                                                         |         | N/A for Maximum Power Reduction (MPR) test case | Modulation (NOTE 2)                | RB allocation (NOTE 1) |
| 1                                                                                       | Default |                                                 | 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                                                                                      | Default |                                                 | CP-OFDM QPSK                       | Inner Full             |
| 17                                                                                      | Low     |                                                 | CP-OFDM QPSK                       | Edge_1RB_Left          |
| 18                                                                                      | High    |                                                 | CP-OFDM QPSK                       | Edge_1RB_Right         |
| 19                                                                                      | Default |                                                 | CP-OFDM QPSK                       | Outer Full             |
| 20                                                                                      | Default |                                                 | CP-OFDM 16 QAM                     | Inner Full             |
| 21                                                                                      | Low     |                                                 | CP-OFDM 16 QAM                     | Edge_1RB_Left          |
| 22                                                                                      | High    |                                                 | CP-OFDM 16 QAM                     | Edge_1RB_Right         |
| 23                                                                                      | Default |                                                 | CP-OFDM 16 QAM                     | Outer Full             |
| 24                                                                                      | Low     |                                                 | CP-OFDM 64 QAM                     | Edge_1RB_Left          |
| 25                                                                                      | High    |                                                 | CP-OFDM 64 QAM                     | Edge_1RB_Right         |
| 26                                                                                      | Default | CP-OFDM 64 QAM                                  | 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. |         |                                                 |                                    |                        |

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.2 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\_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 38.508-1 [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 6.2.2\_1.4.3.

#### 6.2.2\_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 6.2.2\_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 for the UE to reach  $P_{\text{UMAX}}$  level.
3. Measure the sum of the mean power of the UE at each antenna connector 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\_1.4.1-1, 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\_1.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and 5.6.

#### 6.2.2\_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 6.2.2\_1.5-1.

**Table 6.2.2\_1.5-1: UE MPR test requirements for power class 2 with 2Tx**

| Test ID | P <sub>PowerClass</sub> (dBm) | ΔP <sub>PowerClass</sub> (dB) | MPR (dB) | P <sub>CMAX_L,f,c</sub> (dBm) | T(P <sub>CMAX_L,f,c</sub> ) (dB) | T <sub>L,c</sub> (dB) | Upper limit (dBm) | Lower limit (dBm) |
|---------|-------------------------------|-------------------------------|----------|-------------------------------|----------------------------------|-----------------------|-------------------|-------------------|
| 1       | 26                            | 0                             | 0        | 26                            | 3                                | 3                     | 28.0 + TT         | 23.0 - TT         |
| 2       | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 3       | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 4       | 26                            | 0                             | 1        | 25                            | 3                                | 3                     | 28.0 + TT         | 22.0 - TT         |
| 5       | 26                            | 0                             | 0.5      | 25.5                          | 3                                | 3                     | 28.0 + TT         | 22.5 - TT         |
| 6       | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 7       | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 8       | 26                            | 0                             | 2        | 24                            | 3                                | 3                     | 28.0 + TT         | 21.0 - TT         |
| 9       | 26                            | 0                             | 1.5      | 24.5                          | 3                                | 3                     | 28.0 + TT         | 21.5 - TT         |
| 10      | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 11      | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 12      | 26                            | 0                             | 2.5      | 23.5                          | 3                                | 3                     | 28.0 + TT         | 20.5 - TT         |
| 13      | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 14      | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 15      | 26                            | 0                             | 3        | 23                            | 3                                | 3                     | 28.0 + TT         | 20.0 - TT         |
| 16      | 26                            | 0                             | 2        | 24                            | 3                                | 3                     | 28.0 + TT         | 21.0 - TT         |
| 17      | 26                            | 0                             | 4.0      | 22                            | 5                                | 3                     | 28.0 + TT         | 17.0 - TT         |
| 18      | 26                            | 0                             | 4.0      | 22                            | 5                                | 3                     | 28.0 + TT         | 17.0 - TT         |
| 19      | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 20      | 26                            | 0                             | 2.5      | 23.5                          | 3                                | 3                     | 28.0 + TT         | 20.5 - TT         |
| 21      | 26                            | 0                             | 4.0      | 22                            | 5                                | 3                     | 28.0 + TT         | 17.0 - TT         |
| 22      | 26                            | 0                             | 4.0      | 22                            | 5                                | 3                     | 28.0 + TT         | 17.0 - TT         |
| 23      | 26                            | 0                             | 3.5      | 22.5                          | 5                                | 3                     | 28.0 + TT         | 17.5 - TT         |
| 24      | 26                            | 0                             | 4.5      | 21.5                          | 5                                | 3                     | 28.0 + TT         | 16.5 - TT         |
| 25      | 26                            | 0                             | 4.5      | 21.5                          | 5                                | 3                     | 28.0 + TT         | 16.5 - TT         |
| 26      | 26                            | 0                             | 4.5      | 21.5                          | 5                                | 3                     | 28.0 + TT         | 16.5 - TT         |

NOTE 1: P<sub>PowerClass</sub> 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\_1.5-2.

**Table 6.2.2\_1.5-2: Test Tolerance (Maximum Power Reduction (MPR))**

|                   |                   |
|-------------------|-------------------|
|                   | <b>f ≤ 3.0GHz</b> |
| <b>BW ≤ 30MHz</b> | 0.7 dB            |

## 6.2.2\_2 UE maximum output power reduction for UEs supporting 4Tx Tx Diversity

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

- MU and TT are FFS.

### 6.2.2\_2.1 Test purpose

Same as 6.2.2.1.

### 6.2.2\_2.2 Test applicability

The requirements of this test apply to all types of NR Power Class 1 UE release 19 and forward that support satellite access operation and 4Tx Tx Diversity.

NOTE: Test execution is not necessary if TS 38.521-5 clause 6.5.2.4.1\_2 is executed.

### 6.2.2\_2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2.2.3

## 6.2.2\_2.4 Test description

### 6.2.2\_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\_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\_2.4.1-1: Test Configuration Table for power class 1 with 4Tx**

|                                                                                         |         |                                                 | 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               |                        |
|                                                                                         |         | N/A for Maximum Power Reduction (MPR) test case | Modulation (NOTE 2)                | RB allocation (NOTE 1) |
| 1                                                                                       | Default |                                                 | 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                                                                                      | Default |                                                 | DFT-s-OFDM 64 QAM                  | Inner Full             |
| 14                                                                                      | Low     |                                                 | DFT-s-OFDM 64 QAM                  | Edge_1RB_Left          |
| 15                                                                                      | High    |                                                 | DFT-s-OFDM 64 QAM                  | Edge_1RB_Right         |
| 16                                                                                      | Default |                                                 | DFT-s-OFDM 64 QAM                  | Outer Full             |
| 17                                                                                      | Default |                                                 | CP-OFDM QPSK                       | Inner Full             |
| 18                                                                                      | Low     |                                                 | CP-OFDM QPSK                       | Edge_1RB_Left          |
| 19                                                                                      | High    |                                                 | CP-OFDM QPSK                       | Edge_1RB_Right         |
| 20                                                                                      | Default |                                                 | CP-OFDM QPSK                       | Outer Full             |
| 21                                                                                      | Default |                                                 | CP-OFDM 16 QAM                     | Inner Full             |
| 22                                                                                      | Low     |                                                 | CP-OFDM 16 QAM                     | Edge_1RB_Left          |
| 23                                                                                      | High    |                                                 | CP-OFDM 16 QAM                     | Edge_1RB_Right         |
| 24                                                                                      | Default |                                                 | CP-OFDM 16 QAM                     | Outer Full             |
| 25                                                                                      | Default |                                                 | CP-OFDM 64 QAM                     | Inner Full             |
| 26                                                                                      | Low     |                                                 | CP-OFDM 64 QAM                     | Edge_1RB_Left          |
| 27                                                                                      | High    |                                                 | CP-OFDM 64 QAM                     | Edge_1RB_Right         |
| 28                                                                                      | Default | CP-OFDM 64 QAM                                  | 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. |         |                                                 |                                    |                        |

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.2a 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\_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 38.508-1 [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 6.2.2\_2.4.3.

#### 6.2.2\_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\_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 sum of the mean power of the UE at each antenna connector 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\_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\_2.4.3 Message contents

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

#### 6.2.2\_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\_2.5-1.

Table 6.2.2\_2.5-1: UE MPR test requirements for power class 1

| Test ID | P <sub>PowerClass</sub> (dBm) | $\Delta P_{PowerClass}$ (dB) | MPR (dB) | $\Delta T_{C,c}$ (dB) | P <sub>CMAX_L,f,c</sub> (dBm) | T(P <sub>CMAX_L,f,c</sub> ) (dB) | T <sub>L,c</sub> (dB) | Upper limit (dBm) | Lower limit (dBm) |
|---------|-------------------------------|------------------------------|----------|-----------------------|-------------------------------|----------------------------------|-----------------------|-------------------|-------------------|
| 1       | 31                            | 0                            | 0.5      | 0                     | 30.5                          | 3                                | 3                     | 33.0 + TT         | 27.5 - TT         |
| 2       | 31                            | 0                            | 10       | 0                     | 21                            | 5                                | 3                     | 33.0 + TT         | 16.0 - TT         |
| 3       | 31                            | 0                            | 10       | 0                     | 21                            | 5                                | 3                     | 33.0 + TT         | 16.0 - TT         |
| 4       | 31                            | 0                            | 2        | 0                     | 29                            | 3                                | 3                     | 33.0 + TT         | 26.0 - TT         |
| 5       | 31                            | 0                            | 0.5      | 0                     | 30.5                          | 3                                | 3                     | 33.0 + TT         | 27.5 - TT         |
| 6       | 31                            | 0                            | 10.5     | 0                     | 20.5                          | 5                                | 3                     | 33.0 + TT         | 15.5 - TT         |
| 7       | 31                            | 0                            | 10.5     | 0                     | 20.5                          | 5                                | 3                     | 33.0 + TT         | 15.5 - TT         |
| 8       | 31                            | 0                            | 2.5      | 0                     | 28.5                          | 3                                | 3                     | 33.0 + TT         | 25.5 - TT         |
| 9       | 31                            | 0                            | 1.5      | 0                     | 29.5                          | 3                                | 3                     | 33.0 + TT         | 26.5 - TT         |
| 10      | 31                            | 0                            | 10.5     | 0                     | 20.5                          | 5                                | 3                     | 33.0 + TT         | 15.5 - TT         |
| 11      | 31                            | 0                            | 10.5     | 0                     | 20.5                          | 5                                | 3                     | 33.0 + TT         | 15.5 - TT         |
| 12      | 31                            | 0                            | 3.5      | 0                     | 27.5                          | 3                                | 3                     | 33.0 + TT         | 24.5 - TT         |
| 13      | 31                            | 0                            | 3.5      | 0                     | 27.5                          | 3                                | 3                     | 33.0 + TT         | 24.5 - TT         |
| 14      | 31                            | 0                            | 10.5     | 0                     | 20.5                          | 5                                | 3                     | 33.0 + TT         | 15.5 - TT         |
| 15      | 31                            | 0                            | 10.5     | 0                     | 20.5                          | 5                                | 3                     | 33.0 + TT         | 15.5 - TT         |
| 16      | 31                            | 0                            | 4        | 0                     | 27                            | 3                                | 3                     | 33.0 + TT         | 24.0 - TT         |
| 17      | 31                            | 0                            | 2        | 0                     | 29                            | 3                                | 3                     | 33.0 + TT         | 26.0 - TT         |
| 18      | 31                            | 0                            | 11       | 0                     | 20                            | 5                                | 3                     | 33.0 + TT         | 15.0 - TT         |
| 19      | 31                            | 0                            | 11       | 0                     | 20                            | 5                                | 3                     | 33.0 + TT         | 15.0 - TT         |
| 20      | 31                            | 0                            | 4.5      | 0                     | 26.5                          | 3                                | 3                     | 33.0 + TT         | 23.5 - TT         |
| 21      | 31                            | 0                            | 2.5      | 0                     | 28.5                          | 3                                | 3                     | 33.0 + TT         | 25.5 - TT         |
| 22      | 31                            | 0                            | 11       | 0                     | 20                            | 5                                | 3                     | 33.0 + TT         | 15.0 - TT         |
| 23      | 31                            | 0                            | 11       | 0                     | 20                            | 5                                | 3                     | 33.0 + TT         | 15.0 - TT         |
| 24      | 31                            | 0                            | 4.5      | 0                     | 26.5                          | 3                                | 3                     | 33.0 + TT         | 23.5 - TT         |
| 25      | 31                            | 0                            | 5        | 0                     | 26                            | 3                                | 3                     | 33.0 + TT         | 23.0 - TT         |
| 26      | 31                            | 0                            | 11       | 0                     | 20                            | 5                                | 3                     | 33.0 + TT         | 15.0 - TT         |
| 27      | 31                            | 0                            | 11       | 0                     | 20                            | 5                                | 3                     | 33.0 + TT         | 15.0 - TT         |
| 28      | 31                            | 0                            | 5        | 0                     | 26                            | 3                                | 3                     | 33.0 + TT         | 23.0 - TT         |

NOTE 1: P<sub>PowerClass</sub> 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\_2.5-2.

Table 6.2.2\_2.5-2: Test Tolerance (Maximum Power Reduction (MPR))

|            | f ≤ 3.0GHz |
|------------|------------|
| BW ≤ 30MHz | FFS        |

## 6.2.3 UE additional maximum output power reduction

### 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 except for 256QAM. 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 except for 256QAM. 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

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

### 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 (NOTE 3) | 5, 10, 15, 20           | Table 5.3.2-1                 | N/A                                     |
| NS_24N                   | 6.5.3.3.3.7                       | n256                   | 5, 10, 15, 20           |                               | Clause 6.2.3.3.5                        |
| 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 <sup>1</sup>      |                         |                               | Table 6.2.3.1-2 in 3GPP TS 38.101-1 [5] |
| NS_03N                   | 6.5.3.3.3.2                       | n254                   | 3, 5, 10, 15            |                               | Clause 6.2.3.3.2                        |
| NS_04N                   | 6.5.3.3.3.3                       | n254                   | 5                       |                               | Clause 6.2.3.3.3                        |
| NS_05N                   | 6.5.3.3.3.3                       | n254                   | 5, 10, 15               |                               | Clause 6.2.3.3.4                        |
| NS_06N                   | 6.5.3.3.3.4                       | n252                   | 5, 10, 15, 20           |                               | N/A                                     |
| NS_07N                   | 6.5.3.3.3.5                       | n252 <sup>4</sup>      | 5, 10, 15, 20           |                               | Clause 6.2.3.3.6                        |
| NS_08N                   | 6.5.3.3.3.6                       | n252 <sup>4</sup>      | 5, 10, 15, 20           |                               | Clause 6.2.3.3.7                        |
| NS_11N                   | 6.5.2.3.3.1<br>6.5.3.3.3.3        | n254                   | 5                       |                               | Clause 6.2.3.3.3                        |
| NS_12N                   | 6.5.2.3.3.2<br>6.5.3.3.3.3        | n254                   | 5, 10, 15               |                               | Clause 6.2.3.3.4                        |

NOTE 1: This NS can be signalled for NR satellite 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.  
 NOTE 3: The NS\_01 label with the field *additionalPmax* [8] absent is default for all NR satellite bands.  
 NOTE 4: The NS\_07N and NS\_08N is signalled based on coordination between operators and subject to regional/national regulation

**Table 6.2.3.3.1-2: Mapping of network signalling label**

| NR satellite band | Value of <i>additionalSpectrumEmission</i> |        |        |        |        |        |   |   |
|-------------------|--------------------------------------------|--------|--------|--------|--------|--------|---|---|
|                   | 0                                          | 1      | 2      | 3      | 4      | 5      | 6 | 7 |
| n256              | NS_01                                      | NS_24N | NS_100 |        |        |        |   |   |
| n255              | NS_01                                      | NS_02N |        |        |        |        |   |   |
| n254              | NS_01                                      | NS_03N | NS_04N | NS_05N | NS_11N | NS_12N |   |   |
| n252              | NS_01                                      | NS_06N | NS_07N | NS_08N |        |        |   |   |

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: Void**

## 6.2.3.3.2 A-MPR for NS\_03N

Table 6.2.3.3.2-1: A-MPR regions for NS\_03N

| Channel BW | Carrier Center Frequency | RB <sub>start</sub> *12*SCS (MHz) | L <sub>CRB</sub> *12*SCS (MHz) | A-MPR  |
|------------|--------------------------|-----------------------------------|--------------------------------|--------|
| 3MHz       | 1611.5 <= fc < 1613      | >= 0                              | >= 2.16                        | A7     |
| 5MHz       | 1612.5 <= fc < 1613.9    | <= 0.36                           | <= 0.36                        | A1     |
|            |                          |                                   | >= 2.88                        | A2     |
|            | 1613.9 <= fc < 1615.7    |                                   | >= 3.24                        | A3     |
| 10MHz      | 1615 <= fc < 1620.1      | <= 1.8                            | <= 5.04                        | A4     |
|            |                          | <= 1.8                            | > 5.04                         | A5     |
|            |                          | > 7.2                             | > 0                            | A6     |
|            |                          | > 1.8                             | >= 2.88                        | A2     |
|            | 1620.1 <= fc < 1621.5    |                                   | <= 6.48                        | A6     |
|            |                          | <= 0.36                           | <= 0.36                        | A1     |
|            |                          | fc = 1621.5                       |                                | >= 7.2 |
| 15MHz      | all                      | <= 3.6                            | <= 5.04                        | A4     |
|            |                          | <= 3.6                            | > 5.04                         | A5     |
|            |                          | > 10.44                           |                                | A6     |
|            |                          | > 3.6                             | >= 4.32                        | A2     |

Table 6.2.3.3.2-2: A-MPR for NS\_03N

|            | Modulation | A1  | A2  | A3  | A4  | A5   | A6  |
|------------|------------|-----|-----|-----|-----|------|-----|
| DFT-s-OFDM | Pi/2 BPSK  | 2.5 | 3.0 | 1.0 | 4.0 | 6.5  | 1.5 |
|            | QPSK       | 2.5 | 4.0 | 2.5 | 6.0 | 7.0  | 2.0 |
|            | 16QAM      | 3.0 | 4.5 | 3.0 | 6.5 | 7.5  | 2.5 |
|            | 64QAM      | 3.5 | 5   | 3.5 | 7   | 8    | 3   |
| CP-OFDM    | QPSK       | 3.5 | 6.0 | 4.0 | 8.0 | 10.0 | 4.0 |
|            | 16QAM      | 3.5 | 6.0 | 4.0 | 8.0 | 10.0 | 4.0 |
|            | 64QAM      | 3.5 | 6.0 | 4.0 | 8.0 | 10.0 | 4.0 |

## 6.2.3.3.3 A-MPR for NS\_04N and NS\_11N

Table 6.2.3.3.3-1: A-MPR regions for NS\_04N and NS\_11N

| Channel BW | Carrier Center Frequency   | $RB_{start} * 12 * SCS$ (MHz) | $L_{CRB} * 12 * SCS$ (MHz) | A-MPR |
|------------|----------------------------|-------------------------------|----------------------------|-------|
| 5MHz       | $1612.5 \leq f_c < 1613.9$ | $\leq 0.36$                   | $\leq 0.36$                | A1    |
|            |                            |                               | $\geq 2.88$                | A2    |
|            | $1613.9 \leq f_c < 1615.7$ |                               | $\geq 3.24$                | A3    |

Table 6.2.3.3.3-2: A-MPR for NS\_04N and NS\_11N

|            | Modulation | A1  | A2  | A3  |
|------------|------------|-----|-----|-----|
| DFT-s-OFDM | Pi/2 BPSK  | 2.5 | 3.0 | 1.0 |
|            | QPSK       | 2.5 | 4.0 | 2.5 |
|            | 16QAM      | 3.0 | 4.5 | 3.0 |
|            | 64QAM      | 3.5 | 5   | 3.5 |
| CP-OFDM    | QPSK       | 3.5 | 6.0 | 4.0 |
|            | 16QAM      | 3.5 | 6.0 | 4.0 |
|            | 64QAM      | 3.5 | 6.0 | 4.0 |

## 6.2.3.3.4 A-MPR for NS\_05N and NS\_12N

Table 6.2.3.3.4-1: A-MPR regions for NS\_05N and NS\_12N

| Channel BW | Carrier Center Frequency      | $RB_{start} \cdot 12 \cdot SCS$ (MHz) | $L_{CRB} \cdot 12 \cdot SCS$ (MHz) | A-MPR |
|------------|-------------------------------|---------------------------------------|------------------------------------|-------|
| 5MHz       | $1622.4 < f_c \leq 1624$      | $\leq 3.6$                            | $> 0.36$                           | A3    |
|            |                               |                                       | $\geq 2.88$                        | A1    |
| 10MHz      | $1615 \leq f_c < 1620.1$      | $\leq 1.8$                            | $\leq 5.04$                        | A4    |
|            |                               | $\leq 1.8$                            | $> 5.04$                           | A5    |
|            |                               | $> 7.2$                               | $> 0$                              | A6    |
|            |                               | $> 1.8$                               | $\geq 2.88$                        | A2    |
|            | $1620.1 \leq f_c \leq 1621.5$ |                                       | $\leq 7.2$                         | A6    |
|            |                               | $\leq 0.36$                           | $\leq 0.36$                        | A1    |
|            |                               | $> 7.2$                               | $> 0$                              | A6    |
| 15MHz      | all                           | $\leq 3.6$                            | $\leq 5.04$                        | A4    |
|            |                               | $\leq 3.6$                            | $> 5.04$                           | A5    |
|            |                               | $> 10.44$                             |                                    | A6    |
|            |                               | $> 3.6$                               | $\geq 4.32$                        | A2    |

Table 6.2.3.3.4-2: A-MPR for NS\_05N and NS\_12N

|            | Modulation | A1  | A2  | A3  | A4  | A5   | A6  |
|------------|------------|-----|-----|-----|-----|------|-----|
| DFT-s-OFDM | Pi/2 BPSK  | 1.5 | 5.0 | 1.5 | 6.5 | 6.5  | 2.0 |
|            | QPSK       | 1.5 | 5.0 | 1.5 | 6.5 | 7.0  | 2.5 |
|            | 16QAM      | 2.0 | 5.5 | 2.0 | 7.0 | 7.5  | 3.0 |
|            | 64QAM      | 2.5 | 6   | 2.5 | 7.5 | 8    | 3.5 |
| CP-OFDM    | QPSK       | 3.0 | 6.5 |     | 8.0 | 10.0 | 4.5 |
|            | 16QAM      | 3.0 | 6.5 |     | 8.0 | 10.0 | 4.5 |
|            | 64QAM      | 3.0 | 6.5 |     | 8.0 | 10.0 | 4.5 |

## 6.2.3.3.5 A-MPR for NS\_24N

Table 6.2.3.3.5-0a: A-MPR regions for NS\_24N (Power Class 3)

| Channel Bandwidth, MHz | Carrier Centre Frequency, Fc, MHz | Region A                             |                        |       | Region B                             |                        |       | Region C                             |                        |       |
|------------------------|-----------------------------------|--------------------------------------|------------------------|-------|--------------------------------------|------------------------|-------|--------------------------------------|------------------------|-------|
|                        |                                   | RB <sub>end</sub> *12*<br>SCS<br>MHz | LCRB*12*S<br>CS<br>MHz | A-MPR | RB <sub>end</sub> *12*S<br>CS<br>MHz | LCRB*12*S<br>CS<br>MHz | A-MPR | RB <sub>end</sub> *12*S<br>CS<br>MHz | LCRB*12*S<br>CS<br>MHz | A-MPR |
| 5MHz                   | 1987.5 < Fc ≤ 1992.5              |                                      | >3.24                  | A7    |                                      |                        |       |                                      |                        |       |
| 5MHz                   | 1992.5 < Fc ≤ 1997.5              |                                      | >3.24                  | A4    |                                      |                        |       |                                      |                        |       |
| 5MHz                   | 1997.5 < Fc ≤ 2002.5              |                                      | >1.98                  | A1    | >3.6                                 | >1.08<br>≤1.98         | A2    | ≤3.6                                 | ≤1.98                  | A3    |
|                        |                                   |                                      |                        |       |                                      | ≤1.08                  | A6    |                                      |                        |       |
| 10MHz                  | 1975 < Fc ≤ 1985                  | >5.4                                 |                        | A4    |                                      |                        |       |                                      |                        |       |
| 10MHz                  | 1985 < Fc ≤ 1995                  |                                      | >4.32                  | A1    | ≥7.2                                 | >1.08<br>≤4.32         | A2    | <7.2                                 | ≤4.32                  | A3    |
|                        |                                   |                                      |                        |       |                                      | ≤1.08                  | A6    |                                      |                        |       |
| 10MHz                  | 1995 < Fc ≤ 2000                  | ≥5.76                                |                        | A5    | <3.06                                |                        | A5    | ≥3.06<br><5.76                       | >1.44                  | A6    |
| 15MHz                  | 1972.5 < Fc ≤ 1987.5              |                                      | >6.84                  | A1    | ≥10.8                                | >1.08<br>≤6.84         | A2    | <10.8                                | ≤6.84                  | A3    |
|                        |                                   |                                      |                        |       |                                      | ≤1.08                  | A6    |                                      |                        |       |
| 15MHz                  | 1987.5 < Fc ≤ 1997.5              | ≥8.64                                |                        | A5    | <4.04                                |                        | A5    | ≥4.04<br><8.64                       | >1.44                  | A6    |
| 20MHz                  | 1970 < Fc ≤ 1990                  | ≥12.96                               |                        | A5    | <4.68                                |                        | A5    | ≥4.68<br><12.96                      | >2.16                  | A6    |
| 20MHz                  | 1990 < Fc ≤ 1995                  | ≥11.52                               |                        | A5    | <5.58                                |                        | A5    | ≥5.58<br><11.52                      | >1.44                  | A6    |

NOTE 1: The A-MPR values are listed in Table 6.2.3.3.5-0b.

NOTE 2: For any undefined region, MPR applies

Table 6.2.3.3.5-0b: A-MPR for NS\_24N (Power Class 3)

| Modulation/Waveform  | A1          | A2          | A3          | A4    | A5          | A6          | A7    |
|----------------------|-------------|-------------|-------------|-------|-------------|-------------|-------|
|                      | Outer/Inner | Outer/Inner | Outer/Inner | Outer | Outer/Inner | Outer/Inner | Outer |
| DFT-s-OFDM PI/2 BPSK | ≤ 11        | ≤ 5         | ≤ 4         | ≤ 8.5 | ≤ 18        | ≤ 10        | ≤ 3.5 |
| DFT-s-OFDM QPSK      | ≤ 11        | ≤ 5         | ≤ 4         | ≤ 8.5 | ≤ 18        | ≤ 10        | ≤ 3.5 |
| DFT-s-OFDM 16 QAM    | ≤ 11        | ≤ 5         | ≤ 4         | ≤ 8.5 | ≤ 18        | ≤ 10        | ≤ 3.5 |
| DFT-s-OFDM 64 QAM    | ≤ 11        | ≤ 5         | ≤ 4         | ≤ 8.5 | ≤ 19        | ≤ 10        | ≤ 3.5 |
| DFT-s-OFDM 256 QAM   | ≤ 11        | ≤ 5         |             | ≤ 8.5 | ≤ 20        | ≤ 10        |       |
| CP-OFDM QPSK         | ≤ 13        | ≤ 6.5       | ≤ 4         | ≤ 8.5 | ≤ 19        | ≤ 12        | ≤ 5.5 |
| CP-OFDM 16 QAM       | ≤ 13        | ≤ 6.5       | ≤ 4         | ≤ 8.5 | ≤ 19        | ≤ 12        | ≤ 5.5 |
| CP-OFDM 64 QAM       | ≤ 13        | ≤ 6.5       | ≤ 4         | ≤ 8.5 | ≤ 19        | ≤ 12        | ≤ 5.5 |
| CP-OFDM 256 QAM      | ≤ 13        | ≤ 6.5       |             | ≤ 8.5 | ≤ 20        | ≤ 12        |       |

NOTE 1: The backoff applied is max(MPR, A-MPR) where MPR is defined in Table 6.2.2.3-1

NOTE 2: Outer and inner allocations are defined in clause 6.2.2

Table 6.2.3.3.5-1: Void

Table 6.2.3.3.5-2: Void

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

## 6.2.3.3.6 A-MPR for NS\_07N

Table 6.2.3.3.6-1: A-MPR regions for NS\_07N

| Channel BW | Carrier Frequency, $F_c$ , MHz | $RB_{Start} \cdot 12 \cdot SCS$ (MHz) | $L_{CRB} \cdot 12 \cdot SCS$ (MHz) | A-MPR |
|------------|--------------------------------|---------------------------------------|------------------------------------|-------|
| 5MHz       | $< 2007.5$                     | $\geq 0$                              | $\geq 2.16$                        | A1    |
| 10MHz      | $< 2010$                       | $\leq 1.44$                           | $\geq 0$                           | A2    |
|            |                                | $> 1.44$                              | $\geq 3.6$                         | A1    |
|            |                                | $> 7.74$                              | $\leq 0.72$                        | A1    |
|            | $2010 \leq F_c \leq 2015$      | $\geq 0$                              | $\geq 4.5$                         | A1    |
| 15MHz      | $< 2012.5$                     | $\leq 3.24$                           | $\geq 0$                           | A3    |
|            |                                | $> 3.24$                              | $\geq 4.5, \leq 7.2$               | A1    |
|            |                                | $> 3.24$                              | $> 7.2$                            | A2    |
|            |                                | $> 10.8$                              | $\leq 0.72$                        | A1    |
|            | 2012.5                         | $\leq 1.44$                           | $\geq 0$                           | A2    |
|            |                                | $> 1.44$                              | $\geq 6.48$                        | A1    |
|            |                                | $> 12.6$                              | $\leq 0.72$                        | A1    |
|            |                                |                                       |                                    |       |
| 20 MHz     | 2010                           | $\leq 4.68$                           | $\geq 0$                           | A3    |
|            |                                | $> 4.68$                              | $\geq 4.5, \leq 7.2$               | A1    |
|            |                                | $> 4.68$                              | $> 7.2$                            | A2    |
|            |                                | $> 12.6$                              | $\leq 0.72$                        | A1    |

Table 6.2.3.3.6-2: A-MPR for NS\_07N

| Modulation/Waveform  | A1          | A2          | A3          |
|----------------------|-------------|-------------|-------------|
|                      | Outer/Inner | Outer/Inner | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | $\leq 4$    | $\leq 7$    | $\leq 11$   |
| DFT-s-OFDM QPSK      | $\leq 4.5$  | $\leq 7.5$  | $\leq 11.5$ |
| DFT-s-OFDM 16 QAM    | $\leq 5$    | $\leq 8$    | $\leq 12$   |
| DFT-s-OFDM 64 QAM    | $\leq 5.5$  | $\leq 8$    | $\leq 12$   |
| CP-OFDM QPSK         | $\leq 7$    | $\leq 9$    | $\leq 13$   |
| CP-OFDM 16 QAM       | $\leq 7$    | $\leq 9$    | $\leq 13$   |
| CP-OFDM 64 QAM       | $\leq 7$    | $\leq 9$    | $\leq 13$   |

## 6.2.3.3.7 A-MPR for NS\_08N

Table 6.2.3.3.7-1: A-MPR regions for NS\_08N

| Channel BW | Carrier Frequency, $F_c$ , MHz | $RB_{Start} \cdot 12 \cdot SCS$ (MHz) | $L_{CRB} \cdot 12 \cdot SCS$ (MHz) | A-MPR |
|------------|--------------------------------|---------------------------------------|------------------------------------|-------|
| 5 MHz      | -                              | -                                     | -                                  | -     |
| 10MHz      | $< 2010$                       | $\leq 1.44$                           | $\leq 2.7$                         | A1    |
|            |                                | $\leq 1.44$                           | $> 2.7, < 4.5$                     | A2    |
|            |                                | $\leq 1.44$                           | $\geq 4.5$                         | A1    |
|            |                                | $\geq 1.44$                           | $\geq 5.4$                         | A2    |
| 15MHz      | $< 2012.5$                     | $\leq 3.24$                           | $\leq 2.7$                         | A1    |
|            |                                | $\leq 3.24$                           | $> 2.7, < 4.5$                     | A2    |
|            |                                | $\leq 3.24$                           | $\geq 4.5$                         | A1    |
|            |                                | $\geq 3.24$                           | $\geq 5.4$                         | A2    |
|            | 2012.5                         | $\leq 1.44$                           | $\leq 2.7$                         | A1    |
|            |                                | $\leq 1.44$                           | $> 2.7, < 5.4$                     | A2    |
|            |                                | $\leq 1.44$                           | $\geq 5.4$                         | A1    |
|            |                                | $\geq 1.44$                           | $\geq 7.2$                         | A2    |
| 20 MHz     | 2010                           | $\leq 4.68$                           | $\leq 3.6$                         | A1    |
|            |                                | $\leq 4.68$                           | $> 3.6, \leq 5.4$                  | A2    |
|            |                                | $\leq 4.68$                           | $> 5.4$                            | A1    |
|            |                                | $> 4.68$                              | $\geq 7.2$                         | A2    |

**Table 6.2.3.3.7-2: A-MPR for NS\_08N**

| Modulation/Waveform  | A1          | A2          |
|----------------------|-------------|-------------|
|                      | Outer/Inner | Outer/Inner |
| DFT-s-OFDM PI/2 BPSK | $\leq 4$    | $\leq 2.5$  |
| DFT-s-OFDM QPSK      | $\leq 4.5$  | $\leq 3$    |
| DFT-s-OFDM 16 QAM    | $\leq 5$    | $\leq 3.5$  |
| DFT-s-OFDM 64 QAM    | $\leq 5.5$  | $\leq 4$    |
| CP-OFDM QPSK         | $\leq 7$    | $\leq 4.5$  |
| CP-OFDM 16 QAM       | $\leq 7$    | $\leq 4.5$  |
| CP-OFDM 64 QAM       | $\leq 7$    | $\leq 4.5$  |

#### 6.2.3.4 Test description

**Editor's Note:** The following aspects are either missing or not yet determined:

- Test configuration and test requirement table for NS\_06N, NS\_07N and NS\_08N for band n252 are incomplete and TBD.
- Test configuration and test requirement table for NS\_24N for band n256 are incomplete and TBD.

##### 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 |                          | CP OFDM              | QPSK                   | Edge_1RB_Left  |
| 14                                                                                                                        | High    | Default | Default |                          |                      | QPSK                   | Edge_1RB_Right |
| 15                                                                                                                        | Default | Default | Default |                          |                      | QPSK                   | Outer_Full     |
| 16                                                                                                                        | Low     | Default | Default |                          |                      | 16 QAM                 | Edge_1RB_Left  |
| 17                                                                                                                        | High    | Default | Default |                          |                      | 16 QAM                 | Edge_1RB_Right |
| 18                                                                                                                        | Default | Default | Default |                          |                      | 16 QAM                 | Outer_Full     |
| 19                                                                                                                        | Low     | Default | Default |                          |                      | 64 QAM                 | Edge_1RB_Left  |
| 20                                                                                                                        | High    | Default | Default |                          |                      | 64 QAM                 | Edge_1RB_Right |
| 21                                                                                                                        | Default | Default | Default |                          |                      | 64 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\_24N

| 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 <sub>c</sub> ) 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_24N                                         |                         |               |         |                           |                                                                               |                                       |            |                |               |
| Test ID                                                                  | F <sub>c</sub><br>(MHz) | ChBw<br>(MHz) | SCS     | Downlink<br>Configuration | Uplink Configuration                                                          |                                       |            |                |               |
|                                                                          |                         |               |         |                           | Modulation<br>(NOTE 2, 3)                                                     | RB allocation (Note 1)                |            |                |               |
|                                                                          |                         |               |         |                           |                                                                               | Region A                              | Region B   | Region C       |               |
| 1-4                                                                      | 1,992.5                 | 5             | Default | N/A for A-MPR testing     | DFT-s OFDM                                                                    | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full | N/A            | N/A           |
| 5-8                                                                      | 1,997.5                 | 5             | Default |                           |                                                                               | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full | N/A            | N/A           |
| 9-20                                                                     | 2,002.5                 | 5             | Default |                           |                                                                               | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full | Edge_1RB_Right | Edge_1RB_Left |

|       |       |    |         |  |  |                                       |                |     |     |
|-------|-------|----|---------|--|--|---------------------------------------|----------------|-----|-----|
| 21-24 | 1,985 | 10 | Default |  |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | N/A | N/A |
| 25-28 | 1,985 | 10 | Default |  |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A | N/A |

|         |         |    |         |         |  |                                       |                |                |               |
|---------|---------|----|---------|---------|--|---------------------------------------|----------------|----------------|---------------|
| 29-40   | 1,995   | 10 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full     | Edge_1RB_Right | Edge_1RB_Left |
| 41-52   | 2,000   | 10 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | Edge_1RB_Left  | 36@0          |
| 53-56   | 2,000   | 10 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A            | N/A           |
| 57-68   | 1,987.5 | 15 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full     | Edge_1RB_Right | Edge_1RB_Left |
| 69-80   | 1,997.5 | 15 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | Edge_1RB_Left  | 50@0          |
| 81-84   | 1,997.5 | 15 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A            | N/A           |
| 85-96   | 1,990   | 20 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | Edge_1RB_Left  | 72@0          |
| 97-100  | 1,990   | 20 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A            | N/A           |
| 101-112 | 1,995   | 20 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | Edge_1RB_Left  | 64@0          |
| 113-116 | 1,995   | 20 | Default |         |  | Pi/2 BPSK<br>QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A            | N/A           |
| 117-119 | 1,992.5 | 5  | Default | CP-OFDM |  | QPSK<br>16 QAM<br>64 QAM              | Outer_Full     | N/A            | N/A           |
| 120-122 | 1,997.5 | 5  | Default |         |  | QPSK<br>16 QAM<br>64 QAM              | Outer_Full     | N/A            | N/A           |

|         |         |    |         |  |                          |                |                |               |
|---------|---------|----|---------|--|--------------------------|----------------|----------------|---------------|
| 123-131 | 2,002.5 | 5  | Default |  | QPSK<br>16 QAM<br>64 QAM | Outer_Full     | Edge_1RB_Right | Edge_1RB_Left |
| 132-134 | 1,985   | 10 | Default |  | QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | N/A            | N/A           |
| 135-137 | 1,985   | 10 | Default |  | QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A            | N/A           |
| 138-146 | 1,995   | 10 | Default |  | QPSK<br>16 QAM<br>64 QAM | Outer_Full     | Edge_1RB_Right | Edge_1RB_Left |
| 147-155 | 2,000   | 10 | Default |  | QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | Edge_1RB_Left  | 37@0          |
| 156-158 | 2,000   | 10 | Default |  | QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A            | N/A           |
| 159-167 | 1,987.5 | 15 | Default |  | QPSK<br>16 QAM<br>64 QAM | Outer_Full     | Edge_1RB_Right | Edge_1RB_Left |
| 168-176 | 1,997.5 | 15 | Default |  | QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | Edge_1RB_Left  | 51@0          |
| 177-179 | 1,997.5 | 15 | Default |  | QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A            | N/A           |
| 180-188 | 1,990   | 20 | Default |  | QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | Edge_1RB_Left  | 74@0          |
| 189-191 | 1,990   | 20 | Default |  | QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A            | N/A           |
| 192-200 | 1,995   | 20 | Default |  | QPSK<br>16 QAM<br>64 QAM | Edge_1RB_Right | Edge_1RB_Left  | 69@0          |
| 201-203 | 1,995   | 20 | Default |  | QPSK<br>16 QAM<br>64 QAM | Outer_Full     | N/A            | N/A           |
| 204     | 1,992.5 | 5  | Default |  | QPSK                     | Edge_1RB_Right | N/A            | N/A           |
| 205     | 1,997.5 | 5  | Default |  | 16 QAM                   | Edge_1RB_Right | N/A            | N/A           |
| 206     | 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.

**Table 6.2.3.4.1-3: FFS**

Table 6.2.3.4.1-4: Test Configuration table for NS\_03N

| Initial Conditions                                                                                                        |                         |                   |              |                           |                        |                        |                    |            |           |     |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------|--------------|---------------------------|------------------------|------------------------|--------------------|------------|-----------|-----|
| Test Environment as specified in TS 38.508-1 [5] subclause 4.1                                                            |                         |                   |              |                           |                        | Normal                 |                    |            |           |     |
| Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1                                                          |                         |                   |              |                           |                        | (See Freq column)      |                    |            |           |     |
| Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1                                                   |                         |                   |              |                           |                        | (See Ch BW column)     |                    |            |           |     |
| Test SCS as specified in Table 5.3.5-1                                                                                    |                         |                   |              |                           |                        | Lowest, Highest        |                    |            |           |     |
| A-MPR test parameters for NS_03N (Power Class 3)                                                                          |                         |                   |              |                           |                        |                        |                    |            |           |     |
| Test ID                                                                                                                   | F <sub>c</sub><br>(MHz) | Ch<br>BW<br>(MHz) | SCS<br>(kHz) | Downlink<br>Configuration | Uplink Configuration   |                        |                    |            |           |     |
|                                                                                                                           |                         |                   |              |                           | Modulation<br>(Note 2) | RB allocation (Note 1) |                    |            |           |     |
|                                                                                                                           |                         |                   |              |                           |                        | SCS 15 kHz             | SCS 30 kHz         | SCS 60 kHz |           |     |
| 1                                                                                                                         | Low                     | 5                 | Default      | N/A                       | DFT-s-OFDM             | QPSK                   | Edge_1RB_left (A1) | N/A        | N/A       |     |
| 2                                                                                                                         | Low                     | 5                 | Default      |                           |                        | QPSK                   | Outer_Full (A2)    | N/A        | N/A       |     |
| 3                                                                                                                         | 1615.6                  | 5                 | Default      |                           |                        | QPSK                   | Outer_Full (A3)    | N/A        | N/A       |     |
| 4                                                                                                                         | Low                     | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A4) |            |           |     |
| 5                                                                                                                         | Low                     | 10                | Default      |                           |                        | QPSK                   | Outer_Full (A5)    |            |           |     |
| 6                                                                                                                         | Low                     | 10                | Default      |                           |                        | QPSK                   | 10@41 (A6)         | 3@21 (A6)  | N/A       |     |
| 7                                                                                                                         | Low                     | 10                | Default      |                           |                        | QPSK                   | 40@11 (A2)         | 18@6 (A2)  | 8@3 (A2)  |     |
| 8                                                                                                                         | 1621.4                  | 10                | Default      |                           |                        | QPSK                   | 36@0 (A6)          | 18@0 (A6)  | 9@0 (A6)  |     |
| 9                                                                                                                         | 1621.4                  | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A1) |            |           | N/A |
| 10                                                                                                                        | 1621.5                  | 10                | Default      |                           |                        | QPSK                   | Outer_Full (A1)    |            |           |     |
| 11                                                                                                                        | Low                     | 15                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A4) |            |           |     |
| 12                                                                                                                        | Low                     | 15                | Default      |                           |                        | QPSK                   | Outer_Full (A5)    |            |           |     |
| 13                                                                                                                        | Low                     | 15                | Default      |                           |                        | QPSK                   | 20@59 (A6)         | 8@30 (A6)  | 3@15 (A6) |     |
| 14                                                                                                                        | Low                     | 15                | Default      |                           |                        | QPSK                   | 24@55 (A2)         | 12@26 (A2) | 6@12 (A2) |     |
| 14a                                                                                                                       | Low                     | 3                 | Default      |                           |                        | QPSK                   | 12@0 (A7)          | N/A        | N/A       |     |
| 15                                                                                                                        | Low                     | 5                 | Default      | N/A                       | CP-OFDM                | QPSK                   | Edge_1RB_left (A1) | N/A        | N/A       |     |
| 16                                                                                                                        | Low                     | 5                 | Default      |                           |                        | QPSK                   | Outer_Full (A2)    | N/A        | N/A       |     |
| 17                                                                                                                        | 1615.6                  | 5                 | Default      |                           |                        | QPSK                   | Outer_Full (A3)    | N/A        | N/A       |     |
| 18                                                                                                                        | Low                     | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A4) |            |           |     |
| 19                                                                                                                        | Low                     | 10                | Default      |                           |                        | QPSK                   | Outer_Full (A5)    |            |           |     |
| 20                                                                                                                        | Low                     | 10                | Default      |                           |                        | QPSK                   | 11@41 (A6)         | 3@21 (A6)  | N/A       |     |
| 21                                                                                                                        | Low                     | 10                | Default      |                           |                        | QPSK                   | 41@11 (A2)         | 18@6 (A2)  | 8@3 (A2)  |     |
| 22                                                                                                                        | 1621.4                  | 10                | Default      |                           |                        | QPSK                   | 36@0 (A6)          | 18@0 (A6)  | 9@0 (A6)  |     |
| 23                                                                                                                        | 1621.4                  | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A1) |            |           | N/A |
| 24                                                                                                                        | 1621.5                  | 10                | Default      |                           |                        | QPSK                   | Outer_Full(A1)     |            |           |     |
| 25                                                                                                                        | Low                     | 15                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A4) |            |           |     |
| 26                                                                                                                        | Low                     | 15                | Default      |                           |                        | QPSK                   | Outer_Full (A5)    |            |           |     |
| 27                                                                                                                        | Low                     | 15                | Default      |                           |                        | QPSK                   | 20@59 (A6)         | 8@30 (A6)  | 3@15 (A6) |     |
| 28                                                                                                                        | Low                     | 15                | Default      |                           |                        | QPSK                   | 24@55 (A2)         | 12@26 (A2) | 6@12 (A2) |     |
| 29                                                                                                                        | Low                     | 3                 | Default      |                           |                        | QPSK                   | 12@0 (A7)          | 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 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table.

**Table 6.2.3.4.1-5: Test Configuration table for NS\_04N and NS\_11N**

| Initial Conditions                                                      |                         |                |              |                           |                        |                        |                       |            |     |
|-------------------------------------------------------------------------|-------------------------|----------------|--------------|---------------------------|------------------------|------------------------|-----------------------|------------|-----|
| Test Environment as specified in TS 38.508-1 [5] subclause 4.1          |                         |                |              |                           |                        | Normal                 |                       |            |     |
| Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1        |                         |                |              |                           |                        | (See Freq column)      |                       |            |     |
| Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1 |                         |                |              |                           |                        | 5 MHz                  |                       |            |     |
| Test SCS as specified in Table 5.3.5-1                                  |                         |                |              |                           |                        | Lowest, Highest        |                       |            |     |
| A-MPR test parameters for NS_04N and NS_11N (Power Class 3)             |                         |                |              |                           |                        |                        |                       |            |     |
| Test ID                                                                 | F <sub>c</sub><br>(MHz) | Ch BW<br>(MHz) | SCS<br>(kHz) | Downlink<br>Configuration | Uplink Configuration   |                        |                       |            |     |
|                                                                         |                         |                |              |                           | Modulation<br>(Note 2) | RB allocation (Note 1) |                       |            |     |
|                                                                         |                         |                |              |                           |                        | SCS 15 kHz             | SCS 30 kHz            | SCS 60 kHz |     |
| 1                                                                       | Low                     | 5              | Default      | N/A                       | DFT-s-OFDM             | QPSK                   | Edge_1RB_left<br>(A1) | N/A        | N/A |
| 2                                                                       | Low                     | 5              | Default      |                           |                        | QPSK                   | Outer_Full<br>(A2)    | N/A        | N/A |
| 3                                                                       | 1615.6                  | 5              | Default      |                           |                        | QPSK                   | Outer_Full<br>(A3)    | N/A        | N/A |
| 4                                                                       | Low                     | 5              | Default      | N/A                       | CP-OFDM                | QPSK                   | Edge_1RB_left<br>(A1) | N/A        | N/A |
| 5                                                                       | Low                     | 5              | Default      |                           |                        | QPSK                   | Outer_Full<br>(A2)    | N/A        | N/A |
| 6                                                                       | 1615.6                  | 5              | Default      |                           |                        | QPSK                   | Outer_Full<br>(A3)    | 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.

Table 6.2.3.4.1-6: Test Configuration table for NS\_05N and NS\_12N

| Initial Conditions                                                                                                        |                         |                   |              |                           |                        |                        |                       |            |           |  |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------|--------------|---------------------------|------------------------|------------------------|-----------------------|------------|-----------|--|
| Test Environment as specified in TS 38.508-1 [5] subclause 4.1                                                            |                         |                   |              |                           |                        |                        | Normal                |            |           |  |
| Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1                                                          |                         |                   |              |                           |                        |                        | Low range, High range |            |           |  |
| Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1                                                   |                         |                   |              |                           |                        |                        | 5 MHz, 10MHz, 15MHz   |            |           |  |
| Test SCS as specified in Table 5.3.5-1                                                                                    |                         |                   |              |                           |                        |                        | Lowest, Highest       |            |           |  |
| A-MPR test parameters for NS_05N and NS_12N (Power Class 3)                                                               |                         |                   |              |                           |                        |                        |                       |            |           |  |
| Test ID                                                                                                                   | F <sub>c</sub><br>(MHz) | Ch<br>BW<br>(MHz) | SCS<br>(kHz) | Downlink<br>Configuration | Uplink Configuration   |                        |                       |            |           |  |
|                                                                                                                           |                         |                   |              |                           | Modulation<br>(Note 2) | RB allocation (Note 1) |                       |            |           |  |
|                                                                                                                           |                         |                   |              |                           |                        | SCS 15<br>kHz          | SCS 30 kHz            | SCS 60 kHz |           |  |
| 1                                                                                                                         | High                    | 5                 | Default      | N/A                       | DFT-s-OFDM             | QPSK                   | 5@20 (A3)             | N/A        | N/A       |  |
| 2                                                                                                                         | High                    | 5                 | Default      |                           |                        | QPSK                   | Outer_Full (A1)       | N/A        | N/A       |  |
| 3                                                                                                                         | Low                     | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A4)    |            |           |  |
| 4                                                                                                                         | Low                     | 10                | Default      |                           |                        | QPSK                   | Outer_Full (A5)       |            |           |  |
| 5                                                                                                                         | Low                     | 10                | Default      |                           |                        | QPSK                   | 10@41 (A6)            | 3@21 (A6)  | N/A       |  |
| 6                                                                                                                         | Low                     | 10                | Default      |                           |                        | QPSK                   | 40@11 (A2)            | 18@6 (A2)  | 8@3 (A2)  |  |
| 7                                                                                                                         | High                    | 10                | Default      |                           |                        | QPSK                   | 40@0 (A6)             | 20@0 (A6)  | 10@0 (A6) |  |
| 8                                                                                                                         | High                    | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A1)    |            |           |  |
| 9                                                                                                                         | High                    | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_right (A6)   |            |           |  |
| 10                                                                                                                        | Default                 | 15                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A4)    |            |           |  |
| 11                                                                                                                        | Default                 | 15                | Default      |                           |                        | QPSK                   | Outer_Full (A5)       |            |           |  |
| 12                                                                                                                        | Default                 | 15                | Default      |                           |                        | QPSK                   | 20@59 (A6)            | 8@30 (A6)  | 3@15 (A6) |  |
| 13                                                                                                                        | Default                 | 15                | Default      |                           |                        | QPSK                   | 24@55 (A2)            | 12@26 (A2) | 6@12 (A2) |  |
| 14                                                                                                                        | High                    | 5                 | Default      | N/A                       | CP-OFDM                | QPSK                   | 5@20 (A3)             | N/A        | N/A       |  |
| 15                                                                                                                        | High                    | 5                 | Default      |                           |                        | QPSK                   | Outer_Full (A1)       | N/A        | N/A       |  |
| 16                                                                                                                        | Low                     | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A4)    |            |           |  |
| 17                                                                                                                        | Low                     | 10                | Default      |                           |                        | QPSK                   | Outer_Full (A5)       |            |           |  |
| 18                                                                                                                        | Low                     | 10                | Default      |                           |                        | QPSK                   | 11@41 (A6)            | 3@21 (A6)  | N/A       |  |
| 19                                                                                                                        | Low                     | 10                | Default      |                           |                        | QPSK                   | 41@11 (A2)            | 18@6 (A2)  | 8@3 (A2)  |  |
| 20                                                                                                                        | High                    | 10                | Default      |                           |                        | QPSK                   | 40@0 (A6)             | 20@0 (A6)  | 10@0 (A6) |  |
| 21                                                                                                                        | High                    | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A1)    |            |           |  |
| 22                                                                                                                        | High                    | 10                | Default      |                           |                        | QPSK                   | Edge_1RB_right (A6)   |            |           |  |
| 23                                                                                                                        | Default                 | 15                | Default      |                           |                        | QPSK                   | Edge_1RB_left (A4)    |            |           |  |
| 24                                                                                                                        | Default                 | 15                | Default      |                           |                        | QPSK                   | Outer_Full (A5)       |            |           |  |
| 25                                                                                                                        | Default                 | 15                | Default      |                           |                        | QPSK                   | 20@59 (A6)            | 8@30 (A6)  | 3@15 (A6) |  |
| 26                                                                                                                        | Default                 | 15                | Default      |                           |                        | QPSK                   | 24@55 (A2)            | 12@26 (A2) | 6@12 (A2) |  |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table. |                         |                   |              |                           |                        |                        |                       |            |           |  |

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table.

Table 6.2.3.4.1-7: Test Configuration table for NS\_07N

| Initial Conditions                                                                                                        |                         |                   |              |                           |                      |                            |                     |            |            |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------|--------------|---------------------------|----------------------|----------------------------|---------------------|------------|------------|
| Test Environment as specified in TS 38.508-1 [5] subclause 4.1                                                            |                         |                   |              |                           |                      | Normal                     |                     |            |            |
| Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1                                                          |                         |                   |              |                           |                      | Low range, High range      |                     |            |            |
| Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1                                                   |                         |                   |              |                           |                      | 5 MHz, 10MHz, 15MHz, 20MHz |                     |            |            |
| Test SCS as specified in Table 5.3.5-1                                                                                    |                         |                   |              |                           |                      | Lowest, Highest            |                     |            |            |
| A-MPR test parameters for NS_07N                                                                                          |                         |                   |              |                           |                      |                            |                     |            |            |
| Test ID                                                                                                                   | F <sub>c</sub><br>(MHz) | Ch<br>BW<br>(MHz) | SCS<br>(kHz) | Downlink<br>Configuration | Uplink Configuration |                            |                     |            |            |
|                                                                                                                           |                         |                   |              |                           | Modulation           | RB allocation (Note 1)     |                     |            |            |
|                                                                                                                           |                         |                   |              |                           |                      | SCS 15<br>kHz              | SCS 30 kHz          | SCS 60 kHz |            |
| 1                                                                                                                         | Low                     | 5                 | Default      | N/A                       | DFT-s-OFDM           | QPSK                       | Outer_Full (A1)     |            | N/A        |
| 2                                                                                                                         | Low                     | 10                | Default      |                           |                      | QPSK                       | Outer_Full (A2)     |            |            |
| 3                                                                                                                         | Low                     | 10                | Default      |                           |                      | QPSK                       | 40@9 (A1)           | 18@5 (A1)  | 8@3 (A1)   |
| 4                                                                                                                         | Low                     | 10                | Default      |                           |                      | QPSK                       | Edge_1RB_right (A1) |            |            |
| 5                                                                                                                         | High                    | 10                | Default      |                           |                      | QPSK                       | Outer_Full (A1)     |            |            |
| 6                                                                                                                         | Low                     | 15                | Default      |                           |                      | QPSK                       | Outer_Full (A3)     |            |            |
| 7                                                                                                                         | Low                     | 15                | Default      |                           |                      | QPSK                       | 40@39 (A1)          | 20@18 (A1) | 10@8 (A1)  |
| 8                                                                                                                         | Low                     | 15                | Default      |                           |                      | QPSK                       | 60@19 (A2)          | 27@10 (A2) | 12@5 (A2)  |
| 9                                                                                                                         | Low                     | 15                | Default      |                           |                      | QPSK                       | Edge_1RB_right (A1) |            |            |
| 10                                                                                                                        | High                    | 15                | Default      |                           |                      | QPSK                       | Outer_Full (A2)     |            |            |
| 11                                                                                                                        | High                    | 15                | Default      |                           |                      | QPSK                       | 64@9 (A1)           | 32@5 (A1)  | 15@3 (A1)  |
| 12                                                                                                                        | High                    | 15                | Default      |                           |                      | QPSK                       | Edge_1RB_right (A1) |            |            |
| 13                                                                                                                        | 2010                    | 20                | Default      |                           |                      | QPSK                       | Outer_Full (A3)     |            |            |
| 14                                                                                                                        | 2010                    | 20                | Default      |                           |                      | QPSK                       | 40@66 (A1)          | 20@31 (A1) | 10@14 (A1) |
| 15                                                                                                                        | 2010                    | 20                | Default      |                           |                      | QPSK                       | 75@27 (A2)          | 36@14 (A2) | 16@7 (A2)  |
| 16                                                                                                                        | 2010                    | 20                | Default      |                           |                      | QPSK                       | Edge_1RB_right (A1) |            |            |
| 17                                                                                                                        | Low                     | 5                 | Default      | N/A                       | CP-OFDM              | QPSK                       | Outer_Full (A1)     |            | N/A        |
| 18                                                                                                                        | Low                     | 10                | Default      |                           |                      | QPSK                       | Outer_Full (A2)     |            |            |
| 19                                                                                                                        | Low                     | 10                | Default      |                           |                      | QPSK                       | 43@9 (A1)           | 19@5 (A1)  | 8@3 (A1)   |
| 20                                                                                                                        | Low                     | 10                | Default      |                           |                      | QPSK                       | Edge_1RB_right (A1) |            |            |
| 21                                                                                                                        | High                    | 10                | Default      |                           |                      | QPSK                       | Outer_Full (A1)     |            |            |
| 22                                                                                                                        | Low                     | 15                | Default      |                           |                      | QPSK                       | Outer_Full (A3)     |            |            |
| 23                                                                                                                        | Low                     | 15                | Default      |                           |                      | QPSK                       | 40@39 (A1)          | 20@18 (A1) | 10@8 (A1)  |
| 24                                                                                                                        | Low                     | 15                | Default      |                           |                      | QPSK                       | 60@19 (A2)          | 28@10 (A2) | 13@5 (A2)  |
| 25                                                                                                                        | Low                     | 15                | Default      |                           |                      | QPSK                       | Edge_1RB_right (A1) |            |            |
| 26                                                                                                                        | High                    | 15                | Default      |                           |                      | QPSK                       | Outer_Full (A2)     |            |            |
| 27                                                                                                                        | High                    | 15                | Default      |                           |                      | QPSK                       | 70@9 (A1)           | 33@5 (A1)  | 15@3 (A1)  |
| 28                                                                                                                        | High                    | 15                | Default      |                           |                      | QPSK                       | Edge_1RB_right (A1) |            |            |
| 29                                                                                                                        | 2010                    | 20                | Default      |                           |                      | QPSK                       | Outer_Full (A3)     |            |            |
| 30                                                                                                                        | 2010                    | 20                | Default      |                           |                      | QPSK                       | 40@66 (A1)          | 20@31 (A1) | 10@14 (A1) |
| 31                                                                                                                        | 2010                    | 20                | Default      |                           |                      | QPSK                       | 79@27 (A2)          | 37@14 (A2) | 17@7 (A2)  |
| 32                                                                                                                        | 2010                    | 20                | Default      |                           |                      | QPSK                       | Edge_1RB_right (A1) |            |            |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table. |                         |                   |              |                           |                      |                            |                     |            |            |

NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table.

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. 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 38.508-1 [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 6.2.3.4.3.

#### 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\_24N"

1. Information element additionalSpectrumEmission is set to NS\_24N. 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\_24N"**

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

##### 6.2.3.4.3.3 Message contents exceptions for network signalling value "NS\_03N"

1. Information element additionalSpectrumEmission is set to NS\_03N. 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 6.2.3.4.3.3-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_03N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 1 (NS_03N)   |         |           |

#### 6.2.3.4.3.4 Message contents exceptions for network signalling value "NS\_04N"

1. Information element additionalSpectrumEmission is set to NS\_04N. 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 6.2.3.4.3.4-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_04N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 2 (NS_04N)   |         |           |

#### 6.2.3.4.3.5 Message contents exceptions for network signalling value "NS\_05N"

1. Information element additionalSpectrumEmission is set to NS\_05N. 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 6.2.3.4.3.5-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_05N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 3 (NS_05N)   |         |           |

#### 6.2.3.4.3.6 Message contents exceptions for network signalling value "NS\_11N"

1. Information element additionalSpectrumEmission is set to NS\_11N. 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 6.2.3.4.3.6-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_11N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 4 (NS_11N)   |         |           |

#### 6.2.3.4.3.7 Message contents exceptions for network signalling value "NS\_12N"

1. Information element additionalSpectrumEmission is set to NS\_12N. 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 6.2.3.4.3.7-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_12N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 5 (NS_12N)   |         |           |

#### 6.2.3.4.3.8 Message contents exceptions for network signalling value "NS\_06N"

1. Information element additionalSpectrumEmission is set to NS\_06N. 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 6.2.3.4.3.8-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_06N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 1 (NS_06N)   |         |           |

#### 6.2.3.4.3.9 Message contents exceptions for network signalling value "NS\_07N"

1. Information element additionalSpectrumEmission is set to NS\_07N. 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 6.2.3.4.3.9-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_07N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 2 (NS_07N)   |         |           |

#### 6.2.3.4.3.10 Message contents exceptions for network signalling value "NS\_08N"

1. Information element additionalSpectrumEmission is set to NS\_08N. 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 6.2.3.4.3.10-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_08N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 3 (NS_08N)   |         |           |

### 6.2.3.5 Test requirement

**Editor's Note:** The following aspects are either missing or not yet determined:

- Test configuration and test requirement table for NS\_06N, NS\_07N and NS\_08N for band n252 are incomplete and TBD.

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)**

|                   |                   |
|-------------------|-------------------|
|                   | <b>f ≤ 3.0GHz</b> |
| <b>BW ≤ 30MHz</b> | 0.7 dB            |

Table 6.2.3.5-2: UE Power Class 3 test requirements (NS\_100) for n256

| Test ID | P <sub>PowerClass</sub><br>(dBm) | MPR<br>(dB) | A-MPR<br>(dB) | $\Delta T_{C,c}$<br>(dB) | P <sub>CMAX_L,c</sub><br>(dBm) | T(P <sub>CMAX_L,c</sub> )<br>(dB) | T <sub>L,c</sub><br>(dB) | Upper limit<br>(dBm) | Lower limit<br>(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                               | 3           | 4             | 0                        | 19                             | 3.5                               | 2                        | 25+TT                | 15.5-TT              |
| 15      | 23                               | 3           | 4             | 0                        | 19                             | 3.5                               | 2                        | 25+TT                | 15.5-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                               | 3.5         | 4             | 0                        | 19                             | 3.5                               | 2                        | 25+TT                | 15.5-TT              |
| 21      | 23                               | 3.5         | 4             | 0                        | 19                             | 3.5                               | 2                        | 25+TT                | 15.5-TT              |

NOTE 1: P<sub>PowerClass</sub> 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\_24N) for n256

| Test ID                                                                          | P <sub>PowerClass</sub><br>(dBm) | MPR<br>(dB) | A-MPR<br>(dB) | $\Delta T_{C,c}$<br>(dB) | P <sub>CMAX_L,c</sub><br>(dBm) | T(P <sub>CMAX_L,c</sub> )<br>(dB) | T <sub>L,c</sub><br>(dB) | Upper limit<br>(dBm) | Lower limit<br>(dBm) |
|----------------------------------------------------------------------------------|----------------------------------|-------------|---------------|--------------------------|--------------------------------|-----------------------------------|--------------------------|----------------------|----------------------|
| 1, 5, 9-11, 21, 25, 29-31, 41-43, 53, 57-59, 69-71, 81, 85-87, 97, 101-103, 113  | 23                               | N/A         | 1.5           | 0                        | 21.5                           | 2                                 | 2                        | 25+TT                | 19.5-TT              |
| 2, 6, 12-13, 22, 26, 32-33, 44-45, 54, 60-61, 72-73, 82, 88-89, 98, 104-105, 114 | 23                               | N/A         | 2.0           | 0                        | 21                             | 2                                 | 2                        | 25+TT                | 19-TT                |
| 3, 7, 14-16, 23, 27, 34-36, 46-48, 55, 62-64, 74-76, 83, 90-92, 99, 106-108, 115 | 23                               | N/A         | 3.0           | 0                        | 20                             | 2.5                               | 2                        | 25+TT                | 17.5-TT              |

| Test ID                                                                                                                                        | P <sub>PowerClass</sub> (dBm) | MPR (dB) | A-MPR (dB) | $\Delta T_{C,c}$ (dB) | P <sub>C<sub>MAX</sub>_L,c</sub> (dBm) | T(P <sub>C<sub>MAX</sub>_L,c</sub> ) (dB) | T <sub>L,c</sub> (dB) | Upper limit (dBm) | Lower limit (dBm) |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|------------|-----------------------|----------------------------------------|-------------------------------------------|-----------------------|-------------------|-------------------|
| 4, 8, 17-18, 24, 28, 37-38, 49-50, 56, 65-66, 77-78, 84, 93-94, 100, 109-110, 116                                                              | 23                            | N/A      | 3.5        | 0                     | 19.5                                   | 3.5                                       | 2                     | 25+TT             | 16-TT             |
| 19-20, 39-40, 51-52, 67-68, 79-80, 95-96, 111-112                                                                                              | 23                            | N/A      | 5.5        | 0                     | 17.5                                   | 5                                         | 2                     | 25+TT             | 12.5-TT           |
| 117-118, 120-121, 123-127, 132-133, 135-136, 138-142, 147-151, 156-157, 159-163, 168-172, 177-178, 180-184, 189-190, 192-196, 201-202, 204-206 | 23                            | N/A      | 4          | 0                     | 19                                     | 3.5                                       | 2                     | 25+TT             | 15.5-TT           |
| 119, 122, 128-129, 134, 137, 143-144, 152-153, 158, 164-165, 173-174, 179, 185-186, 191, 197-198, 203                                          | 23                            | N/A      | 4.5        | 0                     | 18.5                                   | 4                                         | 2                     | 25+TT             | 14.5-TT           |
| 130-131, 145-146, 154-155, 166-167, 175-176, 187-188, 199-200                                                                                  | 23                            | N/A      | 7.5        | 0                     | 15.5                                   | 5                                         | 2                     | 25+TT             | 10.5-TT           |
| NOTE 1: P <sub>PowerClass</sub> 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 6.2.3.5-4: UE Power Class 3 test requirements (NS\_03N) for n254

| Test ID | P <sub>PowerClass</sub><br>(dBm) | MPR<br>(dB) | A-MPR<br>(dB) | $\Delta T_{C,c}$<br>(dB) | P <sub>CMAX_L,f,c</sub><br>(dBm) | T(P <sub>CMAX_L,f,c</sub> )<br>(dB) | T <sub>L,c</sub><br>(dB) | Upper limit<br>(dBm) | Lower limit<br>(dBm) |
|---------|----------------------------------|-------------|---------------|--------------------------|----------------------------------|-------------------------------------|--------------------------|----------------------|----------------------|
| 1       | 23                               | 1           | 2.5           | 0                        | 20.5                             | 2.5                                 | 2                        | 25.0 + TT            | 18.0 - TT            |
| 2       | 23                               | 1           | 4.0           | 0                        | 19                               | 3.5                                 | 2                        | 25.0 + TT            | 15.5 - TT            |
| 3       | 23                               | 1           | 2.5           | 0                        | 20.5                             | 2.5                                 | 2                        | 25.0 + TT            | 18.0 - TT            |
| 4       | 23                               | 1           | 6.0           | 0                        | 17                               | 5.0                                 | 2                        | 25.0 + TT            | 12.0 - TT            |
| 5       | 23                               | 1           | 7.0           | 0                        | 16                               | 5.0                                 | 2                        | 25.0 + TT            | 11.0 - TT            |
| 6       | 23                               | 1           | 2.0           | 0                        | 21                               | 2.0                                 | 2                        | 25.0 + TT            | 19.0 - TT            |
| 7       | 23                               | 1           | 4.0           | 0                        | 19                               | 3.5                                 | 2                        | 25.0 + TT            | 15.5 - TT            |
| 8       | 23                               | 1           | 2.0           | 0                        | 21                               | 2.0                                 | 2                        | 25.0 + TT            | 19.0 - TT            |
| 9       | 23                               | 1           | 2.5           | 0                        | 20.5                             | 2.5                                 | 2                        | 25.0 + TT            | 18.0 - TT            |
| 10      | 23                               | 1           | 2.5           | 0                        | 20.5                             | 2.5                                 | 2                        | 25.0 + TT            | 18.0 - TT            |
| 11      | 23                               | 1           | 6.0           | 0                        | 17                               | 5.0                                 | 2                        | 25.0 + TT            | 12.0 - TT            |
| 12      | 23                               | 1           | 7.0           | 0                        | 16                               | 5.0                                 | 2                        | 25.0 + TT            | 11.0 - TT            |
| 13      | 23                               | 1           | 2.0           | 0                        | 21                               | 2.0                                 | 2                        | 25.0 + TT            | 19.0 - TT            |
| 14      | 23                               | 1           | 4.0           | 0                        | 19                               | 3.5                                 | 2                        | 25.0 + TT            | 15.5 - TT            |
| 14a     | 23                               | 1           | 3.5           | 0                        | 19.5                             | 3.5                                 | 2                        | 25.0 + TT            | 16.0 - TT            |
| 15      | 23                               | 3           | 3.5           | 0                        | 19.5                             | 3.5                                 | 2                        | 25.0 + TT            | 16.0 - TT            |
| 16      | 23                               | 3           | 6.0           | 0                        | 17                               | 5.0                                 | 2                        | 25.0 + TT            | 12.0 - TT            |
| 17      | 23                               | 3           | 4.0           | 0                        | 19                               | 3.5                                 | 2                        | 25.0 + TT            | 15.5 - TT            |
| 18      | 23                               | 3           | 8.0           | 0                        | 15                               | 5.0                                 | 2                        | 25.0 + TT            | 10.0 - TT            |
| 19      | 23                               | 3           | 10.0          | 0                        | 13                               | 5.0                                 | 2                        | 25.0 + TT            | 8.0 - TT             |
| 20      | 23                               | 3           | 4.0           | 0                        | 19                               | 3.5                                 | 2                        | 25.0 + TT            | 15.5 - TT            |
| 21      | 23                               | 3           | 6.0           | 0                        | 17                               | 5.0                                 | 2                        | 25.0 + TT            | 12.0 - TT            |
| 22      | 23                               | 3           | 4.0           | 0                        | 19                               | 3.5                                 | 2                        | 25.0 + TT            | 15.5 - TT            |
| 23      | 23                               | 3           | 3.5           | 0                        | 19.5                             | 3.5                                 | 2                        | 25.0 + TT            | 16.0 - TT            |
| 24      | 23                               | 3           | 3.5           | 0                        | 19.5                             | 3.5                                 | 2                        | 25.0 + TT            | 16.0 - TT            |
| 25      | 23                               | 3           | 8.0           | 0                        | 15                               | 5.0                                 | 2                        | 25.0 + TT            | 10.0 - TT            |
| 26      | 23                               | 3           | 10.0          | 0                        | 13                               | 5.0                                 | 2                        | 25.0 + TT            | 8.0 - TT             |
| 27      | 23                               | 3           | 4.0           | 0                        | 19                               | 3.5                                 | 2                        | 25.0 + TT            | 15.5 - TT            |
| 28      | 23                               | 3           | 6.0           | 0                        | 17                               | 5.0                                 | 2                        | 25.0 + TT            | 12.0 - TT            |
| 29      | 23                               | 1           | 4.5           | 0                        | 18.5                             | 4.0                                 | 2                        | 25.0 + TT            | 14.5 - TT            |

NOTE 1: P<sub>PowerClass</sub> 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 6.2.3.5-5: UE Power Class 3 test requirements (NS\_04N and NS\_11N) for n254

| Test ID | P <sub>PowerClass</sub><br>(dBm) | MPR<br>(dB) | A-MPR<br>(dB) | $\Delta T_{C,c}$<br>(dB) | P <sub>CMAX_L,c</sub><br>(dBm) | T(P <sub>CMAX_L,c</sub> )<br>(dB) | T <sub>L,c</sub><br>(dB) | Upper limit<br>(dBm) | Lower limit<br>(dBm) |
|---------|----------------------------------|-------------|---------------|--------------------------|--------------------------------|-----------------------------------|--------------------------|----------------------|----------------------|
| 1       | 23                               | 1           | 2.5           | 0                        | 20.5                           | 2.5                               | 2                        | 25 + TT              | 18.0 - TT            |
| 2       | 23                               | 1           | 4.0           | 0                        | 19                             | 3.5                               | 2                        | 25 + TT              | 15.5 - TT            |
| 3       | 23                               | 1           | 2.5           | 0                        | 20.5                           | 2.5                               | 2                        | 25 + TT              | 18.0 - TT            |
| 4       | 23                               | 3           | 3.5           | 0                        | 19.5                           | 3.5                               | 2                        | 25 + TT              | 16.0 - TT            |
| 5       | 23                               | 3           | 6.0           | 0                        | 17                             | 5.0                               | 2                        | 25 + TT              | 12.0 - TT            |
| 6       | 23                               | 3           | 4.0           | 0                        | 19                             | 3.5                               | 2                        | 25 + TT              | 15.5 - TT            |

NOTE 1: P<sub>PowerClass</sub> 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 6.2.3.5-6: UE Power Class 3 test requirements (NS\_05N and NS\_12N) for n254

| Test ID | P <sub>PowerClass</sub> (dBm) | MPR (dB) | A-MPR (dB) | $\Delta T_{C,c}$ (dB) | P <sub>CMAX_L,f,c</sub> (dBm) | T(P <sub>CMAX_L,f,c</sub> ) (dB) | T <sub>L,c</sub> (dB) | Upper limit (dBm) | Lower limit (dBm) |
|---------|-------------------------------|----------|------------|-----------------------|-------------------------------|----------------------------------|-----------------------|-------------------|-------------------|
| 1       | 23                            | 1        | 1.5        | 0                     | 21.5                          | 2.0                              | 2                     | 25.0 + TT         | 19.5 - TT         |
| 2       | 23                            | 1        | 1.5        | 0                     | 21.5                          | 2.0                              | 2                     | 25.0 + TT         | 19.5 - TT         |
| 3       | 23                            | 1        | 6.5        | 0                     | 16.5                          | 5.0                              | 2                     | 25.0 + TT         | 11.5 - TT         |
| 4       | 23                            | 1        | 7.0        | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11 - TT           |
| 5       | 23                            | 1        | 2.5        | 0                     | 20.5                          | 2.5                              | 2                     | 25.0 + TT         | 18 - TT           |
| 6       | 23                            | 1        | 5.0        | 0                     | 18                            | 4.0                              | 2                     | 25.0 + TT         | 14 - TT           |
| 7       | 23                            | 1        | 2.5        | 0                     | 20.5                          | 2.5                              | 2                     | 25.0 + TT         | 18 - TT           |
| 8       | 23                            | 1        | 1.5        | 0                     | 21.5                          | 2.0                              | 2                     | 25.0 + TT         | 19.5 - TT         |
| 9       | 23                            | 1        | 2.5        | 0                     | 20.5                          | 2.5                              | 2                     | 25.0 + TT         | 18 - TT           |
| 10      | 23                            | 1        | 6.5        | 0                     | 16.5                          | 5.0                              | 2                     | 25.0 + TT         | 11.5 - TT         |
| 11      | 23                            | 1        | 7.0        | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11 - TT           |
| 12      | 23                            | 1        | 2.5        | 0                     | 20.5                          | 2.5                              | 2                     | 25.0 + TT         | 18 - TT           |
| 13      | 23                            | 1        | 5.0        | 0                     | 18                            | 4.0                              | 2                     | 25.0 + TT         | 14 - TT           |
| 14      | 23                            | 3        | 0.0        | 0                     | 20                            | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 15      | 23                            | 3        | 3.0        | 0                     | 20                            | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 16      | 23                            | 3        | 8.0        | 0                     | 15                            | 5.0                              | 2                     | 25.0 + TT         | 10 - TT           |
| 17      | 23                            | 3        | 10.0       | 0                     | 13                            | 5.0                              | 2                     | 25.0 + TT         | 8 - TT            |
| 18      | 23                            | 3        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5 - TT         |
| 19      | 23                            | 3        | 6.5        | 0                     | 16.5                          | 5.0                              | 2                     | 25.0 + TT         | 11.5 - TT         |
| 20      | 23                            | 3        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5 - TT         |
| 21      | 23                            | 3        | 3.0        | 0                     | 20                            | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 22      | 23                            | 3        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5 - TT         |
| 23      | 23                            | 3        | 8.0        | 0                     | 15                            | 5.0                              | 2                     | 25.0 + TT         | 10 - TT           |
| 24      | 23                            | 3        | 10.0       | 0                     | 13                            | 5.0                              | 2                     | 25.0 + TT         | 8 - TT            |
| 25      | 23                            | 3        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5 - TT         |
| 26      | 23                            | 3        | 6.5        | 0                     | 16.5                          | 5.0                              | 2                     | 25.0 + TT         | 11.5 - TT         |

NOTE 1: P<sub>PowerClass</sub> 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 6.2.3.5-7: UE Power Class 3 test requirements NS\_07N for n252

| Test ID | P <sub>PowerClass</sub> (dBm) | MPR (dB) | A-MPR (dB) | $\Delta T_{C,c}$ (dB) | P <sub>CMAX_L,f,c</sub> (dBm) | T(P <sub>CMAX_L,f,c</sub> ) (dB) | T <sub>L,c</sub> (dB) | Upper limit (dBm) | Lower limit (dBm) |
|---------|-------------------------------|----------|------------|-----------------------|-------------------------------|----------------------------------|-----------------------|-------------------|-------------------|
| 1       | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 2       | 23                            | 1        | 7.5        | 0                     | 15.5                          | 5.0                              | 2                     | 25.0 + TT         | 10.5-TT           |
| 3       | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 4       | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 5       | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 6       | 23                            | 1        | 11.5       | 0                     | 11.5                          | 6.0                              | 2                     | 25.0 + TT         | 5.5-TT            |
| 7       | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 8       | 23                            | 1        | 7.5        | 0                     | 15.5                          | 5.0                              | 2                     | 25.0 + TT         | 10.5-TT           |
| 9       | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 10      | 23                            | 1        | 7.5        | 0                     | 15.5                          | 5.0                              | 2                     | 25.0 + TT         | 10.5-TT           |
| 11      | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 12      | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 13      | 23                            | 1        | 11.5       | 0                     | 11.5                          | 6.0                              | 2                     | 25.0 + TT         | 5.5-TT            |
| 14      | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 15      | 23                            | 1        | 7.5        | 0                     | 15.5                          | 5.0                              | 2                     | 25.0 + TT         | 10.5-TT           |
| 16      | 23                            | 1        | 4.5        | 0                     | 18.5                          | 4.0                              | 2                     | 25.0 + TT         | 14.5-TT           |
| 17      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |
| 18      | 23                            | 3        | 9          | 0                     | 14                            | 5.0                              | 2                     | 25.0 + TT         | 9-TT              |
| 19      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |
| 20      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |
| 21      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |
| 22      | 23                            | 3        | 13         | 0                     | 10                            | 6.0                              | 2                     | 25.0 + TT         | 4-TT              |
| 23      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |
| 24      | 23                            | 3        | 9          | 0                     | 14                            | 5.0                              | 2                     | 25.0 + TT         | 9-TT              |
| 25      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |
| 26      | 23                            | 3        | 9          | 0                     | 14                            | 5.0                              | 2                     | 25.0 + TT         | 9-TT              |
| 27      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |
| 28      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |
| 29      | 23                            | 3        | 13         | 0                     | 10                            | 6.0                              | 2                     | 25.0 + TT         | 4-TT              |
| 30      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |
| 31      | 23                            | 3        | 9          | 0                     | 14                            | 5.0                              | 2                     | 25.0 + TT         | 9-TT              |
| 32      | 23                            | 3        | 7          | 0                     | 16                            | 5.0                              | 2                     | 25.0 + TT         | 11-TT             |

NOTE 1: P<sub>PowerClass</sub> 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.

## 6.2.4 Configured transmitted power

### 6.2.4.1 Test purpose

To verify the measured UE configured maximum output power P<sub>UMAX,f,c</sub> 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, with following notes:

- P<sub>PowerClass</sub> is the maximum UE power specified in Table 6.2.1-1;

- $MPR_c$  and  $A-MPR_c$  for serving cell  $c$  are specified in clause 6.2.2 and clause 6.2.3, respectively;
- $\Delta T_{C,c}$ ,  $\Delta T_{IB,c}$ ,  $\Delta T_{RxSRS}$  are not applicable to NR-NTN 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 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 38.508-1 [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 6.2.4.4.3.

#### 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 P<sub>max</sub> 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. 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: Void**

#### 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<sub>C</sub>MAX 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                                                | 20 dBm ± (2.5+TT)    |
| 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: .                                                                            |                      |

**Table 6.2.4.5-1a: Void****Table 6.2.4.5-2: Test Tolerance (Configured transmitted power)**

|            | f ≤ 3.0GHz |
|------------|------------|
| BW ≤ 30MHz | 0.7 dB     |

## 6.2.4\_2 Configured transmitted power for UEs supporting 4Tx Tx Diversity

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

- MU and TT are FFS.

### 6.2.4\_2.1 Test purpose

Same as 6.2.4.1.

### 6.2.4\_2.2 Test applicability

The requirements of this test apply to all types of NR Power Class 1 UE release 19 and forward that support satellite access operation and 4Tx Tx Diversity.

### 6.2.4\_2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2.2.4.

### 6.2.4\_2.4 Test description

#### 6.2.4\_2.4.1 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\_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 6.2.4\_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] 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.3.1.1.2a 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\_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 38.508-1 [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 6.2.4\_2.4.3.

#### 6.2.4\_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 6.2.4\_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 starting from the first TPC command in this step to ensure that the UE reaches the P<sub>max</sub> level of the test point.
3. Measure the sum of the mean power of the UE at each antenna connector in the channel bandwidth for each test point in Table 6.2.4\_2.5-1 according to the test configuration from Table 6.2.4\_2.4.1-1. 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\_2.4.3 Message contents

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

**Table 6.2.4\_2.4.3-0: PUSCH-Config**

Derivation Path: TS 38.508-1 [12], Table 4.6.3-118 with condition TRANSFORM\_PRECODER\_ENABLED

**Table 6.2.4\_2.4.3-1: 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                                                                | 0            |         |           |

**Table 6.2.4\_2.4.3-2: 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                                                                | 15           |         |           |

**Table 6.2.4\_2.4.3-3: 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                                                                | 18           |         |           |

**Table 6.2.4\_2.4.3-4: 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                                                                | 22           |         |           |

## 6.2.4\_2.5 Test requirement

The maximum output power measured shall not exceed the values specified in Table 6.2.4\_2.5-1.

**Table 6.2.4\_2.5-1: P<sub>C<sub>MAX</sub></sub> configured UE output power**

|                                                                                        | Maximum output power |                 |
|----------------------------------------------------------------------------------------|----------------------|-----------------|
|                                                                                        | Lower limit          | Upper limit     |
| Measured UE output power test point 1                                                  | 0 dBm - (7+TT)       | 0 dBm + (7+TT)  |
| Measured UE output power test point 2                                                  | 15 dBm - (6+TT)      | 15 dBm + (6+TT) |
| Measured UE output power test point 3                                                  | 18 dBm - (5+TT)      | 18 dBm + (5+TT) |
| Measured UE output power test point 4                                                  | 22 dBm - (5+TT)      | 22 dBm + (2+TT) |
| Note 1: TT for each frequency and channel bandwidth is specified in Table 6.2.4_2.5-2. |                      |                 |

**Table 6.2.4\_2.5-2: Test Tolerance (Configured transmitted power)**

|            | f ≤ 3.0GHz |
|------------|------------|
| BW ≤ 30MHz | FFS        |

## 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<br>(MHz) | Minimum output power<br>(dBm) | Measurement bandwidth<br>(MHz) |
|----------------------------|-------------------------------|--------------------------------|
| 3                          | -40                           | 2.715                          |
| 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 PDCCCH 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 | Modulation                         | RB allocation (NOTE 1) |
| 1                                                                                   | test case                    | 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. 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) |
|-------------------------------------------------------------------------------------|----------------------------|-----------------------------|
| 3                                                                                   | -40+TT                     | 2.715                       |
| 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)**

|                        | $f \leq 3.0\text{GHz}$ |
|------------------------|------------------------|
| BW $\leq 40\text{MHz}$ | 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) | 3, 5, 10, 15, 20                                                 |
| REF_SCS               | (kHz) | 15                                                               |
| Transmit OFF power    | (dBm) | -50                                                              |
| Measurement bandwidth | (MHz) | $\text{MBW} = \text{REF\_SCS} * (12 * N_{\text{RB}} + 1) / 1000$ |

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<br>(MHz)                                                          | Transmit OFF power<br>(dBm) | Measurement bandwidth<br>(MHz) |
|-------------------------------------------------------------------------------------|-----------------------------|--------------------------------|
| 3                                                                                   | -50+TT                      | 2.715                          |
| 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)**

|            | <b>f ≤ 3.0GHz</b> |
|------------|-------------------|
| BW ≤ 40MHz | 1.5 dB            |

## 6.3.3 Transmit on/off time mask

### 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 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 6.3.3.4.3.

#### 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 for 15 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  $\mu$ s 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  $\mu$ s at the beginning of the slot.

#### 6.3.3.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 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 6.3.3.4.3-1: 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, |
|                                                                                                                                                                                                                | 6            |                                                                                                                         | FR1_30kHz  |
| mappingType                                                                                                                                                                                                    | typeA        |                                                                                                                         | FR1_60kHz  |
| startSymbolAndLength                                                                                                                                                                                           | 27           | Start symbol(S)=0, Length(L)=14                                                                                         |            |
| }                                                                                                                                                                                                              |              |                                                                                                                         |            |
| PUSCH-TimeDomainResourceAllocation[2]                                                                                                                                                                          |              | Addressed by Msg3 PUSCH time resource allocation field of the Random Access Response acc. to TS 38.213 [7] Table 8.2-1. |            |
| SEQUENCE {                                                                                                                                                                                                     |              |                                                                                                                         |            |
| k2                                                                                                                                                                                                             | 2            | $K_2 + \Delta = 4$ acc. to TS 38.214 [16] Table 6.1.2.1.1-5 (NOTE 1)                                                    | FR1_15kHz  |
|                                                                                                                                                                                                                | 6            | $K_2 + \Delta = 9$ 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<br>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**

|                   |                   |
|-------------------|-------------------|
|                   | <b>f ≤ 3.0GHz</b> |
| <b>BW ≤ 40MHz</b> | 1.5 dB            |

## 6.3.4 Power Control

### 6.3.4.1 General

The requirements for configured transmitted power defined in subclause 6.2.4 of 3GPP TS 38.101-1 [5] clause 6.2.4 shall apply to NTN satellite UE.

The requirements on power control accuracy apply under normal conditions.

The normative reference for this requirement is TS 38.101-5 [11] clause 6.3.4 and TS 38.101-1 [5] clause 6.3.4.1

### 6.3.4.2 Absolute power tolerance

#### 6.3.4.2.1 Test purpose

To verify the ability of the UE transmitter to set its initial output power to a specific value at the start of a contiguous transmission or non-contiguous transmission with a long transmission gap, i.e. transmission gap is larger than 20ms.

#### 6.3.4.2.2 Test applicability

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

#### 6.3.4.2.3 Minimum conformance requirements

The absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame(1ms) at the start of a contiguous transmission or non-contiguous transmission with a transmission gap larger than 20ms. The tolerance includes the channel estimation error.

The minimum requirement specified in Table 6.3.4.2.3-1 apply in the power range bounded by the minimum output power as specified in sub-clause 6.3.1 and the maximum output power as specified in sub-clause 6.2.1.

**Table 6.3.4.2.3-1: Absolute power tolerance**

| Conditions | Tolerance |
|------------|-----------|
| Normal     | ± 9.0 dB  |

The normative reference for this requirement is TS 38.101-1 [5] clause 6.3.4.2

#### 6.3.4.2.4 Test description

##### 6.3.4.2.4.1 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, 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 6.3.4.2.4.1-1. 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 6.3.4.2.4.1-1: 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                   |                                            |               | 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, Highest      |                        |
| Test Parameters                                                                     |                                            |               |                      |                        |
| Test ID                                                                             | Downlink Configuration                     |               | Uplink Configuration |                        |
|                                                                                     | Modulation                                 | RB allocation | Modulation           | RB allocation (NOTE 1) |
| 1                                                                                   | N/A for Absolute power tolerance test case |               | CP-OFDM QPSK         | Outer_Full             |
| NOTE 1: The specific configuration of each RF 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 section 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 6.3.4.2.4.1-1.
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 38.508-1 [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 6.3.4.2.4.3. Note that PDCCH DCI format 0\_1 sent after resetting uplink power with RRC Connection Reconfiguration, should have TPC command 0dB.

##### 6.3.4.2.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0\_1 with TPC command 0dB for C\_RNTI to schedule the UL RMC according to Table 6.3.4.2.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Measure the initial output power of the first sub-frame (1ms) of UE PUSCH first transmission.
3. Repeat for the two test points as indicated in section 6.3.4.2.4.3. The timing of the execution between the two test points shall be larger than 20ms.

#### 6.3.4.2.4.3 Message contents

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

**Table 6.3.4.2.4.3-1: UplinkPowerControlCommon: Test point 1**

| Derivation Path: TS 38.508-1 [12] subclause 4.6.3 Table 4.6.3-119 PUSCH-ConfigCommon |              |                                                                     |           |
|--------------------------------------------------------------------------------------|--------------|---------------------------------------------------------------------|-----------|
| Information Element                                                                  | Value/remark | Comment                                                             | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE {                                                    |              |                                                                     |           |
| p0-NominalWithGrant                                                                  | -114         | Test point 1 to verify a UE relative low initial power transmission |           |
| }                                                                                    |              |                                                                     |           |

**Table 6.3.4.2.4.3-2: UplinkPowerControlCommon: Test point 2**

| Derivation Path: TS 38.508-1 [12] subclause 4.6.3 Table 4.6.3-119 PUSCH-ConfigCommon |              |                                                                      |           |
|--------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------|-----------|
| Information Element                                                                  | Value/remark | Comment                                                              | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE {                                                    |              |                                                                      |           |
| p0-NominalWithGrant                                                                  | -100         | Test point 2 to verify a UE relative high initial power transmission |           |
| }                                                                                    |              |                                                                      |           |

**Table 6.3.4.2.4.3-3: ServingCellConfigCommon**

| Derivation Path: 38.508-1[5], Table 4.6.3-168 |              |         |           |
|-----------------------------------------------|--------------|---------|-----------|
| Information Element                           | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE {        |              |         |           |
| ss-PBCH-BlockPower                            | 18           |         | SCS_15kHz |
|                                               | 21           |         | SCS_30kHz |
| }                                             |              |         |           |

| Condition | Explanation                 |
|-----------|-----------------------------|
| SCS_15kHz | SCS=15kHz for SS/PBCH block |
| SCS_30kHz | SCS=30kHz for SS/PBCH block |

#### 6.3.4.2.5 Test requirement

The requirement for the power measured in step (2) of the test procedure is not to exceed the values specified in Table 6.3.4.2.5-1 and 6.3.4.2.5-2.

**Table 6.3.4.2.5-1: Absolute power tolerance: test point 1**

|                         |                                                                                                             | Channel bandwidth / expected output power (dBm) |            |        |        |        |        |        |        |        |        |        |        |        |        |         |
|-------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                         |                                                                                                             | 5 MHz                                           | 10 MHz     | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 35 MHz | 40 MHz | 45 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz |
| Expected Measured power | SCS15                                                                                                       | -17.6                                           | -14.4      | -12.6  | -11.3  | -10.4  | -9.6   | -8.9   | -8.3   | -7.8   | -7.3   | N/A    | N/A    | N/A    | N/A    | N/A     |
|                         | SCS30                                                                                                       | -18.2                                           | -14.8      | -12.8  | -11.5  | -10.5  | -9.7   | -9     | -8.3   | -7.8   | -7.4   | -6.5   | -5.8   | -5.2   | -4.7   | -4.2    |
|                         | SCS60                                                                                                       | N/A                                             | -15.2      | -13    | -11.8  | -10.7  | -9.8   | -9.1   | -8.5   | -7.9   | -7.5   | -6.6   | -5.9   | -5.3   | -4.8   | -4.3    |
| Power tolerance         |                                                                                                             |                                                 | ± (9+TT)dB |        |        |        |        |        |        |        |        |        |        |        |        |         |
| Note 1:                 | The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3.2.3  |                                                 |            |        |        |        |        |        |        |        |        |        |        |        |        |         |
| Note 2:                 | TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3.4.2.5-3. |                                                 |            |        |        |        |        |        |        |        |        |        |        |        |        |         |

**Table 6.3.4.2.5-2: Absolute power tolerance: test point 2**

|                         |                                                                                                             | Channel bandwidth / expected output power (dBm) |        |        |        |        |        |        |        |        |        |        |        |        |        |         |
|-------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                         |                                                                                                             | 5 MHz                                           | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 35 MHz | 40 MHz | 45 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz |
| Expected Measured power | SCS15                                                                                                       | -3.6                                            | -0.4   | 1.4    | 2.7    | 3.6    | 4.4    | 5.1    | 5.7    | 6.2    | 6.7    | N/A    | N/A    | N/A    | N/A    | N/A     |
|                         | SCS30                                                                                                       | -4.2                                            | -0.8   | 1.2    | 2.5    | 3.5    | 4.3    | 5      | 5.7    | 6.2    | 6.6    | 7.5    | 8.2    | 8.8    | 9.3    | 9.8     |
|                         | SCS60                                                                                                       | N/A                                             | -1.2   | 1      | 2.2    | 3.3    | 4.2    | 4.9    | 5.5    | 6.1    | 6.5    | 7.4    | 8.1    | 8.7    | 9.2    | 9.7     |
| Power tolerance         |                                                                                                             | ± (9+TT)dB                                      |        |        |        |        |        |        |        |        |        |        |        |        |        |         |
| Note 1:                 | The higher power limit shall not exceed the maximum output power requirements defined in sub-clause 6.2.1.3 |                                                 |        |        |        |        |        |        |        |        |        |        |        |        |        |         |
| Note 2:                 | TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3.4.2.5-3. |                                                 |        |        |        |        |        |        |        |        |        |        |        |        |        |         |

**Table 6.3.4.2.5-3: Test Tolerance**

|                                                                    | $f \leq 3.0\text{GHz}$                     | $3.0\text{GHz} < f \leq 4.2\text{GHz}$ | $4.2\text{GHz} < f \leq 6.0\text{GHz}$ |
|--------------------------------------------------------------------|--------------------------------------------|----------------------------------------|----------------------------------------|
| <b>BW <math>\leq 40\text{MHz}</math></b>                           | 1.0 dB <sup>1</sup><br>1.2 dB <sup>2</sup> | 1.4 dB                                 | 1.4 dB                                 |
| <b><math>40\text{MHz} &lt; \text{BW} \leq 100\text{MHz}</math></b> | 1.4 dB                                     | 1.4 dB                                 | 1.4 dB                                 |
| Note 1: Applicable for test point with UL power $\geq 0$ dBm.      |                                            |                                        |                                        |
| Note 2: Applicable for test point with UL power $< 0$ dBm.         |                                            |                                        |                                        |

### 6.3.4.3 Relative power tolerance

#### 6.3.4.3.1 Test purpose

To verify the ability of the UE transmitter to set its output power in a target sub-frame(1ms) relatively to the power of the most recently transmitted reference sub-frame if the transmission gap between these sub-frames is less than or equal to 20ms.

#### 6.3.4.3.2 Test applicability

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

#### 6.3.4.3.3 Minimum conformance requirement

The UE shall meet the requirements specified in Table 6.3.4.3.3-1.

The minimum requirements specified in Table 6.3.4.3.3-1 apply when the power of the target and reference sub-frames are within the power range bounded by the minimum output power as defined in sub-clause 6.3.1 and the measured  $P_{\text{UMAX}}$  as defined in sub-clause 6.2.1.

To account for RF Power amplifier mode changes, 2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep over a range bounded by the requirements of minimum power and maximum power specified in subclauses 6.3.1 and 6.2.1, respectively. For those exceptions, the power tolerance limit is a maximum of  $\pm 6.0$  dB in Table 6.3.4.3.3-1.

**Table 6.3.4.3.3-1: Relative Power Tolerance**

| Power step $\Delta P$<br>(Up or down)<br>(dB)                                                                                                                                                                                                                                                              | All combinations<br>of PUSCH and<br>PUCCH<br>transitions (dB) | All combinations of<br>PUSCH/PUCCH and<br>SRS transitions<br>between sub-<br>frames (dB) | PRACH (dB) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------|------------|
| $\Delta P < 2$                                                                                                                                                                                                                                                                                             | $\pm 2.0$ (NOTE)                                              | $\pm 2.5$                                                                                | $\pm 2.0$  |
| $2 \leq \Delta P < 3$                                                                                                                                                                                                                                                                                      | $\pm 2.5$                                                     | $\pm 3.5$                                                                                | $\pm 2.5$  |
| $3 \leq \Delta P < 4$                                                                                                                                                                                                                                                                                      | $\pm 3.0$                                                     | $\pm 4.5$                                                                                | $\pm 3.0$  |
| $4 \leq \Delta P \leq 10$                                                                                                                                                                                                                                                                                  | $\pm 3.5$                                                     | $\pm 5.5$                                                                                | $\pm 3.5$  |
| $10 \leq \Delta P < 15$                                                                                                                                                                                                                                                                                    | $\pm 4.0$                                                     | $\pm 7.0$                                                                                | $\pm 4.0$  |
| $15 \leq \Delta P$                                                                                                                                                                                                                                                                                         | $\pm 5.0$                                                     | $\pm 8.0$                                                                                | $\pm 5.0$  |
| NOTE: For PUSCH to PUSCH transitions with the allocated resource blocks fixed in frequency and no transmission gaps other than those generated by downlink subframes, DwPTS fields or Guard Periods: for a power step $\Delta P \leq 1$ dB, the relative power tolerance for transmission is $\pm 0.7$ dB. |                                                               |                                                                                          |            |

The normative reference for this requirement is TS 38.101-1 [5] clause 6.3.4.3.

#### 6.3.4.3.4 Test description

##### 6.3.4.3.4.1 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 table 6.3.4.3.4.1-1. 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 6.3.4.3.4.1-1: Test Configuration Table**

| Initial Conditions                                                       |                                            |               |                      |                                                                         |
|--------------------------------------------------------------------------|--------------------------------------------|---------------|----------------------|-------------------------------------------------------------------------|
| Test Environment as specified in TS 38.508-1 [12] subclause 4.3.1        |                                            |               | Normal               |                                                                         |
| Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1        |                                            |               | Low range            |                                                                         |
| Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1 |                                            |               | Lowest, Mid, Highest |                                                                         |
| Test SCS as specified in TS 38.508-1 [12] subclause 4.3.1                |                                            |               | Lowest, Highest      |                                                                         |
| Test Parameters                                                          |                                            |               |                      |                                                                         |
| Ch BW                                                                    | Downlink Configuration                     |               | Uplink Configuration |                                                                         |
|                                                                          | Modulation                                 | RB Allocation | Modulation           | RB allocation (NOTE 1)                                                  |
| 5MHz                                                                     | N/A for Relative power tolerance test case |               | DFT-s-OFDM QPSK      | See Table 6.3.4.3.5-1<br>See Table 6.3.4.3.5-2<br>See Table 6.3.4.3.5-5 |
| 10MHz                                                                    |                                            |               | DFT-s-OFDM QPSK      | See Table 6.3.4.3.5-3<br>See Table 6.3.4.3.5-4<br>See Table 6.3.4.3.5-5 |
| 15MHz                                                                    |                                            |               | DFT-s-OFDM QPSK      | See Table 6.3.4.3.5-3<br>See Table 6.3.4.3.5-4<br>See Table 6.3.4.3.5-5 |
| 20MHz                                                                    |                                            |               | DFT-s-OFDM QPSK      | See Table 6.3.4.3.5-3<br>See Table 6.3.4.3.5-4<br>See Table 6.3.4.3.5-5 |
| Note 1: The starting resource block shall be RB# 0.                      |                                            |               |                      |                                                                         |

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and section 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 6.3.4.3.4.1-1.
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 38.508-1 [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 6.3.4.3.4.3.

#### 6.3.4.3.4.2 Test procedure

The procedure is separated in various subtests to verify different aspects of relative power control. The power patterns of the subtests are described in figure 6.3.4.3.4.2-1 thru figure 6.3.4.3.4.2-5. Note that the sub frame and radio frame numbers in the patterns assume a consecutive UL scheduling which is not always possible and, thus, are to be considered as logical numbering of the active UL slots.

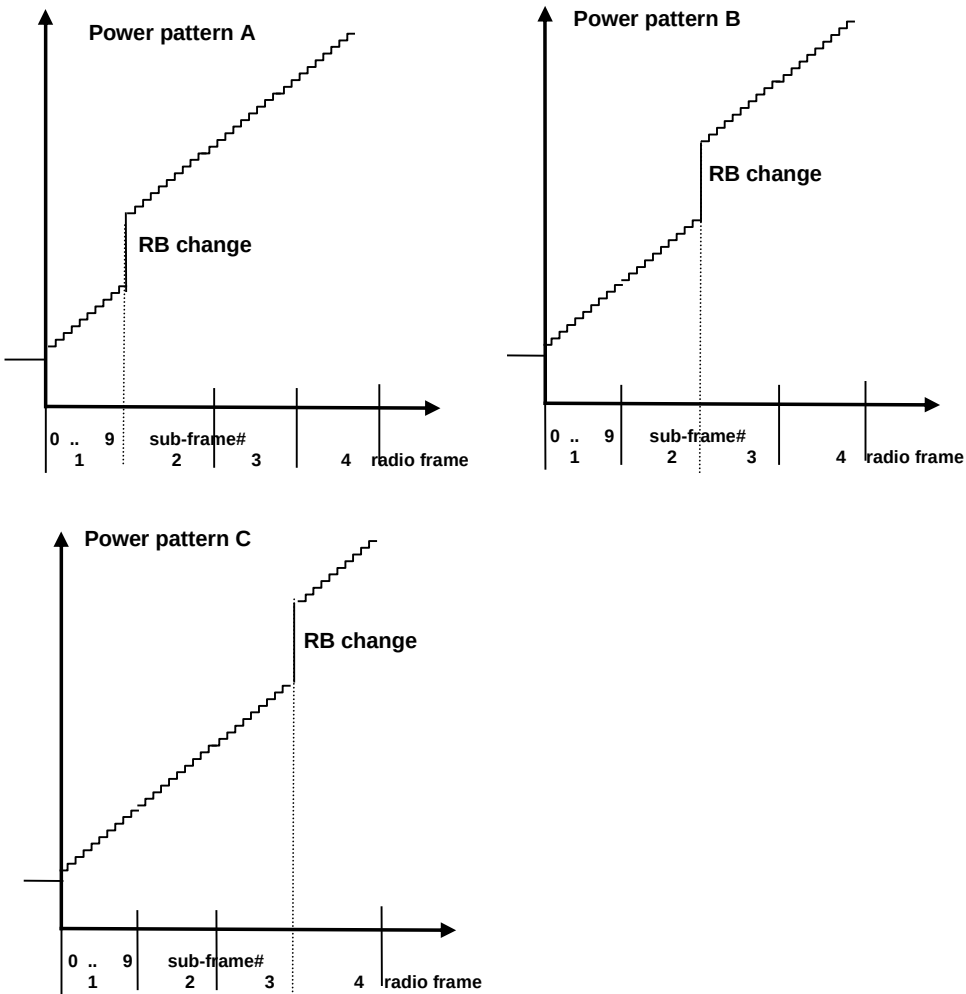


Figure 6.3.4.3.4.2-1: FDD ramping up test power patterns

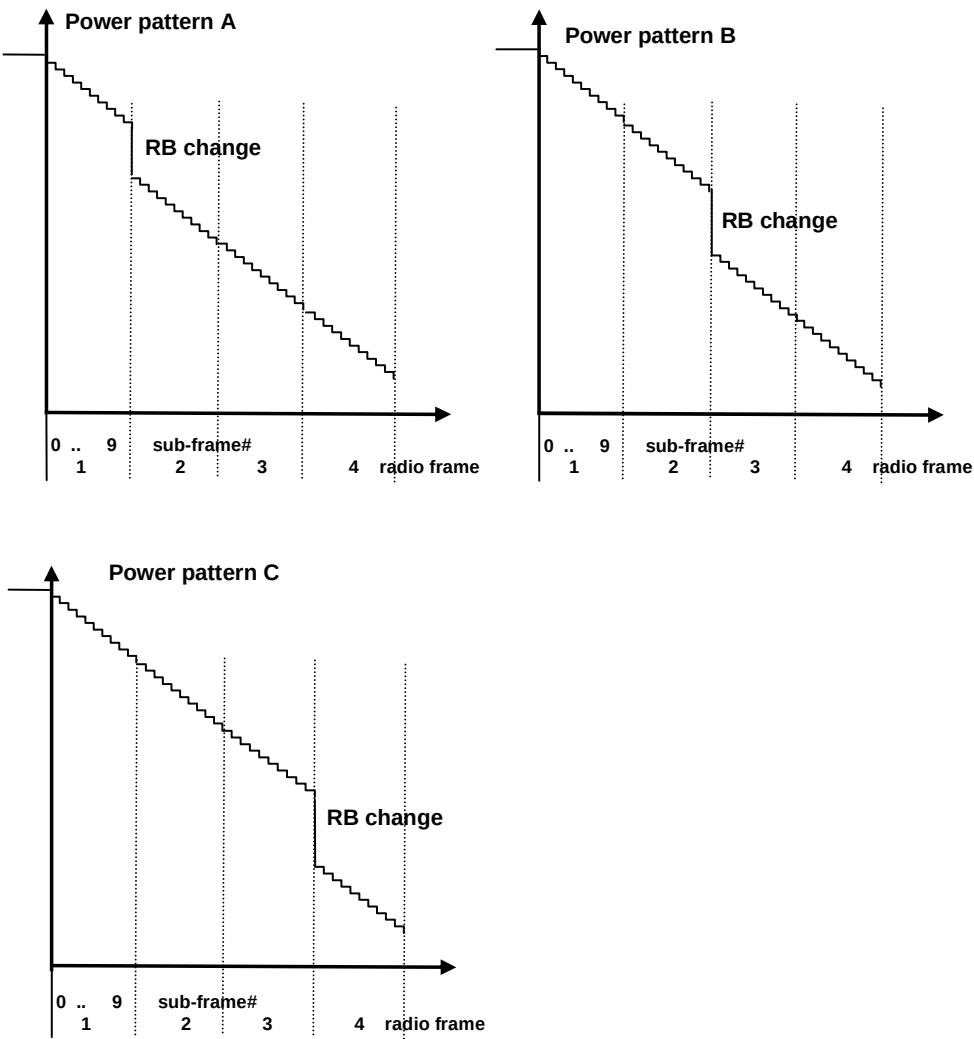


Figure 6.3.4.3.4.2-2: FDD ramping down test power patterns

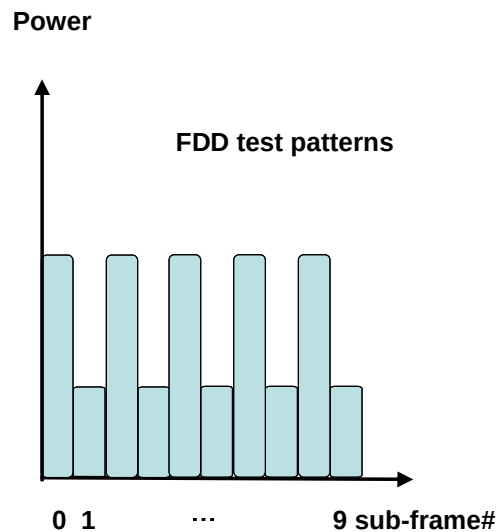


**Figure 6.3.4.3.4.2-3: Alternating Test Power pattern**

1. Sub test: ramping up pattern

- 1.1. 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 6.3.4.3.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. 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 -33 dBm, where:
  - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 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.
- 1.2. Schedule the UE's PUSCH data transmission as described in Figure 6.3.4.3.4.2-1 (FDD pattern A: assuming consecutive UL scheduling the sub-test is divided in 4 arbitrary radio frames with 10 active uplink sub-frames per radio frame. For non-consecutive UL scheduling the pattern is partitioned suitably.). Uplink RB allocation as defined in table 6.3.4.3.5-1/6.3.4.3.5-3 depending on channel bandwidth. On the PDCCH format 0\_1 for the scheduling of the PUSCH the SS will transmit a +1dB TPC command for every first slot in a sub-frame. Note that the measurement need not be done continuously, provided that interruptions are whole numbers of frames, and TPC commands of 0dB are sent during the interruption.
- 1.3. Measure the power of PUSCH transmissions to verify the UE relative power control meet test requirements 6.3.4.3.5. For power transients between sub-frames, transient periods of 20us between sub-frames are excluded.
- 1.4. Repeat the subtest different pattern B, C to move the RB allocation change at different points in the pattern as described in Table 6.3.4.3.5-1/6.3.4.3.5-3 to force bigger UE power steps at various points in the power range.

**NOTE:** The purpose of the Uplink power control window is to ensure that the actual UE output power is no less 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, clause F.4.2.

## 2. Sub test: ramping down pattern

- 2.1. 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 6.3.4.3.4.1-1. 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  $-(MU + \text{Uplink power control window size})$  to  $-MU$  dB of the target power level 20.7 dBm, where:
  - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency  $f$  and the channel bandwidth BW.
  - Uplink power control window size is same as defined in step 1.1.
- 2.2. Schedule the UE's PUSCH data transmission as described in Figure 6.3.4.3.4.2-2 (FDD pattern A: assuming consecutive UL scheduling the sub-test is divided in 4 arbitrary radio frames with 10 active uplink slots per radio frame. For non-consecutive UL scheduling the pattern is partitioned suitably.). Uplink RB allocation as defined in table 6.3.4.3.5-2/6.3.4.3.5-4 depending on channel bandwidth. On the PDCCH format 0\_1 for the scheduling of the PUSCH the SS will transmit a -1dB TPC command for every first slot in a sub-frame. Note that the measurement need not be done continuously, provided that interruptions are whole numbers of frames, and TPC commands of 0dB are sent during the interruption.
- 2.3. Measure the power of PUSCH transmissions to verify the UE relative power control meet test requirements 6.3.4.4.5. For power transients between sub-frames, transient periods of 20us between sub-frames are excluded.
- 2.4. Repeat the subtest different pattern B, C to move the RB allocation change at different points in the pattern as described in Table 6.3.4.3.5-2/6.3.4.3.5-4 to force bigger UE power steps at various points in the power range.

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, clause F.4.3.

## 3. Sub test: alternating pattern

- 3.1. 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 6.3.4.3.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send uplink power control commands for PUSCH 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  $-(\text{Uplink power control window size} / 2)$  dB to  $+(\text{Uplink power control window size} / 2)$  dB of the target power level -10 dBm, where:
  - Uplink power control window size is same as defined in step 1.1.
- 3.2. Schedule the UE's PUSCH data transmission as described in Figure 6.3.5.2.4.2-3 for 10 sub-frames (assuming consecutive UL scheduling) an uplink RB allocation alternating pattern as defined in table 6.3.4.3.5- while transmitting 0dB TPC command for PUSCH via the PDCCH. For non-consecutive UL scheduling the pattern is partitioned suitably.
- 3.3. Measure the power of PUSCH transmissions to verify the UE relative power control meet test requirements specified in clause 6.3.4.3.5. For power transients between sub-frames, transient periods of 20us between sub-frames are excluded.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is 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.4.4.

### 6.3.4.3.4.3 Message contents

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

**Table 6.3.4.3.4.3-1: PUSCH-Config**

Derivation Path: TS 38.508-1 [12], Table 4.6.3-118 with condition TRANSFORM\_PRECODER\_ENABLED

**6.3.4.3.5 Test requirement**

Each UE power step measured in the test procedure 6.3.4.3.4.2 should satisfy the test requirements specified in Table 6.3.4.3.5-1 thru 6.3.4.3.5-5.

To account for RF Power amplifier mode changes 2 exceptions are allowed for each of ramping up and ramping down test patterns. For these exceptions the power tolerance limit is a maximum of  $\pm (6.0 + TT)$  dB. If there is an exception in the power step caused by the RB change for all test patterns (A, B, C) then fail the UE.

**Table 6.3.4.3.5-1: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp up sub-test**

| Test SCS [kHz]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Sub-test ID | Applicable sub-frames       | Uplink RB allocation | TPC command | Expected power step size (Up) $\Delta P$ [dB] | Power step size range (Up) $\Delta P$ [dB] | PUSCH [dB]          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------|----------------------|-------------|-----------------------------------------------|--------------------------------------------|---------------------|
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1           | Sub-frames before RB change | Fixed = 1            | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             | RB change                   | 1RB to 5 RBs         | TPC=+1dB    | 7.99                                          | $4\text{dB} \leq \Delta P < 10\text{dB}$   | 7.99 +/- (3.5 + TT) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             | Sub-frames after RB change  | Fixed = 5            | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2           | Sub-frames before RB change | Fixed = 1            | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             | RB change                   | 1RB to 15 RBs        | TPC=+1dB    | 12.76                                         | $10\text{dB} \leq \Delta P < 15\text{dB}$  | 12.76 +/- (4 + TT)  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             | Sub-frames after RB change  | Fixed = 15           | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
| 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1           | Sub-frames before RB change | Fixed = 1            | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             | RB change                   | 1RB to 5 RBs         | TPC=+1dB    | 7.99                                          | $4\text{dB} \leq \Delta P < 10\text{dB}$   | 7.99 +/- (3.5 + TT) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             | Sub-frames after RB change  | Fixed = 5            | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2           | Sub-frames before RB change | Fixed = 1            | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             | RB change                   | 1RB to 10 RBs        | TPC=+1dB    | 11.00                                         | $10\text{dB} \leq \Delta P < 15\text{dB}$  | 11.00 +/- (4 + TT)  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |             | Sub-frames after RB change  | Fixed = 10           | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
| Note 1: Position of RB change:<br>Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames<br>Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames<br>Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames<br>Note 2: The starting resource block shall be RB# 0.<br>Note 3: TT=0.7dB<br>Note 4: Applicable if $P_{UMAX} \geq P \geq P_{min}$ . $P_{min}$ as defined in sub-clause 6.3.1. |             |                             |                      |             |                                               |                                            |                     |

**Table 6.3.4.3.5-2: Test Requirements Relative Power Tolerance for Transmission, channel BW 5MHz, ramp down sub-test**

| Test SCS [kHz]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Sub-test ID | Applicable sub-frames       | Uplink RB allocation | TPC command | Expected power step size (Down) $\Delta P$ [dB] | Power step size range (Down) $\Delta P$ [dB] | PUSCH [dB]           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------|----------------------|-------------|-------------------------------------------------|----------------------------------------------|----------------------|
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1           | Sub-frames before RB change | Fixed = 5            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | RB change                   | 5 RBs to 1 RB        | TPC=-1dB    | 7.99                                            | $4\text{dB} \leq \Delta P < 10\text{dB}$     | 7.99 +/- (3.5 + TT)  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | Sub-frames after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2           | Sub-frames before RB change | Fixed = 15           | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | RB change                   | 15 RBs to 1 RB       | TPC=-1dB    | 12.76                                           | $10\text{dB} \leq \Delta P < 15\text{dB}$    | 12.76 +/- (3.5 + TT) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | Sub-frames after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)     |
| 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1           | Sub-frames before RB change | Fixed = 5            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | RB change                   | 5 RBs to 1 RB        | TPC=-1dB    | 7.99                                            | $4\text{dB} \leq \Delta P < 10\text{dB}$     | 7.99 +/- (3.5 + TT)  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | Sub-frames after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2           | Sub-frames before RB change | Fixed = 10           | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | RB change                   | 10 RBs to 1 RB       | TPC=-1dB    | 11.00                                           | $10\text{dB} \leq \Delta P < 15\text{dB}$    | 11.00 +/- (4 + TT)   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             | Sub-frames after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)     |
| Note 1: Position of RB change:<br>Pattern A the position of RB uplink allocation change is after 10 active uplink Sub-frames<br>Pattern B the position of RB uplink allocation change is after 20 active uplink Sub-frames<br>Pattern C the position of RB uplink allocation change is after 30 active uplink Sub-frames<br>Note 2: The starting resource block shall be RB# 0.<br>Note 3: TT=0.7dB<br>Note 4: Applicable if $P_{\text{UMAX}} \geq P \geq P_{\text{min}}$ . $P_{\text{min}}$ as defined in sub-clause 6.3.1. |             |                             |                      |             |                                                 |                                              |                      |

**Table 6.3.4.3.5-3: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz ramp up sub-test**

| Test SCS [kHz] | Sub-test ID | Applicable sub-frames      | Uplink RB allocation | TPC command | Expected power step size (Up) $\Delta P$ [dB] | Power step size range (Up) $\Delta P$ [dB] | PUSCH [dB]          |
|----------------|-------------|----------------------------|----------------------|-------------|-----------------------------------------------|--------------------------------------------|---------------------|
| 15             | 1           | Subframes before RB change | 1RB                  | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                |             | RB change                  | 1RB to 5 RBs         | TPC=+1dB    | 7.99                                          | $4\text{dB} \leq \Delta P < 10\text{dB}$   | 7.99 +/- (3.5 + TT) |
|                |             | Subframes after RB change  | Fixed = 5            | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                | 2           | Subframes before RB change | 1RB                  | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                |             | RB change                  | 1RB to 20 RBs        | TPC=+1dB    | 14.01                                         | $10\text{dB} \leq \Delta P < 15\text{dB}$  | 14.01 +/- (4 + TT)  |
|                |             | Subframes after RB change  | Fixed = 20           | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/-0.7 + TT       |
|                | 3           | Subframes before RB change | 1RB                  | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                |             | RB change                  | 1RB to 50 RBs        | TPC=+1dB    | 17.99                                         | $15\text{dB} \leq \Delta P$                | 17.99 +/- (5 + TT)  |
|                |             | Subframes after RB change  | Fixed = 50           | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
| 30             | 1           | Subframes before RB change | 1RB                  | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                |             | RB change                  | 1RB to 5 RBs         | TPC=+1dB    | 7.99                                          | $4\text{dB} \leq \Delta P < 10\text{dB}$   | 7.99 +/- (3.5 + TT) |
|                |             | Subframes after RB change  | Fixed = 5            | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                | 2           | Subframes before RB change | 1RB                  | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/-0.7 + TT       |
|                |             | RB change                  | 1RB to 24 RBs        | TPC=+1dB    | 14.80                                         | $10\text{dB} \leq \Delta P < 15\text{dB}$  | 14.80 +/- (4 + TT)  |
|                |             | Subframes after RB change  | Fixed = 24           | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
| 60             | 1           | Subframes before RB change | 1RB                  | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/-0.7 + TT       |
|                |             | RB change                  | 1RB to 5 RBs         | TPC=+1dB    | 7.99                                          | $4\text{dB} \leq \Delta P < 10\text{dB}$   | 7.99 +/- (3.5 + TT) |
|                |             | Subframes after RB change  | Fixed = 5            | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                | 2           | Subframes before RB change | 1RB                  | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |
|                |             | RB change                  | 1RB to 10 RBs        | TPC=+1dB    | 11.00                                         | $10\text{dB} \leq \Delta P < 15\text{dB}$  | 11.00 +/- (4 + TT)  |
|                |             | Subframes after RB change  | Fixed = 10           | TPC=+1dB    | 1                                             | $\Delta P \leq 1$ dB                       | 1 +/- (0.7 + TT)    |

Note 1: Position of RB change:  
Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes.  
Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes  
Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.

Note 2: The starting resource block shall be RB# 0.

Note 3: TT=0.7dB

Note 4: Applicable if  $P_{\text{UMAX}} \geq P \geq P_{\text{min}}$ .  $P_{\text{min}}$  as defined in sub-clause 6.3.1.

**Table 6.3.4.3.5-4: Test Requirements Relative Power Tolerance for Transmission, channel BW 10MHz, 15MHz, 20MHz ramp down sub-test**

| Test SCS [kHz] | Sub-test ID | Applicable sub-frames      | Uplink RB allocation | TPC command | Expected power step size (Down) $\Delta P$ [dB] | Power step size range (Down) $\Delta P$ [dB] | PUSCH [dB]          |
|----------------|-------------|----------------------------|----------------------|-------------|-------------------------------------------------|----------------------------------------------|---------------------|
| 15             | 1           | Subframes before RB change | Fixed = 5            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
|                |             | RB change                  | 5 RBs to 1RBs        | TPC=-1dB    | 7.99                                            | $4\text{dB} \leq \Delta P < 10\text{dB}$     | 7.99 +/- (3.5 + TT) |
|                |             | Subframes after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
|                | 2           | Subframes before RB change | Fixed = 20           | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
|                |             | RB change                  | 20 RBs to 1 RB       | TPC=-1dB    | 14.01                                           | $10\text{dB} \leq \Delta P < 15\text{dB}$    | 14.01 +/- (4 + TT)  |
|                |             | Subframes after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
|                | 3           | Subframes before RB change | Fixed = 50           | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
|                |             | RB change                  | 50 RBs to 1 RB       | TPC=-1dB    | 17.99                                           | $15\text{dB} \leq \Delta P$                  | 17.99 +/- (5 + TT)  |
|                |             | Subframes after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
| 30             | 1           | Subframes before RB change | Fixed = 5            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/-0.7 + TT       |
|                |             | RB change                  | 5 RBs to 1 RB        | TPC=-1dB    | 7.99                                            | $4\text{dB} \leq \Delta P < 10\text{dB}$     | 7.99 +/- (3.5 + TT) |
|                |             | Subframes after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
|                | 2           | Subframes before RB change | Fixed = 24           | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/-0.7 + TT       |
|                |             | RB change                  | 24 RBs to 1 RB       | TPC=-1dB    | 14.80                                           | $10\text{dB} \leq \Delta P < 15\text{dB}$    | 14.80 +/- (4 + TT)  |
|                |             | Subframes after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
| 60             | 1           | Subframes before RB change | Fixed = 5            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
|                |             | RB change                  | 5 RBs to 1 RB        | TPC=-1dB    | 7.99                                            | $4\text{dB} \leq \Delta P < 10\text{dB}$     | 7.99 +/- (3.5 + TT) |
|                |             | Subframes after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |
|                | 2           | Subframes before RB change | Fixed = 10           | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/-0.7 + TT       |
|                |             | RB change                  | 10 RBs to 1 RB       | TPC=-1dB    | 11.00                                           | $10\text{dB} \leq \Delta P < 15\text{dB}$    | 11.00 +/- (4 + TT)  |
|                |             | Subframes after RB change  | Fixed = 1            | TPC=-1dB    | 1                                               | $\Delta P \leq 1$ dB                         | 1 +/- (0.7 + TT)    |

Note 1: Position of RB change:  
Pattern A the position of RB uplink allocation change is after 10 active uplink Subframes.  
Pattern B the position of RB uplink allocation change is after 20 active uplink Subframes.  
Pattern C the position of RB uplink allocation change is after 30 active uplink Subframes.

Note 2: The starting resource block shall be RB# 0.

Note 3: TT=0.7dB

Note 4: Applicable if  $P_{\text{UMAX}} \geq P \geq P_{\text{min}}$ .  $P_{\text{min}}$  as defined in sub-clause 6.3.1.

**Table 6.3.4.3.5-5: Test Requirements Relative Power Tolerance for Transmission, alternating sub-test**

| BW       | Test SCS [kHz]                                                                                                | Sub-test ID | Uplink RB allocation | TPC command | Expected power step size (Up or Down) $\Delta P$ [dB] | Power step size range (Up or Down) $\Delta P$ [dB] | PUSCH [dB]            |
|----------|---------------------------------------------------------------------------------------------------------------|-------------|----------------------|-------------|-------------------------------------------------------|----------------------------------------------------|-----------------------|
| 5        | 15                                                                                                            | 1           | Alternating 1 and 2  | TPC=0dB     | 3.01                                                  | $3\text{dB} \leq \Delta P < 4\text{dB}$            | $3.01 \pm (3 + TT)$   |
|          |                                                                                                               | 2           | Alternating 1 and 5  | TPC=0dB     | 6.99                                                  | $4\text{dB} \leq \Delta P < 10\text{dB}$           | $6.99 \pm (3.5 + TT)$ |
|          |                                                                                                               | 3           | Alternating 1 and 15 | TPC=0dB     | 11.76                                                 | $10\text{dB} \leq \Delta P < 15\text{dB}$          | $11.76 \pm (4 + TT)$  |
|          | 30                                                                                                            | 1           | Alternating 1 and 2  | TPC=0dB     | 3.01                                                  | $3\text{dB} \leq \Delta P < 4\text{dB}$            | $3.01 \pm (3 + TT)$   |
|          |                                                                                                               | 2           | Alternating 1 and 10 | TPC=0dB     | 10.00                                                 | $10\text{dB} \leq \Delta P < 15\text{dB}$          | $10.00 \pm (4 + TT)$  |
| 10,15,20 | 15                                                                                                            | 1           | Alternating 1 and 2  | TPC=0dB     | 3.01                                                  | $3\text{dB} \leq \Delta P < 4\text{dB}$            | $3.01 \pm (3 + TT)$   |
|          |                                                                                                               | 2           | Alternating 1 and 5  | TPC=0dB     | 6.99                                                  | $4\text{dB} \leq \Delta P < 10\text{dB}$           | $6.99 \pm (3.5 + TT)$ |
|          |                                                                                                               | 3           | Alternating 1 and 20 | TPC=0dB     | 13.01                                                 | $10\text{dB} \leq \Delta P < 15\text{dB}$          | $13.01 \pm (4 + TT)$  |
|          |                                                                                                               | 4           | Alternating 1 and 50 | TPC=0dB     | 16.99                                                 | $15\text{dB} \leq \Delta P$                        | $16.99 \pm (5 + TT)$  |
|          | 30                                                                                                            | 1           | Alternating 1 and 2  | TPC=0dB     | 3.01                                                  | $3\text{dB} \leq \Delta P < 4\text{dB}$            | $3.01 \pm (3 + TT)$   |
|          |                                                                                                               | 2           | Alternating 1 and 5  | TPC=0dB     | 6.99                                                  | $4\text{dB} \leq \Delta P < 10\text{dB}$           | $6.99 \pm (3.5 + TT)$ |
|          |                                                                                                               | 3           | Alternating 1 and 24 | TPC=0dB     | 13.80                                                 | $10\text{dB} \leq \Delta P < 15\text{dB}$          | $13.80 \pm (4 + TT)$  |
|          | 60                                                                                                            | 1           | Alternating 1 and 5  | TPC=0dB     | 6.99                                                  | $4\text{dB} \leq \Delta P < 10\text{dB}$           | $6.99 \pm (3.5 + TT)$ |
|          |                                                                                                               | 2           | Alternating 1 and 10 | TPC=0dB     | 10.00                                                 | $10\text{dB} \leq \Delta P < 15\text{dB}$          | $10.00 \pm (4 + TT)$  |
| Note 1:  | The starting resource block shall be RB# 0.                                                                   |             |                      |             |                                                       |                                                    |                       |
| Note 2:  | TT=0.7dB                                                                                                      |             |                      |             |                                                       |                                                    |                       |
| Note 3:  | Applicable if $P_{\text{UMAX}} \geq P \geq P_{\text{min}}$ . $P_{\text{min}}$ as defined in sub-clause 6.3.1. |             |                      |             |                                                       |                                                    |                       |

### 6.3.4.4 Aggregate power tolerance

#### 6.3.4.4.1 Test purpose

To verify the ability of the UE transmitter to maintain its power during non-contiguous transmissions within 21ms in response to 0 dB commands with respect to the first UE transmission and all other power control parameters as specified in 38.213 kept constant.

#### 6.3.4.4.2 Test applicability

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

#### 6.3.4.4.3 Minimum conformance requirements

The aggregate power control tolerance is the ability of the UE transmitter to maintain its power in a sub-frame(1ms) during non-contiguous transmissions within 21ms in response to 0 dB commands with respect to the first UE transmission and all other power control parameters as specified in 38.213 kept constant.

The minimum requirement specified in Table 6.3.4.4.3-1 apply in the power range bounded by the minimum output power as specified in sub-clause 6.3.1 and the maximum output power as specified in sub-clause 6.2.2.

**Table 6.3.4.4.3-1: Aggregate power tolerance**

| TPC command | UL channel | Aggregate power tolerance within 21ms |
|-------------|------------|---------------------------------------|
| 0 dB        | PUCCH      | $\pm 2.5$ dB                          |
| 0 dB        | PUSCH      | $\pm 3.5$ dB                          |

The normative reference for this requirement is TS 38.01-1 [5] clause 6.3.4.4

#### 6.3.4.4.4 Test description

##### 6.3.4.4.4.1 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 test channel bandwidth and sub-carrier spacing, and are shown in table 6.3.4.4.4.1-1 and table 6.3.4.4.4.1-2. 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 6.3.4.4.4.1-1: Test Configuration Table: PUCCH sub-test**

| 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, Highest                                        |
| Test Parameters                                                                                         |                        |                  |                                                        |
|                                                                                                         | Downlink Configuration |                  | Uplink Configuration                                   |
| Test ID                                                                                                 | Modulation             | RB allocation    | PUCCH format = Format 1<br>Length in OFDM symbols = 14 |
| 1                                                                                                       | CP-OFDM<br>QPSK        | Full RB (NOTE 1) |                                                        |
| NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. |                        |                  |                                                        |

**Table 6.3.4.4.4.1-2: Test Configuration Table: PUSCH sub-test**

| 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, Highest      |                        |
| Test Parameters for Channel Bandwidths                                              |                                            |                      |                        |
| Test ID                                                                             | Downlink Configuration                     | Uplink Configuration |                        |
|                                                                                     | N/A for aggregate power tolerance testcase | Modulation           | RB allocation (NOTE 1) |
| 1                                                                                   |                                            | CP-OFDM QPSK         | Outer_Full             |
| NOTE 1: The specific configuration of each RF 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 section 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 G.0, G.1, G.2, G.3.0.
4. The UL and DL Reference Measurement channels are set according to Table 6.3.4.4.4.1-1 (PUCCH sub-test) and Table 6.3.4.4.4.1-2 (PUSCH sub-test)
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 6.3.4.4.4.3.

#### 6.3.4.4.4.2 Test procedure

The procedure is separated in two subtests to verify PUCCH and PUSCH aggregate power control tolerance respectively. The uplink transmission patterns are described in figure 6.3.4.4.4.2-1.

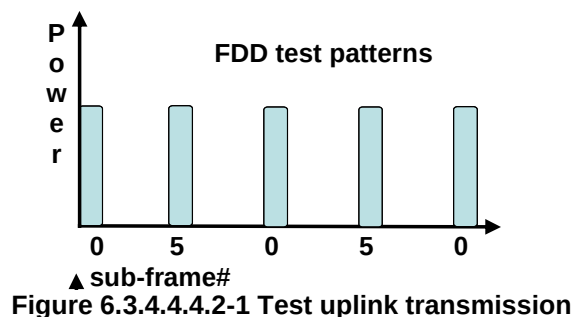


Figure 6.3.4.4.4.2-1 Test uplink transmission

##### 1. PUCCH sub test:

- 1.1. The SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 6.3.4.4.4.1-1. The SS sends downlink MAC padding bits on the DL RMC. The transmission of PDSCH will make the UE send uplink ACK/NACK using PUCCH. Send uplink power control commands for PUCCH 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  $-(\text{Uplink power control window size} / 2) \text{ dB}$  to  $+(\text{Uplink power control window size} / 2) \text{ dB}$  of the target power level + 0 dBm, where:
  - Uplink power control window size = 1dB (UE power step size) + 2.0dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 2.0dB for PUCCH with 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.
- 1.2. Every 5 sub-frames (5ms) transmit to the UE downlink PDSCH MAC padding bits as well as 0 dB TPC command for PUCCH via the PDCCH to make the UE transmit ACK/NACK on the PUCCH for 1 sub-frame(1ms). The downlink transmission is scheduled in the appropriate slots to make the UE transmit PUCCH as described in figure 6.3.4.4.4.2-1
- 1.3. Measure the power of 5 consecutive PUCCH transmissions to verify the UE transmitted PUCCH power is maintained within 21ms.

##### 2. PUSCH sub test:

- 2.1. The SS sends uplink scheduling information via PDCCH DCI format 0\_1 for C\_RNTI to schedule the PUSCH. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Send uplink power control commands for PUSCH 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  $-(\text{Uplink power control window size} / 2) \text{ dB}$  to  $+(\text{Uplink power control window size} / 2) \text{ dB}$  of the target power level + 0 dBm, where:

- 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 [2], Table 6.3.4.3-1 and is 0.7dB for PUSCH with 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is 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.4.4.

- 2.2. Every 5 sub-frames (5ms) schedule the UE's PUSCH data transmission for 1 sub-frame(1ms), and transmit 0 dB TPC command for PUSCH via the PDCCH to make the UE transmit PUSCH. The uplink transmission patterns are described in figure 6.3.4.4.2-1,
- 2.3. Measure the power of 5 consecutive PUSCH transmissions to verify the UE transmitted PUSCH power is maintained within 21ms transmissions.

#### 6.3.4.4.3 Message contents

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

#### 6.3.4.4.5 Test requirement

The requirement for the power measurements made in step (1.3) and (2.3) of the test procedure shall not exceed the values specified in Table 6.3.4.4.5-1. The power measurement period shall be 1 sub-frame(1ms).

**Table 6.3.4.4.5-1: Power control tolerance**

| TPC command                                                                                                                                                                    | UL channel | Test requirement measured power                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0 dB                                                                                                                                                                           | PUCCH      | Given 5 power measurements in the pattern, the 2 <sup>nd</sup> , and later measurements shall be within $\pm (2.5 + TT) \text{ dB}$ of the 1 <sup>st</sup> measurement. |
| 0 dB                                                                                                                                                                           | PUSCH      | Given 5 power measurements in the pattern, the 2 <sup>nd</sup> , and later measurements shall be within $\pm (3.5 + TT) \text{ dB}$ of the 1 <sup>st</sup> measurement. |
| Note 1: For SCS 30kHz 1 sub-frame corresponds to 2 slots and for SCS 60kHz 1 sub-frame corresponds to 4 slots, so 2 TPC commands will be sent for a single measurement period. |            |                                                                                                                                                                         |
| Note 2: TT=0.7dB.                                                                                                                                                              |            |                                                                                                                                                                         |

## 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  $\pm 0.1$  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.]

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] Annex 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  $P_{\text{UMAX}}$  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  $P_{\text{UMAX}}$  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 {                                                                                                           |              |         |           |
| cellSpecificOffset-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 129.9354103 ms and Doppler equal to 0.17001 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 {                                                                                                             |              |         |           |
| cellSpecificOffset-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 129.7416514 ms and Doppler equal to -0.17055 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 {                                                                                                            |              |         |           |
| cellSpecificOffset-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 131.7015009 ms and Doppler equal to 0.08500 ppm. |              |         |           |

**Table 6.4.1.4.3-3b: Void**

### 6.4.1\_1.5 Test requirement

The frequency error  $\Delta f$  shall fulfil the test requirement:

$$|\Delta f| \leq (0.1 \text{ PPM} + 15 \text{ Hz}) \text{ for } f \leq 3.0 \text{ GHz}$$

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 6.4435608 ms and Doppler equal to 22.64767 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 6.6054758 ms and Doppler equal to -22.61940 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 2.3001572 ms and Doppler equal to 11.28784 ppm. |              |         |           |

### 6.4.1\_2.5 Test requirement

The frequency error  $\Delta f$  shall fulfil the test requirement:

$$|\Delta f| \leq (0.1 \text{ PPM} + 15 \text{ Hz}) \text{ for } f \leq 3.0 \text{ GHz}$$

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

### 6.4.2 Transmit modulation quality

Transmit modulation quality defines the modulation quality for expected in-channel RF transmissions from the UE. The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs),
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage
- In-band emissions for the non-allocated RB

All the parameters defined in subclause 6.4.2 are defined using the measurement methodology specified in Annex E in TS 38.521-1 [2].

In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE (as defined in TS 38.331 [8]), carrier leakage measurement requirement in subclause 6.4.2.2 and 6.4.2.3 shall be waived, and the RF correction with regard to the carrier leakage and IQ image shall be omitted during the calculation of transmit modulation quality.

#### 6.4.2.1 Error Vector Magnitude

##### 6.4.2.1.1 Test Purpose

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further equalised using the channel estimates subjected to the EVM equaliser spectrum flatness requirement specified in sub-clause 6.4.2.4.3. For DFT-s-OFDM waveforms, the EVM result is defined after the front-end FFT and IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %. For CP-OFDM waveforms, the EVM result is defined after the front-end FFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in the time domain is one preamble sequence for the PRACH and the duration of PUCCH/PUSCH channel, or one hop, if frequency hopping is enabled for PUCCH and PUSCH in the time domain. The EVM measurement interval is reduced by any symbols that contains an allowable power transient as defined in subclause 6.3.3.3.

#### 6.4.2.1.2 Test applicability

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

#### 6.4.2.1.3 Minimum conformance requirements

The RMS average of the basic EVM measurements for 10 sub-frames excluding any transient period for the average EVM case, and 60 sub-frames excluding any transient period for the reference signal EVM case, for the different modulation schemes shall not exceed the values specified in Table 6.4.2.1.3-1 for the parameters defined in Table 6.4.2.1.3-2. For EVM evaluation purposes, all PRACH preamble formats 0-4 and all 5 PUCCH formats are considered to have the same EVM requirement as QPSK modulated.

**Table 6.4.2.1.3-1: Requirements for Error Vector Magnitude**

| Parameter | Unit | Average EVM Level |
|-----------|------|-------------------|
| Pi/2-BPSK | %    | 30                |
| QPSK      | %    | 17.5              |
| 16 QAM    | %    | 12.5              |
| 64 QAM    | %    | 8                 |

**Table 6.4.2.1.3-2: Parameters for Error Vector Magnitude**

| Parameter            | Unit | Level             |
|----------------------|------|-------------------|
| UE Output Power      | dBm  | ≥ Table 6.3.1.3-1 |
| Operating conditions |      | Normal conditions |

The normative reference for this requirement is TS 38.101-1 [5] clause 6.4.2.1, as indicated in TS 38.101-5 [11] clause 6.4.2.

#### 6.4.2.1.4 Test description

##### 6.4.2.1.4.1 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 channel bandwidth and sub-carrier spacing, are shown in table 6.4.2.1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

**Table 6.4.2.1.4.1-1: Test Configuration Table for PUSCH**

| 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, Highest                  |                        |
| Test SCS as specified in Table 5.3.5-1                                                                                                       |                        | All                              |                        |
| Test Parameters                                                                                                                              |                        |                                  |                        |
| Test ID                                                                                                                                      | Downlink Configuration | Uplink Configuration             |                        |
|                                                                                                                                              | N/A                    | Modulation (NOTE 3)              | RB allocation (NOTE 1) |
| 1 <sup>3</sup>                                                                                                                               |                        | DFT-s-OFDM PI/2 BPSK             | Inner Full             |
| 2 <sup>3</sup>                                                                                                                               |                        | DFT-s-OFDM PI/2 BPSK             | Outer Full             |
| 3                                                                                                                                            |                        | DFT-s-OFDM QPSK                  | Inner Full             |
| 4                                                                                                                                            |                        | DFT-s-OFDM QPSK                  | Outer Full             |
| 5                                                                                                                                            |                        | DFT-s-OFDM 16 QAM                | Inner Full             |
| 6                                                                                                                                            |                        | DFT-s-OFDM 16 QAM                | Outer Full             |
| 7                                                                                                                                            |                        | DFT-s-OFDM 64 QAM                | Outer Full             |
| 8                                                                                                                                            |                        | CP-OFDM QPSK                     | Inner Full             |
| 9                                                                                                                                            |                        | CP-OFDM QPSK                     | Outer Full             |
| 10                                                                                                                                           |                        | CP-OFDM 16 QAM                   | Inner Full             |
| 11                                                                                                                                           |                        | CP-OFDM 16 QAM                   | Outer Full             |
| 12                                                                                                                                           |                        | CP-OFDM 64 QAM                   | Outer Full             |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.                                                          |                        |                                  |                        |
| NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. |                        |                                  |                        |
| NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.                                                   |                        |                                  |                        |

**Table 6.4.2.1.4.1-2: Test Configuration Table for PUCCH**

| 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                                                                                                                                                                                                                                                                                                                                |                        |                  | See Table 6.4.2.1.4.1-1 |                                                                 |            |
| Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1                                                                                                                                                                                                                                                                                                                         |                        |                  | See Table 6.4.2.1.4.1-1 |                                                                 |            |
| Test SCS as specified in Table 5.3.5-1                                                                                                                                                                                                                                                                                                                                                           |                        |                  | See Table 6.4.2.1.4.1-1 |                                                                 |            |
| Test Parameters                                                                                                                                                                                                                                                                                                                                                                                  |                        |                  |                         |                                                                 |            |
| ID                                                                                                                                                                                                                                                                                                                                                                                               | Downlink Configuration |                  | Uplink Configuration    |                                                                 |            |
|                                                                                                                                                                                                                                                                                                                                                                                                  | Modulation             | RB allocation    | Waveform                | PUCCH format                                                    | RB index   |
| 1                                                                                                                                                                                                                                                                                                                                                                                                | CP-OFDM QPSK           | Full RB (Note 1) | CP-OFDM                 | PUCCH format = Format 1<br>Length in OFDM symbols = 14          | 0          |
| 2                                                                                                                                                                                                                                                                                                                                                                                                | CP-OFDM QPSK           | Full RB (Note 1) | CP-OFDM                 | PUCCH format = Format 1<br>Length in OFDM symbols = 14          | $N_{RB}-1$ |
| 3                                                                                                                                                                                                                                                                                                                                                                                                | CP-OFDM QPSK           | Full RB (Note 1) | DFT-s-OFDM              | PUCCH format = Format 3 (Note 3)<br>Length in OFDM symbols = 14 | 0          |
| 4                                                                                                                                                                                                                                                                                                                                                                                                | CP-OFDM QPSK           | Full RB (Note 1) | DFT-s-OFDM              | PUCCH format = Format 3 (Note 3)<br>Length in OFDM symbols = 14 | $N_{RB}-1$ |
| 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: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1.                                                                                                                                                                                                                                                     |                        |                  |                         |                                                                 |            |
| NOTE 3: For FDD, set K1 value (PDSCH-to-HARQ-timing-indicator) as follows:<br>K1 = 2 if mod(i,5) = 0<br>K1 = 2 if mod(i,5) = 1<br>K1 = 4 if mod(i,5) = 2<br>K1 = 3 if mod(i,5) = 3<br>K1 = 2 if mod(i,5) = 4<br>where i is slot index per frame<br>PDSCH shall not be transmitted in slots where Number of Code Blocks per Slot is N/A in Table A.3.4.1.1-1 for NGSO, Table A.3.4.1.1-3 for GSO. |                        |                  |                         |                                                                 |            |

**Table 6.4.2.1.4.1-3: Test Configuration for PRACH**

| 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        | See Table 6.4.2.1.4.1-1                                                                 |
| Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1 | See Table 6.4.2.1.4.1-1                                                                 |
| Test SCS as specified in Table 5.3.5-1                                   | SCS defined in TS 38.211 [17] subclause 6.3.3.2 determined by PRACH Configuration Index |
| PRACH preamble format                                                    |                                                                                         |
|                                                                          | FDD                                                                                     |
| PRACH Configuration Index                                                | 17                                                                                      |
| RS EPRE setting for test point 1 (dBm/15kHz)                             | -71                                                                                     |
| RS EPRE setting for test point 2 (dBm/15kHz)                             | -86                                                                                     |

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 section 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 channels are set according to Table 6.4.2.1.4.1-1.
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 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 6.4.2.1.4.3.

#### 6.4.2.1.4.2 Test procedure

Test procedure for PUSCH:

- 1.1. 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 6.4.2.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
- 1.2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at  $P_{UMAX}$  level, allow at least 200ms starting from the first TPC command in this step for the UE to reach  $P_{UMAX}$  level.
- 1.3. Measure the EVM and  $\overline{EVM}_{DMRS}$  using Global In-Channel Tx-Test (Annex E).
- 1.4. 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 Pmin, where:
  - Pmin is the minimum output power according to Table 6.3.1.3-1.
  - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 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.
- 1.5. Measure the EVM and  $\overline{EVM}_{DMRS}$  using Global In-Channel Tx-Test (Annex E).

NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.1.4.1-1, 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.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less 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.4.2.

**Table 6.4.2.1.4.2-1: Void**

Test procedure for PUCCH:

- 2.1. PUCCH is set according to Table 6.4.2.1.4.1-2.
- 2.2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 6.4.2.1.4.1-2. The SS sends downlink MAC padding bits on the DL RMC. The transmission of PDSCH will make the UE send uplink ACK/NACK using PUCCH. There is no PUSCH transmission.

- 2.3. SS send appropriate TPC commands for PUCCH to the UE until the UE transmit PUCCH at  $P_{\text{UMAX}}$  level. Allow at least 200ms starting from the first TPC command in this step for the UE to reach  $P_{\text{UMAX}}$  level.
- 2.4. Measure PUCCH EVM using Global In-Channel Tx-Test (Annex E).
- 2.5. Send uplink power control commands for PUCCH to the UE using 1dB power step size to ensure that the UE PUCCH output power measured by the test system is within the Uplink power control window, defined as  $+MU$  to  $+(MU + \text{Uplink power control window size})$  dB of the target power level  $P_{\text{min}}$ , where:
- $P_{\text{min}}$  is the minimum output power according to Table 6.3.1.3-1.
  - $MU$  is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency  $f$  and the channel bandwidth  $BW$ .
  - Uplink power control window size = 1dB (UE power step size) + 2.0dB (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 2.0dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.
- 2.6. Measure PUCCH EVM using Global In-Channel Tx-Test (Annex E).
- NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.1.4.1-2, 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.
- NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less 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.4.2.

Test procedure for PRACH:

- 3.1. The SS shall set RS EPRE according to Table 6.4.2.1.4.1-3.
- 3.2. PRACH is set according to Table 6.4.2.1.4.1-3.
- 3.3. The SS shall signal a Random Access Preamble ID via a PDCCH order to the UE and initiate a Non-contention based Random Access procedure.
- 3.4. The UE shall send the signalled preamble to the SS.
- 3.5. In response to the preamble, the SS shall transmit a random access response not corresponding to the transmitted random access preamble, or send no response.
- 3.6. The UE shall consider the random access response reception not successful then re-transmit the preamble with the calculated PRACH transmission power.
- 3.7. Repeat step 5 and 6 until the SS collect enough PRACH preambles. Measure the EVM in PRACH channel using Global In-Channel Tx-Test (Annex E).

#### 6.4.2.1.4.3 Message contents

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

**Table 6.4.2.1.4.3-1: RACH-ConfigCommon: PRACH measurement**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-128 |                                                 |                                                                                                                      |                 |
|----------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------|
| Information Element                                | Value/remark                                    | Comment                                                                                                              | Condition       |
| RACH-ConfigCommon ::= SEQUENCE {                   |                                                 |                                                                                                                      |                 |
| rach-ConfigGeneric                                 | RACH-ConfigGeneric                              |                                                                                                                      |                 |
| totalNumberOfRA-Preambles                          | Not present                                     |                                                                                                                      |                 |
| ssb-perRACH-OccasionAndCB-PreamblesPerSSB CHOICE { |                                                 |                                                                                                                      |                 |
| one                                                | n8                                              |                                                                                                                      | FR1             |
| }                                                  |                                                 |                                                                                                                      |                 |
| groupBconfigured                                   | Not present                                     |                                                                                                                      |                 |
| ra-ContentionResolutionTimer                       | sf64                                            |                                                                                                                      |                 |
| rsrp-ThresholdSSB                                  | RSRP-Range                                      |                                                                                                                      |                 |
| rsrp-ThresholdSSB-SUL                              | Not present                                     |                                                                                                                      |                 |
| prach-RootSequenceIndex CHOICE {                   |                                                 |                                                                                                                      |                 |
| l139                                               | Set according to table 4.4.2-2 for the NR Cell. |                                                                                                                      | PRACH Format A3 |
| l839                                               | 0                                               | NR Cell 1                                                                                                            | PRACH Format 0  |
| }                                                  |                                                 |                                                                                                                      |                 |
| msg1-SubcarrierSpacing                             | SubcarrierSpacing                               |                                                                                                                      |                 |
| restrictedSetConfig                                | unrestrictedSet                                 |                                                                                                                      |                 |
| msg3-transformPrecoder                             | Not present                                     | transform precoding is disabled for Msg3 PUSCH transmission and any PUSCH transmission scheduled with DCI format 0_0 |                 |
| }                                                  |                                                 |                                                                                                                      |                 |

**Table 6.4.2.1.4.3-2: RACH-ConfigGeneric: PRACH measurement**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-130 |              |                   |                |
|----------------------------------------------------|--------------|-------------------|----------------|
| Information Element                                | Value/remark | Comment           | Condition      |
| RACH-ConfigGeneric ::= SEQUENCE {                  |              |                   |                |
| prach-ConfigurationIndex                           | 17           | Paired Spectrum   | PRACH Format 0 |
|                                                    | 7            | Unpaired Spectrum | PRACH Format 0 |
| msg1-FDM                                           | four         |                   | FR1            |
| msg1-FrequencyStart                                | 0            |                   |                |
| zeroCorrelationZoneConfig                          | 15           |                   |                |
| preambleReceivedTargetPower                        | -92          |                   | Test point 1   |
|                                                    | -74          |                   | Test point 2   |
| preambleTransMax                                   | n7           |                   |                |
| powerRampingStep                                   | dB0          |                   |                |
| ra-ResponseWindow                                  | sl20         |                   |                |
| }                                                  |              |                   |                |

**Table 6.4.2.1.4.3-3: PUSCH-TimeDomainResourceAllocationList: PRACH measurement**

| 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 PUSCH-TimeDomainResourceAllocation { | 2 entries    |                                                                                                                                 |                                                   |
| PUSCH-TimeDomainResourceAllocation[2] SEQUENCE {                                                                             |              | entry 2 addressed by Msg3 PUSCH time resource allocation field of the Random Access Response acc. to TS 38.213 [7] Table 8.2-1. |                                                   |
| k2                                                                                                                           | 6            | K2+ $\Delta=8$ acc. to TS 38.214 [16] Table 6.1.2.1.1-5                                                                         | Unpaired Spectrum for SCS15kHz and PRACH Format 0 |
| }                                                                                                                            |              |                                                                                                                                 |                                                   |
| }                                                                                                                            |              |                                                                                                                                 |                                                   |

**Table 6.4.2.1.4.3-4: PDSCH-ServingCellConfig: PUCCH format3 measurement**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-102 |              |         |           |
|----------------------------------------------------|--------------|---------|-----------|
| Information Element                                | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE {             |              |         |           |
| codeBlockGroupTransmission                         | Not present  |         |           |
| xOverhead                                          | Not present  |         |           |
| nrofHARQ-ProcessesForPDSCH                         | n16          |         | FDD       |
| pucch-Cell                                         | Not present  |         |           |
| maxMIMO-Layers                                     | Not present  |         |           |
| processingType2Enabled                             | Not present  |         |           |
| pdsch-CodeBlockGroupTransmissionList-r16           | Not present  |         |           |
| }                                                  |              |         |           |

#### 6.4.2.1.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4.2.1.5-1.

The PUSCH  $\overline{EVM}_{DMRS}$ , derived in Annex E.4.6.2, shall not exceed the values in Table 6.4.2.1.5-1 when embedded with data symbols of the respective modulation scheme.

**Table 6.4.2.1.5-1: Test requirements for Error Vector Magnitude**

| Parameter                                   | Unit | Average EVM Level |
|---------------------------------------------|------|-------------------|
| Pi/2-BPSK                                   | %    | 30 + TT           |
| QPSK                                        | %    | 17.5 + TT         |
| 16 QAM                                      | %    | 12.5 + TT         |
| 64 QAM                                      | %    | 8 + TT            |
| Note 1: TT is defined in Table 6.4.2.1.5-2. |      |                   |

Table 6.4.2.1.5-2: Test Tolerance

| Parameter | Unit | Average EVM Level |
|-----------|------|-------------------|
| Pi/2-BPSK | %    | 0                 |
| QPSK      | %    | 0                 |
| 16 QAM    | %    | 0                 |
| 64 QAM    | %    | 0                 |

The PUCCH EVM derived in Annex E.5.9.2 shall not exceed 17.5%.

The PRACH EVM derived in Annex E.6.9.2 shall not exceed 17.5%.

### 6.4.2.1a Error Vector Magnitude including symbols with transient period

#### 6.4.2.1a.1 Test Purpose

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

#### 6.4.2.1a.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 support short transient period capability.

#### 6.4.2.1a.3 Minimum conformance requirements

In 6.4.2.1, EVM has been defined by excluding the symbols which have a transient period. In this section, measurement interval is defined for the symbols with a transient period to include these symbols in the RMS average EVM computation when the UE reports a transient period capability other than the default. Before calculating the EVM, the measured waveform is corrected for sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM. The symbols with transient period should not be used for equalization. Only CP-OFDM waveform is used for conformance testing.

In the case of PUSCH or PUCCH transmissions when the mean power, modulation or RB allocation across slot or subslot boundaries is expected to change the EVM result over the symbols where the transient occurs is calculated according to Table 6.4.2.1a.3-1.

Table 6.4.2.1a.3-1: EVM definition for reported transient period

| Reported transient capability (us)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | EVM definition                                                                                                                  | $tp_{start}$ (μs) | SCS <sup>4</sup>            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------|
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $EVM_{after} = \max(\overline{EVM_{l,tp}}, \overline{EVM_h})$<br>$EVM_{before} = \max(\overline{EVM_l}, \overline{EVM_{h,tp}})$ | -0.5              | 15kHz or 30kHz <sup>5</sup> |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $EVM_{after} = \max(\overline{EVM_{l,tp}}, \overline{EVM_h})$<br>$EVM_{before} = \max(\overline{EVM_l}, \overline{EVM_{h,tp}})$ | -1                | 15kHz                       |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $EVM_{after} = \min(\overline{EVM_{l,tp}}, \overline{EVM_h})$<br>$EVM_{before} = \max(\overline{EVM_l}, \overline{EVM_{h,tp}})$ | -2.7              | 15kHz                       |
| NOTE 1: $\overline{EVM_l}$ , $\overline{EVM_h}$ , $\overline{EVM_{l,tp}}$ , and $\overline{EVM_{h,tp}}$ are defined in Annex E.4.7<br>NOTE 2: $EVM_{after}$ is the EVM for a symbol right after a transition; $EVM_{before}$ is the EVM for a symbol right before a transition<br>NOTE 3: $tp_{start}$ denotes the start position of the EVM exclusion window as shown in Annex E.4.7<br>NOTE 4: SCS denotes the SCS that can be used in the conformance test<br>NOTE 5: 30kHz shall be used in the conformance test unless the UE signals in <i>supportedSubCarrierSpacingUL</i> in <i>FeatureSetPerCC</i> that it only supports 15kHz in the corresponding band |                                                                                                                                 |                   |                             |

The RMS average of the basic EVM measurements over 108 subframes calculated only on the symbols where the transient occurs for the different modulation schemes shall not exceed the values specified in Table 6.4.2.1a.3-2 for the parameters defined in Table 6.4.2.1a.3-3. This requirement can be verified with 64 QAM modulation.

**Table 6.4.2.1a.3-2: Requirements for Error Vector Magnitude**

| Parameter | Unit | Average EVM Level |
|-----------|------|-------------------|
| 64 QAM    | %    | 10                |

**Table 6.4.2.1a.3-3: Parameters for Error Vector Magnitude**

| Parameter            | Unit | Level             |
|----------------------|------|-------------------|
| UE Output Power      | dBm  | ≥ Table 6.3.1-1   |
| Operating conditions |      | Normal conditions |

The normative reference for this requirement is TS 38.101-1 [5] clause 6.4.2.1a, as indicated in TS 38.101-5 [11] clause 6.4.2.

#### 6.4.2.1a.4 Test description

##### 6.4.2.1a.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 6.4.2.1a.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

**Table 6.4.2.1a.4.1-1: Test Configuration Table for PUSCH**

| 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, Highest                  |                                          |
| Test SCS as specified in Table 5.3.5-1                                                                                                                                                                                                     |                        | 15 kHz (Note 3)                  |                                          |
| Test Parameters                                                                                                                                                                                                                            |                        |                                  |                                          |
| Test ID                                                                                                                                                                                                                                    | Downlink Configuration | Uplink Configuration             |                                          |
|                                                                                                                                                                                                                                            | N/A                    | Modulation                       | RB allocation                            |
| 1                                                                                                                                                                                                                                          |                        | CP-OFDM 64 QAM                   | 24@0 <sup>1,4</sup> and 1@0 <sup>5</sup> |
| NOTE 1: This RB allocation is used for all UL slots when UL power is fixed within the UL power control window (step 2 of the test procedure).                                                                                              |                        |                                  |                                          |
| NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1.                                                                                               |                        |                                  |                                          |
| NOTE 3: For UE supporting 2 us transient period, 30kHz shall be used in the conformance test unless the UE signals in <i>supportedSubCarrierSpacingUL</i> in <i>FeatureSetPerCC</i> that it only supports 15kHz in the corresponding band. |                        |                                  |                                          |
| NOTE 4: During the EVM measurement, this UL RB allocation is applied to slots 3 and 9 for SCS 15 kHz, and slots 8 and 19 for SCS 30 kHz, as shown in Figure 6.4.2.1a.4.2-2.                                                                |                        |                                  |                                          |
| NOTE 5: During the EVM measurement, this UL RB allocation is applied to slots 4 and 8 for SCS 15 kHz, and slots 9 and 18 for SCS 30 kHz, as shown in Figure 6.4.2.1a.4.2-2.                                                                |                        |                                  |                                          |

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 section 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 channels are set according to Table 6.4.2.1a.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 38.508-1 [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 6.4.2.1a.4.3.

#### 6.4.2.1a.4.2 Test procedure

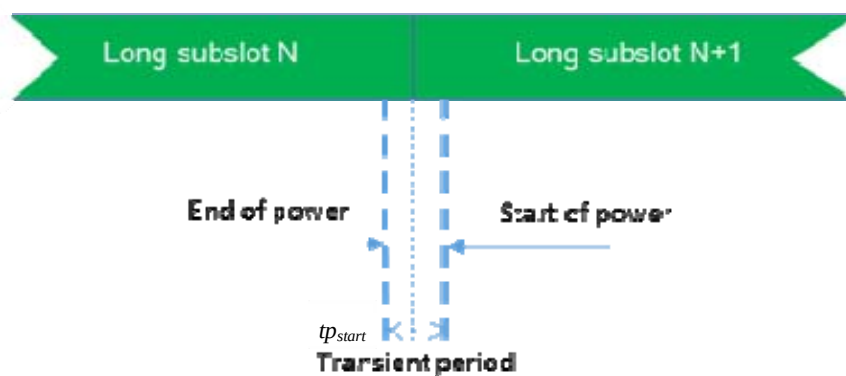


Figure 6.4.2.1a.4.2-1: Error Vector Magnitude including symbols with transient period

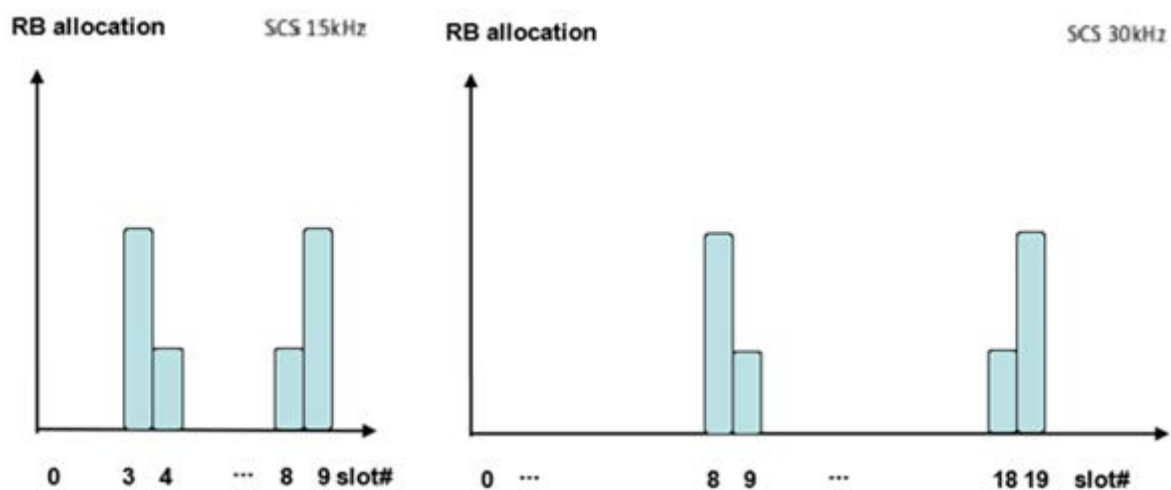


Figure 6.4.2.1a.4.2-2: Test power patterns for Error Vector Magnitude including symbols with transient period

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 6.4.2.1a.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slots 3, 4, and 8, 9 for 15 kHz SCS, on slots 8, 9, and 18, 19 for 30 kHz SCS.
2. Set Uplink RB allocation as 24@0 as defined in Table 6.4.2.1a.4.1-1. 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  $-\text{MU}$  to  $-(\text{MU} + \text{Uplink power control window size})$  dB of the target power level +11.5 dBm, where:
  - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 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 [2], 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.
3. Schedule the UE's PUSCH data transmission as described in Figure 6.4.2.1a.4.2-2 and Uplink RB allocation pattern as defined in Table 6.4.2.1a.4.1-1 while transmitting 0 dB TPC command for PUSCH via the PDCCH.
4. Measure the  $EVM_{\text{before}}$  and  $EVM_{\text{after}}$  using Global In-Channel Tx-Test (Annex E) applying  $tp_{\text{start}}$  of Table 6.4.2.1a.3-1 according to the declared enhanced transient capability.
5. Repeat test steps 3~4 with UL RMC according to Table 6.4.2.1a.4.1-1 until the SS collect enough  $EVM_{\text{before}}$  and  $EVM_{\text{after}}$ .

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.

#### 6.4.2.1a.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

#### 6.4.2.1a.5 Test requirement

The  $EVM_{\text{before}}$  and  $EVM_{\text{after}}$  derived in Table 6.4.2.1a.3-1 shall not exceed the values in Table 6.4.2.1a.5-1. Both rising and falling edges of transient occurring at the respective slot boundaries are considered to have the same EVM requirements.

**Table 6.4.2.1a.5-1: Test requirements for Error Vector Magnitude**

| Parameter                                    | Unit | Average EVM Level |
|----------------------------------------------|------|-------------------|
| 64 QAM                                       | %    | 10 + TT           |
| Note 1: TT is defined in Table 6.4.2.1a.5-2. |      |                   |

**Table 6.4.2.1a.5-2: Test Tolerance**

| Parameter | Unit | Average EVM Level |
|-----------|------|-------------------|
| 64 QAM    | %    | 0                 |

#### 6.4.2.2 Carrier leakage

##### 6.4.2.2.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency or centre frequency of aggregated transmission bandwidth configuration. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal.

The purpose of this test is to exercise the UE transmitter to verify its modulation quality in terms of carrier leakage.

#### 6.4.2.2.2 Test applicability

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

#### 6.4.2.2.3 Minimum conformance requirements

Carrier leakage is an additive sinusoid waveform whose frequency is the same as the modulated waveform carrier frequency. The measurement interval is one slot in the time domain.

In the case that uplink sharing, the carrier leakage may have 7.5 kHz shift with the carrier frequency.

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.3-1.

**Table 6.4.2.2.3-1: Requirements for Carrier Leakage**

| Parameter                        | Relative Limit (dBc) |
|----------------------------------|----------------------|
| Output power > 10 dBm            | -28                  |
| 0 dBm ≤ Output power ≤ 10 dBm    | -25                  |
| -30 dBm ≤ Output power < 0 dBm   | -20                  |
| -40 dBm ≤ Output power < -30 dBm | -10                  |

The normative reference for this requirement is TS 38.101-1 [5] clause 6.4.2.2, as indicated in TS 38.101-5 [11] clause 6.4.2.

#### 6.4.2.2.4 Test description

##### 6.4.2.2.4.1 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 6.4.2.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

**Table 6.4.2.2.4.1-1: Test Configuration**

| 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                                                                     |                        | Mid                              |                           |
| 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, 3) |
| 1                                                                                                                                            |                        | DFT-s-OFDM QPSK                  | Inner_1RB_Left            |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.                                                          |                        |                                  |                           |
| NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. |                        |                                  |                           |
| NOTE 3: When the reported DC carrier position is at Inner_1RB_Left, use Inner_1RB_Right for UL RB allocation.                                |                        |                                  |                           |

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 section 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 channels are set according to Table 6.4.2.2.4.1-1.
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 38.508-1 [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 6.4.2.2.4.3.
10. In case the parameter 3300 or 3301 is reported from the UE via *txDirectCurrentLocation* IE, do not proceed to test procedure and mark the test not applicable with reasoning in the test report.

#### 6.4.2.2.4.2 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 6.4.2.2.4.1-1. 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 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 10 dBm, where:
  - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency  $f$  and the channel bandwidth BW.
  - Uplink power control window size = 1dB (UE power step size) + 0.7 dB (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.
3. Measure carrier leakage using Global In-Channel Tx-Test (Annex E).
4. 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 0 dBm, where MU and Uplink power control window size are defined above.
5. Measure carrier leakage using Global In-Channel Tx-Test (Annex E).
6. 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 -30 dBm, where MU and Uplink power control window size are defined above.
7. Measure carrier leakage using Global In-Channel Tx-Test (Annex E).
8. 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  $P_{min}$ , where MU and Uplink power control window size are defined above,  $P_{min}$  is the minimum output power according to Table 6.3.1.3-1.

9. Measure carrier leakage using Global In-Channel Tx-Test (Annex E).

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less 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.4.2.

6.4.2.2.4.3 Message contents

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

Table 6.4.2.2.4.3-1: *PUSCH-Config*

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

Table 6.4.2.2.4.3-2: *CellGroupConfig*

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-19 |              |         |           |
|---------------------------------------------------|--------------|---------|-----------|
| Information Element                               | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE {                    |              |         |           |
| reportUplinkTxDirectCurrent                       | true         |         |           |
| }                                                 |              |         |           |

6.4.2.2.5 Test requirement

In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE, carrier leakage measurement requirement shall be waived. Otherwise, each of the  $n$  carrier leakage results, derived in Annex E.3.1, shall not exceed the values in table 6.4.2.2.5-1. Allocated RBs are not under test.

**Table 6.4.2.2.5-1: Test requirements for Relative Carrier Leakage Power**

| Parameters<br>UE output power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Relative limit<br>(dBc) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 10 + MU to 10 + (MU + Uplink power control window size) dBm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -28 + TT                |
| 0 + MU to 0 + (MU + Uplink power control window size) dBm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | -25 + TT                |
| -30 + MU to -30 + (MU + Uplink power control window size) dBm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -20 + TT                |
| Pmin + MU to Pmin + (MU + Uplink power control window size) dBm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | -10 + TT                |
| <p>NOTE 1: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.</p> <p>NOTE 2: The applicable frequencies for this limit depend on the parameter <i>txDirectCurrentLocation</i> in <i>UplinkTxDirectCurrent</i> IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB.</p> <p>NOTE 3: <math>N_{RB}</math> is the Transmission Bandwidth Configuration (see Section 5.3).</p> <p>NOTE 4: MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency <math>f</math> and the channel bandwidth BW.</p> <p>NOTE 5: 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.</p> <p>NOTE 6: Test tolerance TT = 0.8 dB.</p> <p>NOTE 7: Pmin is the minimum output power according to Table 6.3.1.3-1.</p> |                         |

### 6.4.2.3 In-band emissions

#### 6.4.2.3.1 Test purpose

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks.

The in-band emission is defined as the average emission across 12 sub-carriers and as a function of the RB offset from the edge of the allocated UL transmission bandwidth. The in-band emission is measured as the ratio of the UE output power in a non-allocated RB to the UE output power in an allocated RB.

The basic in-band emissions measurement interval is defined over one slot in the time domain; however, the minimum requirement applies when the in-band emission measurement is averaged over 10 sub-frames. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one or more symbols, accordingly.

The purpose of this test is to exercise the UE transmitter to verify its modulation quality in terms of in-band emissions.

#### 6.4.2.3.2 Test applicability

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

## 6.4.2.3.3 Minimum conformance requirements

The average of the basic in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.3-1.

**Table 6.4.2.3.3-1: Requirements for in-band emissions**

| Parameter description                                                                                                                                                                                                                                                                                                                            | Unit | Limit (NOTE 1)                                                                                                                                                                                                                        |                                              | Applicable Frequencies                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------|
| General                                                                                                                                                                                                                                                                                                                                          | dB   | $\max \left\{ -25 - 10 \cdot \log_{10} (N_{RB} / L_{CRB}), \right.$ $20 \cdot \log_{10} EVM - 3 - 5 \cdot ( \Delta_{RB}  - 1) / L_{CRB},$ $\left. -57 \text{ dBm} + 10 \log_{10} (SCS / 15 \text{ kHz}) - \overline{P_{RB}} \right\}$ |                                              | Any non-allocated (NOTE 2)             |
| IQ Image                                                                                                                                                                                                                                                                                                                                         | dB   | -28                                                                                                                                                                                                                                   | Image frequencies when output power > 10 dBm | Image frequencies (NOTES 2, 3)         |
|                                                                                                                                                                                                                                                                                                                                                  |      | -25                                                                                                                                                                                                                                   | Image frequencies when output power ≤ 10 dBm |                                        |
| Carrier leakage                                                                                                                                                                                                                                                                                                                                  | dBc  | -28                                                                                                                                                                                                                                   | Output power > 10 dBm                        | Carrier leakage frequency (NOTES 4, 5) |
|                                                                                                                                                                                                                                                                                                                                                  |      | -25                                                                                                                                                                                                                                   | 0 dBm ≤ Output power ≤ 10 dBm                |                                        |
|                                                                                                                                                                                                                                                                                                                                                  |      | -20                                                                                                                                                                                                                                   | -30 dBm ≤ Output power < 0 dBm               |                                        |
|                                                                                                                                                                                                                                                                                                                                                  |      | -10                                                                                                                                                                                                                                   | -40 dBm ≤ Output power < -30 dBm             |                                        |
| NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of $P_{RB} - 30$ dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. $P_{RB}$ is defined in NOTE 10.                                            |      |                                                                                                                                                                                                                                       |                                              |                                        |
| NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.                                                                                                                  |      |                                                                                                                                                                                                                                       |                                              |                                        |
| NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier leakage frequency, but excluding any allocated RBs.                                                                                                                    |      |                                                                                                                                                                                                                                       |                                              |                                        |
| NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.                                                                                                                                                                      |      |                                                                                                                                                                                                                                       |                                              |                                        |
| NOTE 5: The applicable frequencies for this limit depend on the parameter <i>txDirectCurrentLocation</i> in <i>UplinkTxDirectCurrent</i> IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency but excluding any allocated RB. |      |                                                                                                                                                                                                                                       |                                              |                                        |
| NOTE 6: $L_{CRB}$ is the Transmission Bandwidth (see Section 5.3).                                                                                                                                                                                                                                                                               |      |                                                                                                                                                                                                                                       |                                              |                                        |
| NOTE 7: $N_{RB}$ is the Transmission Bandwidth Configuration (see Section 5.3).                                                                                                                                                                                                                                                                  |      |                                                                                                                                                                                                                                       |                                              |                                        |
| NOTE 8: $EVM$ is the limit specified in Table 6.4.2.1.3-1 for the modulation format used in the allocated RBs.                                                                                                                                                                                                                                   |      |                                                                                                                                                                                                                                       |                                              |                                        |
| NOTE 9: $\Delta_{RB}$ is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB} = 1$ or $\Delta_{RB} = -1$ for the first adjacent RB outside of the allocated bandwidth).                                                                                                                   |      |                                                                                                                                                                                                                                       |                                              |                                        |
| NOTE 10: $\overline{P_{RB}}$ is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.                                                                                                                                                                                               |      |                                                                                                                                                                                                                                       |                                              |                                        |

The normative reference for this requirement is TS 38.101-1 [5] clause 6.4.2.3, as indicated in TS 38.101-5 [11] clause 6.4.2.

## 6.4.2.3.4 Test description

## 6.4.2.3.4.1 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 6.4.2.3.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

**Table 6.4.2.3.4.1-1: Test Configuration Table for PUSCH**

| 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                                                                                                                                            |                        | DFT-s-OFDM QPSK                  | Inner_1RB_Left         |
| 2                                                                                                                                            |                        | DFT-s-OFDM QPSK                  | Inner_1RB_Right        |
| 3                                                                                                                                            |                        | CP-OFDM QPSK                     | Inner_1RB_Left         |
| 4                                                                                                                                            |                        | CP-OFDM QPSK                     | Inner_1RB_Right        |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.                                                          |                        |                                  |                        |
| NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. |                        |                                  |                        |
| NOTE 3: Void.                                                                                                                                |                        |                                  |                        |

**Table 6.4.2.3.4.1-2: Test Configuration Table for PUCCH**

| Initial Conditions                                                                                                                                                                                                                                                                                                                                                                               |                        |                  |                         |                                                                 |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------|-------------------------|-----------------------------------------------------------------|------------|
| Test Environment as specified in TS 38.508-1 [12] subclause 4.1                                                                                                                                                                                                                                                                                                                                  |                        |                  | See Table 6.4.2.3.4.1-1 |                                                                 |            |
| Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1                                                                                                                                                                                                                                                                                                                                |                        |                  | See Table 6.4.2.3.4.1-1 |                                                                 |            |
| Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1                                                                                                                                                                                                                                                                                                                         |                        |                  | See Table 6.4.2.3.4.1-1 |                                                                 |            |
| Test SCS as specified in Table 5.3.5-1                                                                                                                                                                                                                                                                                                                                                           |                        |                  | See Table 6.4.2.3.4.1-1 |                                                                 |            |
| Test Parameters                                                                                                                                                                                                                                                                                                                                                                                  |                        |                  |                         |                                                                 |            |
| ID                                                                                                                                                                                                                                                                                                                                                                                               | Downlink Configuration |                  | Uplink Configuration    |                                                                 |            |
|                                                                                                                                                                                                                                                                                                                                                                                                  | Modulation             | RB allocation    | Waveform                | PUCCH format                                                    | RB index   |
| 1                                                                                                                                                                                                                                                                                                                                                                                                | CP-OFDM QPSK           | Full RB (Note 1) | DFT-s-OFDM              | PUCCH format = Format 3 (Note 4)<br>Length in OFDM symbols = 14 | 0          |
| 2                                                                                                                                                                                                                                                                                                                                                                                                | CP-OFDM QPSK           | Full RB (Note 1) | DFT-s-OFDM              | PUCCH format = Format 3 (Note 4)<br>Length in OFDM symbols = 14 | $N_{RB}-1$ |
| 3                                                                                                                                                                                                                                                                                                                                                                                                | CP-OFDM QPSK           | Full RB (Note 1) | CP-OFDM                 | PUCCH format = Format 1<br>Length in OFDM symbols = 14          | 0          |
| 4                                                                                                                                                                                                                                                                                                                                                                                                | CP-OFDM QPSK           | Full RB (Note 1) | CP-OFDM                 | PUCCH format = Format 1<br>Length in OFDM symbols = 14          | $N_{RB}-1$ |
| 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: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1.                                                                                                                                                                                                                                                     |                        |                  |                         |                                                                 |            |
| NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.                                                                                                                                                                                                                                                                                                       |                        |                  |                         |                                                                 |            |
| NOTE 4: For FDD, set K1 value (PDSCH-to-HARQ-timing-indicator) as follows:<br>K1 = 2 if mod(i,5) = 0<br>K1 = 2 if mod(i,5) = 1<br>K1 = 4 if mod(i,5) = 2<br>K1 = 3 if mod(i,5) = 3<br>K1 = 2 if mod(i,5) = 4<br>where i is slot index per frame<br>PDSCH shall not be transmitted in slots where Number of Code Blocks per Slot is N/A in Table A.3.4.1.1-1 for NGSO, Table A.3.4.1.1-3 for GSO. |                        |                  |                         |                                                                 |            |

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 section 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 channels are set according to Table 6.4.2.3.4.1-1.
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 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 38.508-1 [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 6.4.2.3.4.3

#### 6.4.2.3.4.2 Test procedure

Test procedure for PUSCH:

- 1.1. 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 6.4.2.3.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
- 1.2. 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 10 dBm, where:
  - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 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.
- 1.3. Measure In-band emission using Global In-Channel Tx-Test (Annex E).
- 1.4. 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 0 dBm, where MU and Uplink power control window size are defined above.
- 1.5. Measure In-band emission using Global In-Channel Tx-Test (Annex E).
- 1.6. 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 -30 dBm, where MU and Uplink power control window size are defined above.
- 1.7. Measure In-band emission using Global In-Channel Tx-Test (Annex E).
- 1.8. 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  $P_{min}$ , where MU and Uplink power control window size are defined above and  $P_{min}$  is the minimum output power according to Table 6.3.1.3-1.
- 1.9. Measure In-band emission using Global In-Channel Tx-Test (Annex E).

NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.3.4.1-1, 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.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less 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.4.2.

Test procedure for PUCCH:

- 2.1. PUCCH is set according to Table 6.4.2.3.4.1-2. SS transmits PDSCH via PDCCH DCI format 1-1 for C\_RNTI to transmit the DL RMC according to Table 6.4.2.3.4.1-2. The SS sends downlink MAC padding bits on the DL RMC. The transmission of PDSCH will make the UE send uplink ACK/NACK using PUCCH.
- 2.2. Send uplink power control commands for PUCCH 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 10 dBm, where:
  - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.2-1 for the carrier frequency  $f$  and the channel bandwidth BW.
  - Uplink power control window size = 1dB (UE power step size) + 2.0 dB (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.
- 2.3. Measure In-band emission using Global In-Channel Tx-Test (Annex E)
- 2.4. Send uplink power control commands for PUCCH 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 0 dBm, where MU and Uplink power control window size are defined above.
- 2.5. Measure In-band emission using Global In-Channel Tx-Test (Annex E)
- 2.6. Send uplink power control commands for PUCCH 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 -30 dBm, where MU and Uplink power control window size are defined above.
- 2.7. Measure In-band emission using Global In-Channel Tx-Test (Annex E)
- 2.8. Send uplink power control commands for PUCCH 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  $P_{min}$ , where MU and Uplink power control window size are defined above and  $P_{min}$  is the minimum output power according to Table 6.3.1.3-1.
- 2.9. Measure In-band emission using Global In-Channel Tx-Test (Annex E)

NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.3.4.1-2, 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.

NOTE2: The purpose of the Uplink power control window is to ensure that the actual UE output power is no less 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.4.2.

#### 6.4.2.3.4.3 Message contents

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

**Table 6.4.2.3.4.3-1: PDSCH-ServingCellConfig: PUCCH format3 measurement**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-102 |              |         |           |
|----------------------------------------------------|--------------|---------|-----------|
| Information Element                                | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE {             |              |         |           |
| codeBlockGroupTransmission                         | Not present  |         |           |
| xOverhead                                          | Not present  |         |           |
| nrofHARQ-ProcessesForPDSCH                         | n16          |         | FDD       |
| pucch-Cell                                         | Not present  |         |           |
| maxMIMO-Layers                                     | Not present  |         |           |
| processingType2Enabled                             | Not present  |         |           |
| pdsch-CodeBlockGroupTransmissionList-r16           | Not present  |         |           |
| }                                                  |              |         |           |

#### 6.4.2.3.5 Test requirement

The averaged In-band emission result, derived in Annex E.4.3 shall not exceed the corresponding values in Tables 6.4.2.3.5-1.

**Table 6.4.2.3.5-1: Test requirements for in-band emissions**

| Parameter description                                                                                                                                                                                                                                                                                                                             | Unit | Limit (NOTE 1)                                                                                                                                                                                                                             |                                              | Applicable Frequencies                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------|
| General (NOTE 12)                                                                                                                                                                                                                                                                                                                                 | dB   | $\max \left\{ -25 - 10 \cdot \log_{10} (N_{RB} / L_{CRB}), \right. \\ 20 \cdot \log_{10} EVM - 3 - 5 \cdot ( \Delta_{RB}  - 1) / L_{CRB}, \\ \left. -57 \text{ dBm} + 10 \log_{10} (SCS / 15\text{kHz}) - \overline{P_{RB}} \right\} + TT$ |                                              | Any non-allocated (NOTE 2)             |
| IQ Image (NOTE 12)                                                                                                                                                                                                                                                                                                                                | dB   | -28 + TT                                                                                                                                                                                                                                   | Image frequencies when output power > 10 dBm | Image frequencies (NOTES 2, 3)         |
|                                                                                                                                                                                                                                                                                                                                                   |      | -25 + TT                                                                                                                                                                                                                                   | Image frequencies when output power ≤ 10 dBm |                                        |
| Carrier leakage (NOTE 12)                                                                                                                                                                                                                                                                                                                         | dBc  | -28 + TT                                                                                                                                                                                                                                   | Output power > 10 dBm                        | Carrier leakage frequency (NOTES 4, 5) |
|                                                                                                                                                                                                                                                                                                                                                   |      | -25 + TT                                                                                                                                                                                                                                   | 0 dBm ≤ Output power ≤ 10 dBm                |                                        |
|                                                                                                                                                                                                                                                                                                                                                   |      | -20 + TT                                                                                                                                                                                                                                   | -30 dBm ≤ Output power < 0 dBm               |                                        |
|                                                                                                                                                                                                                                                                                                                                                   |      | -10 + TT                                                                                                                                                                                                                                   | -40 dBm ≤ Output power < -30 dBm             |                                        |
| NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of $P_{RB} - 30$ dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. $P_{RB}$ is defined in NOTE 10.                                             |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.                                                                                                                   |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the carrier leakage frequency, but excluding any allocated RBs.                                                                                                                     |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.                                                                                                                                                                       |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 5: The applicable frequencies for this limit depend on the parameter <i>txDirectCurrentLocation</i> in <i>UplinkTxDirectCurrent</i> IE, and are those that are enclosed either in the RBs containing the carrier leakage frequency, or in the two RBs immediately adjacent to the carrier leakage frequency, but excluding any allocated RB. |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 6: $L_{CRB}$ is the Transmission Bandwidth (see Section 5.3).                                                                                                                                                                                                                                                                                |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 7: $N_{RB}$ is the Transmission Bandwidth Configuration (see Section 5.3).                                                                                                                                                                                                                                                                   |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 8: $EVM$ is the limit specified in Table 6.4.2.1.3-1 for the modulation format used in the allocated RBs.                                                                                                                                                                                                                                    |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 9: $\Delta_{RB}$ is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB} = 1$ or $\Delta_{RB} = -1$ for the first adjacent RB outside of the allocated bandwidth).                                                                                                                    |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 10: $\overline{P_{RB}}$ is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.                                                                                                                                                                                                |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 11: Test tolerance TT = 0.8 dB.                                                                                                                                                                                                                                                                                                              |      |                                                                                                                                                                                                                                            |                                              |                                        |
| NOTE 12: In case the parameter 3300 or 3301 is reported from UE via <i>txDirectCurrentLocation</i> IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies.                                                                                                                               |      |                                                                                                                                                                                                                                            |                                              |                                        |

## 6.4.2.4 EVM equalizer spectrum flatness

### 6.4.2.4.1 Test purpose

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex E) must meet a spectral flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the allocated uplink block, at which the equalizer coefficients are generated by the EVM measurement process. The basic measurement interval is the same as for EVM.

The EVM equalizer spectrum flatness requirement does not limit the correction applied to the signal in the EVM measurement process but for the EVM result to be valid, the equalizer correction that was applied must meet the EVM equalizer spectrum flatness minimum requirements.

### 6.4.2.4.2 Test applicability

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

### 6.4.2.4.3 Minimum conformance requirements

The peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.4.2.4.3-1 for normal conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 5 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 7 dB (see Figure 6.4.2.4.3-1).

The EVM equalizer spectral flatness shall not exceed the values specified in Table 6.4.2.4.3-2 for extreme conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 10 dB (see Figure 6.4.2.4.3-1).

**Table 6.4.2.4.3-1: Requirements for EVM equalizer spectrum flatness (normal conditions)**

| Frequency range                                                                                                   | Maximum ripple (dB) |
|-------------------------------------------------------------------------------------------------------------------|---------------------|
| $F_{UL\_Meas} - F_{UL\_Low} \geq 3 \text{ MHz}$ and $F_{UL\_High} - F_{UL\_Meas} \geq 3 \text{ MHz}$<br>(Range 1) | 4 (p-p)             |
| $F_{UL\_Meas} - F_{UL\_Low} < 3 \text{ MHz}$ or $F_{UL\_High} - F_{UL\_Meas} < 3 \text{ MHz}$<br>(Range 2)        | 8 (p-p)             |
| NOTE 1: $F_{UL\_Meas}$ refers to the sub-carrier frequency for which the equalizer coefficient is evaluated       |                     |
| NOTE 2: $F_{UL\_Low}$ and $F_{UL\_High}$ refer to each E-UTRA frequency band specified in Table 5.5-1             |                     |

**Table 6.4.2.4.3-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)**

| Frequency range                                                                                                   | Maximum Ripple (dB) |
|-------------------------------------------------------------------------------------------------------------------|---------------------|
| $F_{UL\_Meas} - F_{UL\_Low} \geq 5 \text{ MHz}$ and $F_{UL\_High} - F_{UL\_Meas} \geq 5 \text{ MHz}$<br>(Range 1) | 4 (p-p)             |
| $F_{UL\_Meas} - F_{UL\_Low} < 5 \text{ MHz}$ or $F_{UL\_High} - F_{UL\_Meas} < 5 \text{ MHz}$<br>(Range 2)        | 12 (p-p)            |
| NOTE 1: $F_{UL\_Meas}$ refers to the sub-carrier frequency for which the equalizer coefficient is evaluated       |                     |
| NOTE 2: $F_{UL\_Low}$ and $F_{UL\_High}$ refer to each E-UTRA frequency band specified in Table 5.5-1             |                     |

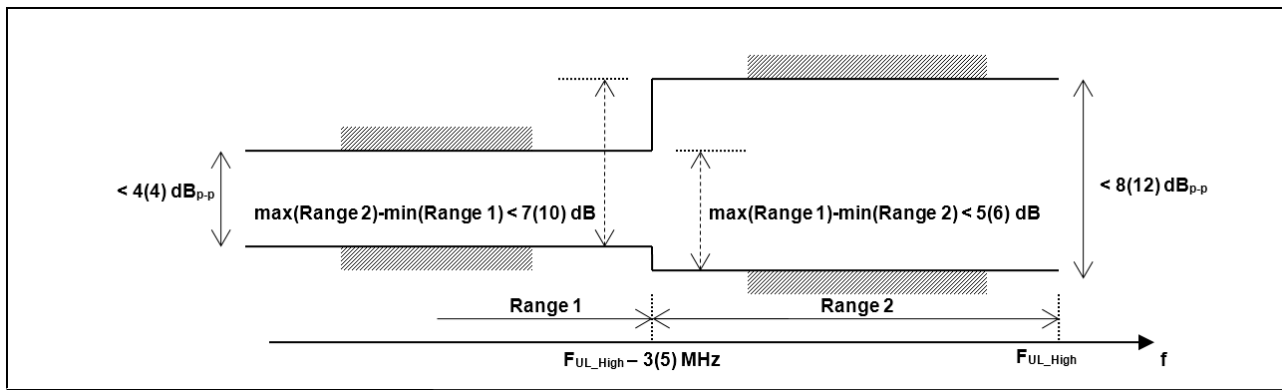


**Figure 6.4.2.4.3-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated (the ETC minimum requirement are within brackets)**

The normative reference for this requirement is TS 38.101-1 [5] clause 6.4.2.4, as indicated in TS 38.101-5 [11] clause 6.4.2.

#### 6.4.2.4.4 Test description

##### 6.4.2.4.4.1 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 channel bandwidth and sub-carrier spacing, are shown in table 6.4.2.4.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

**Table 6.4.2.4.4.1-1: Test Configuration**

| 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                             |                        |
| Test Parameters                                                                                                                              |                        |                                    |                        |
| Test ID                                                                                                                                      | Downlink Configuration | Uplink Configuration               |                        |
|                                                                                                                                              | N/A                    | Modulation                         | RB allocation (NOTE 1) |
| 1                                                                                                                                            |                        | DFT-s-OFDM QPSK                    | Outer Full             |
| 2                                                                                                                                            |                        | CP-OFDM QPSK                       | Outer Full             |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.                                                          |                        |                                    |                        |
| NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. |                        |                                    |                        |

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, in Figure A.3.1.1.1 for TE diagram and section 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 channels are set according to Table 6.4.2.4.4.1-1.

5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 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 38.508-1 [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 6.4.2.4.4.3.

#### 6.4.2.4.4.2 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 6.4.2.4.4.1-1. 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 the uplink scheduling information to the UE until the UE transmits at  $P_{UMAX}$  level. Allow at least 200ms starting from the first TPC command in this step for the UE to reach  $P_{UMAX}$  level.
3. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E).

NOTE1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.4.2.1.4.1-1, 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.

#### 6.4.2.4.4.3 Message contents

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

#### 6.4.2.4.5 Test requirement

Each of the  $n$  spectrum flatness functions, shall derive four ripple results in Annex E.4.4.1. The derived results shall not exceed the values in Figure 6.4.2.4.5-1:

For normal conditions, the maximum ripple in Range 1 and Range 2 shall not exceed the values specified in Table 6.4.2.4.5-1 and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 8.4 dB (see Figure 6.4.2.4.5-1).

For normal conditions, the peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.4.2.4.5-1. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 8.4 dB (see Figure 6.4.2.4.5-1).

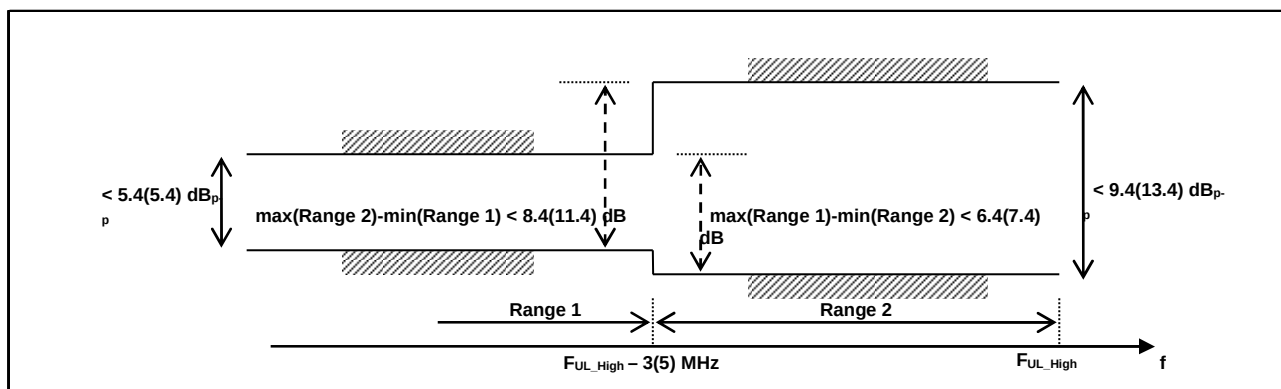
For extreme conditions, the EVM equalizer spectral flatness shall not exceed the values specified in Table 6.4.2.4.5-2. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 7.4 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 11.4 dB (see Figure 6.4.2.4.5-1).

**Table 6.4.2.4.5-1: Requirements for EVM equalizer spectrum flatness (normal conditions)**

| Frequency range                                                                                                   | Maximum ripple [dB] |
|-------------------------------------------------------------------------------------------------------------------|---------------------|
| $F_{UL\_Meas} - F_{UL\_Low} \geq 3 \text{ MHz}$ and $F_{UL\_High} - F_{UL\_Meas} \geq 3 \text{ MHz}$<br>(Range 1) | $4 + TT$ (p-p)      |
| $F_{UL\_Meas} - F_{UL\_Low} < 3 \text{ MHz}$ or $F_{UL\_High} - F_{UL\_Meas} < 3 \text{ MHz}$<br>(Range 2)        | $8 + TT$ (p-p)      |
| NOTE 1: $F_{UL\_Meas}$ refers to the sub-carrier frequency for which the equalizer coefficient is evaluated       |                     |
| NOTE 2: $F_{UL\_Low}$ and $F_{UL\_High}$ refer to each E-UTRA frequency band specified in Table 5.5-1             |                     |
| NOTE 3: Test tolerance $TT = 1.4 \text{ dB}$ .                                                                    |                     |

**Table 6.4.2.4.5-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)**

| Frequency range                                                                                                   | Maximum Ripple [dB] |
|-------------------------------------------------------------------------------------------------------------------|---------------------|
| $F_{UL\_Meas} - F_{UL\_Low} \geq 5 \text{ MHz}$ and $F_{UL\_High} - F_{UL\_Meas} \geq 5 \text{ MHz}$<br>(Range 1) | $4 + TT$ (p-p)      |
| $F_{UL\_Meas} - F_{UL\_Low} < 5 \text{ MHz}$ or $F_{UL\_High} - F_{UL\_Meas} < 5 \text{ MHz}$<br>(Range 2)        | $12 + TT$ (p-p)     |
| NOTE 1: $F_{UL\_Meas}$ refers to the sub-carrier frequency for which the equalizer coefficient is evaluated       |                     |
| NOTE 2: $F_{UL\_Low}$ and $F_{UL\_High}$ refer to each E-UTRA frequency band specified in Table 5.5-1             |                     |
| NOTE 3: Test tolerance $TT = 1.4 \text{ dB}$ .                                                                    |                     |

**Figure 6.4.2.4.5-1: The test requirements for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated for unshaped modulations (the ETC test requirements are within brackets)**

## 6.4.2.5 EVM equalizer spectrum flatness for Pi/2 BPSK

### 6.4.2.5.1 Test purpose

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex E) must meet a spectral flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the allocated uplink block, at which the equalizer coefficients are generated by the EVM measurement process. The basic measurement interval is the same as for EVM.

### 6.4.2.5.2 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 UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*.

### 6.4.2.5.3 Minimum conformance requirements

These requirements apply if the IE *dmrs-UplinkTransformPrecoding-r16* is configured and UE indicates support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*. Otherwise the requirements for EVM equalizer spectrum flatness defined in clause 6.4.2.4.3 apply.

The EVM equalizer coefficients across the allocated uplink block shall be modified to fit inside the mask specified in Table 6.4.2.5.3-1 for normal conditions, prior to the calculation of EVM. The limiting mask shall be placed to minimize the change in equalizer coefficients in a sum of squares sense.

**Table 6.4.2.5.3-1: Mask for EVM equalizer coefficients for Pi/2 BPSK, normal conditions**

| Frequency range                                                                                             | Parameter | Maximum ripple (dB) |
|-------------------------------------------------------------------------------------------------------------|-----------|---------------------|
| $ F_{UL\_Meas} - F_{center}  \leq X$ MHz<br>(Range 1)                                                       | X1        | 6 (p-p)             |
| $ F_{UL\_Meas} - F_{center}  > X$ MHz<br>(Range 2)                                                          | X2        | 14 (p-p)            |
| NOTE 1: $F_{UL\_Meas}$ refers to the sub-carrier frequency for which the equalizer coefficient is evaluated |           |                     |
| NOTE 2: $F_{center}$ refers to the center frequency of an allocated block of PRBs                           |           |                     |
| NOTE 3: X, in MHz, is equal to 25% of the bandwidth of the PRB allocation                                   |           |                     |
| NOTE 4: See Figure 6.4.2.5.3-1 for description of X1, X2                                                    |           |                     |

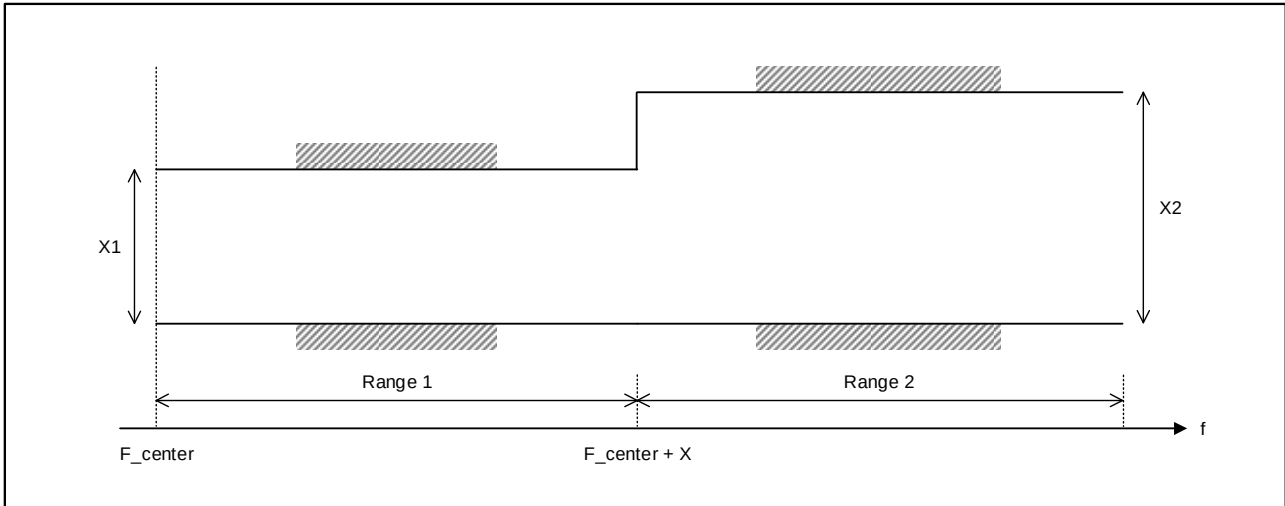


**Figure 6.4.2.5.3-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation.  $F_{center}$  denotes the center frequency of the allocated block of PRBs. X, in MHz, is equal to 25 % of the bandwidth of the PRB allocation.**

For pi/2 BPSK modulation the UE shall be allowed to employ spectral shaping and the shaping filter shall be restricted so that the impulse response of the shaping filter itself shall meet

$$|\tilde{a}_t(t,0)| \geq |\tilde{a}_t(t,\tau)| \quad \forall \tau \neq 0$$

$$20\log_{10} |\tilde{a}_t(t,\tau)| < -15 \text{ dB} \quad 1 < \tau < M - 1,$$

where,  $|\tilde{a}_t(t,\tau)| = \text{IDFT}\{|\tilde{a}_t(t,f)| e^{j\varphi(t,f)}\}$ ,  $f$  is the frequency of the  $M$  allocated subcarriers,  $\tilde{a}_t(t,f)$  and  $\varphi(t,f)$  are the amplitude and phase response.

0dB reference is defined as  $20\log_{10} |\tilde{a}_t(t,0)|$ .

The normative reference for this requirement is TS 38.101-1 [5] clause 6.4.2.4.1, as indicated in TS 38.101-5 [11] clause 6.4.2.

## 6.4.2.5.4 Test description

## 6.4.2.5.4.1 Initial condition

Same initial conditions as in clause 6.4.2.4.4.1 with following exceptions:

- Instead of Table 6.4.2.4.4.1-1 → use Table 6.4.2.5.4.1-1

**Table 6.4.2.5.4.1-1: Test Configuration**

| 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                                                                                                                                            |                        | 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: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. |                        |                                       |                        |

## 6.4.2.5.4.2 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 6.4.2.5.4.1-1. 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 the uplink scheduling information to the UE until the UE transmits at  $P_{\text{UMAX}}$  level. Allow at least 200ms starting from the first TPC command in this step for the UE to reach  $P_{\text{UMAX}}$  level.
3. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

## 6.4.2.5.4.3 Message contents

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

**Table 6.4.2.5.4.3-1: DMRS-UplinkConfig**

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

#### 6.4.2.5.5 Test requirement

Each of the  $n$  spectrum flatness functions, shall derive four ripple results in Annex E.4.4.1 The derived results shall not exceed the values in Figure 6.4.2.5.5-1:

**Table 6.4.2.5.5-1: Mask for EVM equalizer coefficients for Pi/2 BPSK, normal conditions**

| Frequency range                                                                                                                                                                                                                                                                                                                                                                       | Parameter | Maximum ripple (dB) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------|
| $ F_{UL\_Meas} - F_{center}  \leq X$ MHz<br>(Range 1)                                                                                                                                                                                                                                                                                                                                 | X1        | $6 + TT$ (p-p)      |
| $ F_{UL\_Meas} - F_{center}  > X$ MHz<br>(Range 2)                                                                                                                                                                                                                                                                                                                                    | X2        | $14 + TT$ (p-p)     |
| NOTE 1: $F_{UL\_Meas}$ refers to the sub-carrier frequency for which the equalizer coefficient is evaluated<br>NOTE 2: $F_{center}$ refers to the center frequency of an allocated block of PRBs<br>NOTE 3: $X$ , in MHz, is equal to 25% of the bandwidth of the PRB allocation<br>NOTE 4: See Figure 6.4.2.5.5-1 for description of X1, X2<br>NOTE 5: Test tolerance $TT = 1.4$ dB. |           |                     |

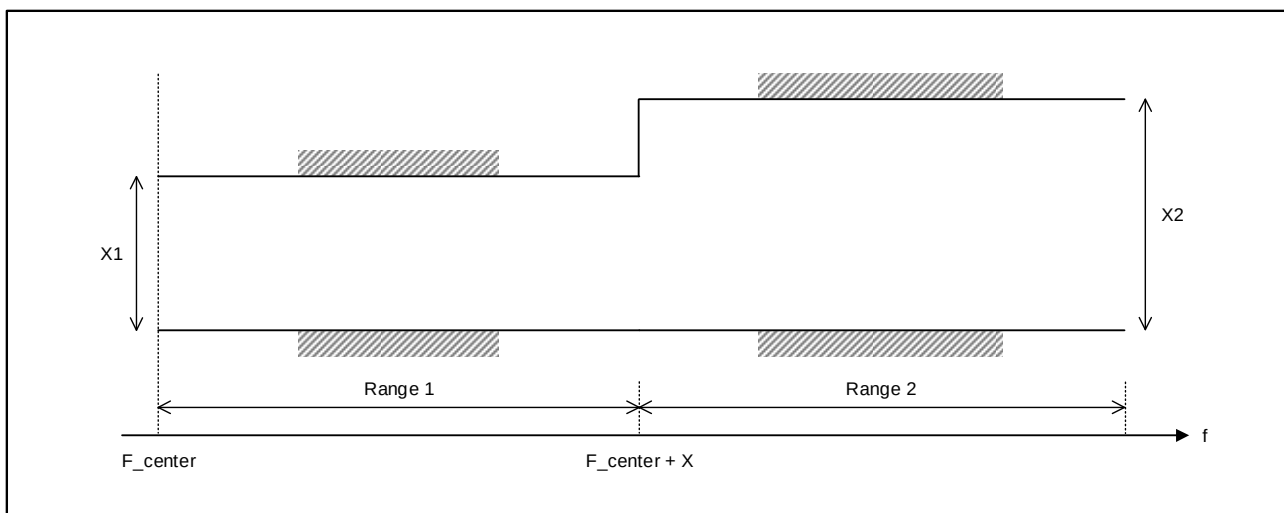


**Figure 6.4.2.5.5-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation.  $F_{center}$  denotes the center frequency of the allocated block of PRBs.  $X$ , in MHz, is equal to 25 % of the bandwidth of the PRB allocation.**

Each of the  $n$  spectrum flatness functions shall derive an impulse response of the spectral shaping filter in Annex E.4.4.2. The derived results shall fulfill:

$$|\tilde{a}(0)| \geq |\tilde{a}(\tau)| \quad \forall \tau \neq 0$$

$$20 \log_{10} |\tilde{a}(\tau)| < -15 \text{ dB} + TT \quad 1 < \tau < M - 1,$$

where  $TT = 1.4$  dB.

## 6.5 Output RF spectrum emissions

### 6.5.0 General

Unwanted emissions are divided into "Out-of-band emission" and "Spurious emissions" in 3GPP RF specifications. This notation is in line with ITU-R recommendations such as SM.329-10 and the Radio Regulations [15].

ITU defines:

Out-of-band emission = Emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process but excluding spurious emissions.

Spurious emission = Emission on a frequency, or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out-of-band emissions.

Unwanted emissions = Consist of spurious emissions and out-of-band emissions.

The UE transmitter spectrum emission consists of the three components: the occupied bandwidth (channel bandwidth), the Out Of Band (OOB) emissions and the far out spurious emission domain.

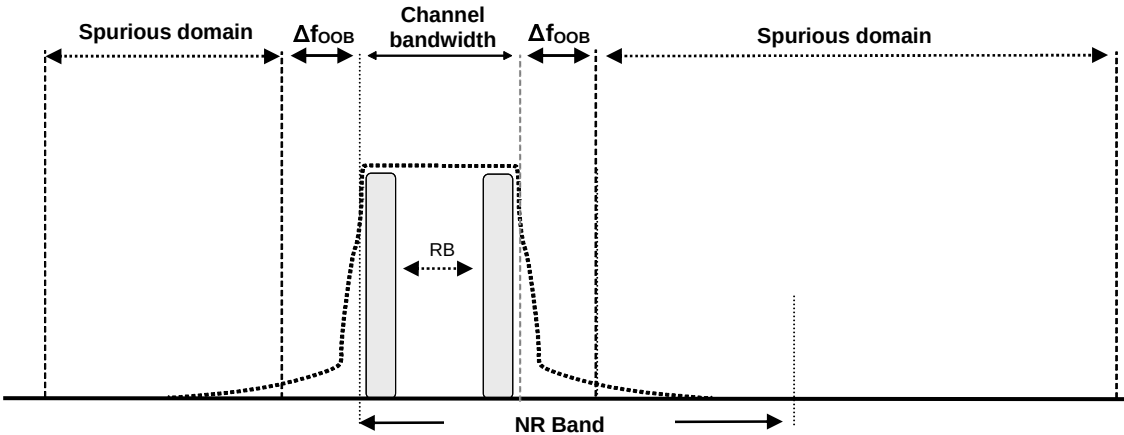


Figure 6.5.0-1: Transmitter RF spectrum

6.5.1 Occupied bandwidth

6.5.1.1 Test purpose

To verify that the UE occupied bandwidth for all transmission bandwidth configurations supported by the UE are less than their specific limits.

6.5.1.2 Test applicability

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

6.5.1.3 Minimum conformance requirements

Occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel. The occupied bandwidth for all transmission bandwidth configurations (Resources Blocks) shall be less than the channel bandwidth specified in Table 6.5.1.3-1.

Table 6.5.1.3-1: Occupied channel bandwidth

|                                  | NR NTN satellite channel bandwidth (MHz)   |
|----------------------------------|--------------------------------------------|
|                                  | 3, 5, 10, 15, 20                           |
| Occupied channel bandwidth (MHz) | Same as NR NTN satellite channel bandwidth |

The normative reference for this requirement is TS 38.101-5 [11] clause 6.5.1.

#### 6.5.1.4 Test description

##### 6.5.1.4.1 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 6.5.1.4.1-1. 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 6.5.1.4.1-1: 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                   |                                      | Mid range            |                        |
| Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1            |                                      | All                  |                        |
| Test SCS as specified in Table 5.3.5-1                                              |                                      | Lowest               |                        |
| Test Parameters                                                                     |                                      |                      |                        |
| Test ID                                                                             | Downlink Configuration               | Uplink Configuration |                        |
|                                                                                     | N/A for occupied bandwidth test case | Modulation           | RB allocation (NOTE 1) |
| 1                                                                                   |                                      | CP-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 section 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 channels are set according to Table 6.5.1.4.1-1.
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 38.508-1 [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 6.5.1.4.3.

##### 6.5.1.4.2 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 6.5.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously power control “up” commands to the UE until the UE transmits at PUMAX level. Allow at least 200ms for the UE to reach PUMAX level.

3. Measure the power spectrum distribution within two times or more range over the requirement for Occupied Bandwidth specification centring on the current carrier frequency. The characteristics of the filter shall be approximately Gaussian (typical spectrum analyser filter). Other methods to measure the power spectrum distribution are allowed. The measuring duration is at least 1ms over consecutive active uplink slots.
4. Calculate the total power within the range of all frequencies measured in step 3 and save this value as “Total power”.
5. Identify the measurement window whose centre is aligned on the centre of the channel for which the sum of the power measured is 99% of the “Total power”.
6. The “Occupied Bandwidth” is the width of the measurement window obtained in step 5.

#### 6.5.1.4.3 Message contents

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

#### 6.5.1.5 Test requirement

The measured Occupied Bandwidth shall not exceed values in Table 6.5.1.5-1.

**Table 6.5.1.5-1: Occupied channel bandwidth**

|                                  | NR NTN satellite channel bandwidth |       |        |        |        |
|----------------------------------|------------------------------------|-------|--------|--------|--------|
|                                  | 3 MHz                              | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| Occupied channel bandwidth (MHz) | 3                                  | 5     | 10     | 15     | 20     |

## 6.5.2 Out of band emission

### 6.5.2.1 General

The Out of band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission limit is specified in terms of a spectrum emission mask and an adjacent channel leakage power ratio.

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.

### 6.5.2.2 Spectrum emission mask

#### 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 ( $\Delta f_{\text{OoB}}$ ) starting from the  $\pm$  edge of the assigned NR channel bandwidth. For frequencies offset greater than  $\Delta f_{\text{OoB}}$ , 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**

| $\Delta f_{\text{OoB}}$<br>(MHz)                                    | Channel bandwidth (MHz) / Spectrum emission limit (dBm) |     |            | Measurement bandwidth |
|---------------------------------------------------------------------|---------------------------------------------------------|-----|------------|-----------------------|
|                                                                     | 3                                                       | 5   | 10, 15, 20 |                       |
| $\pm 0$ -1                                                          | -13                                                     | -13 | -13        | 1 % of channel BW     |
| $\pm 1$ -5                                                          | -10                                                     | -10 | -10        | 1 MHz                 |
| $\pm 5$ -6                                                          | -25                                                     | -13 |            |                       |
| $\pm 6$ -10                                                         |                                                         | -25 |            |                       |
| $\pm 5$ -BW <sub>Channel</sub>                                      |                                                         |     | -13        |                       |
| $\pm \text{BW}_{\text{Channel}} - (\text{BW}_{\text{Channel}} + 5)$ |                                                         |     | -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)**

|                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Same content as Table 6.2.2.4.1-1 with the exception that Test Environment is restricted to Normal and that test IDs with Inner Full allocation are skipped. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|

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 6.5.2.2.4.1-1.
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 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 6.5.2.2.4.3.

#### 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. 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. 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 27 – 29 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**

| $\Delta f_{\text{OoB}}$<br>(MHz)                                               | Channel bandwidth (MHz) / Spectrum emission limit (dBm) |        |            | Measurement bandwidth |
|--------------------------------------------------------------------------------|---------------------------------------------------------|--------|------------|-----------------------|
|                                                                                | 3                                                       | 5      | 10, 15, 20 |                       |
| $\pm 0-1$                                                                      | -13+TT                                                  | -13+TT | -13+TT     | 1 % of channel BW     |
| $\pm 1-5$                                                                      | -10+TT                                                  | -10+TT | -10+TT     | 1 MHz                 |
| $\pm 5-6$                                                                      | -25+TT                                                  | -13+TT |            |                       |
| $\pm 6-10$                                                                     |                                                         | -25+TT |            |                       |
| $\pm 5\text{-BW}_{\text{Channel}}$                                             |                                                         |        | -13+TT     |                       |
| $\pm \text{BW}_{\text{Channel}}\text{-}$<br>( $\text{BW}_{\text{Channel}}+5$ ) |                                                         |        | -25+TT     |                       |

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

|                                |                        |
|--------------------------------|------------------------|
|                                | $f \leq 3.0\text{GHz}$ |
| $\text{BW} \leq 100\text{MHz}$ | 1.5 dB                 |

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 Additional spectrum emission mask

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

- MU Analysis, test tolerances and any associated Annex F updates pending.
- Addition to applicability spec is pending

#### 6.5.2.3.1 Test purpose

To verify that the power of any UE emission shall not exceed specified level for the specified channel bandwidth under the deployment scenarios where additional requirements are specified.

#### 6.5.2.3.2 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.

#### 6.5.2.3.3 Minimum conformance requirements

##### 6.5.2.3.3.1 Requirements for network signalling value "NS\_04N" and "NS\_11N"

When "NS\_04N" or "NS\_11N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.2.3.3.1-1 for any channel bandwidth configured within 1610-1618.25MHz.

**Table 6.5.2.3.3.1-1: Additional requirements for "NS\_04N" and "NS\_11N"**

| $\Delta f_{\text{OoB}}$ (kHz)                                                                          | Spectrum emission limit (dBm) | Measurement bandwidth | Measurement method |
|--------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------|--------------------|
| $\pm 0\text{-}160$                                                                                     | -2                            | 30kHz                 | Average            |
| $\pm 160\text{-}2300$                                                                                  | -2 to -26                     |                       |                    |
| $\pm 2300\text{-}18500$                                                                                | -26                           |                       |                    |
| NOTE 1: Spectrum emissions are linearly interpolated in dBm versus frequency offset.                   |                               |                       |                    |
| NOTE 2: The EIRP requirement in regulation is converted to conducted requirement using a 0dBi antenna. |                               |                       |                    |

#### 6.5.2.3.3.2 Requirements for network signalling value "NS\_05N" and "NS\_12N"

When "NS\_05N" or "NS\_12N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.2.3.3.2-1 for any channel bandwidth configured within 1618.25-1626.5MHz.

**Table 6.5.2.3.3.2-1: Additional requirements for "NS\_05N" and "NS\_12N"**

| $\Delta f_{\text{OoB}}$ (kHz)                                                                          | Spectrum emission limit (dBm) | Measurement bandwidth | Measurement method |
|--------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------|--------------------|
| $\pm 0\text{-}160$                                                                                     | -5                            | 30kHz                 | Average            |
| $\pm 160\text{-}225$                                                                                   | -5 to -8.5                    |                       |                    |
| $\pm 225\text{-}650$                                                                                   | -8.5 to -15                   |                       |                    |
| $\pm 650\text{-}1365$                                                                                  | -15                           |                       |                    |
| $\pm 1365\text{-}1800$                                                                                 | -23 to -26                    |                       |                    |
| $\pm 1800\text{-}16500$                                                                                | -26                           |                       |                    |
| NOTE 1: Spectrum emissions are linearly interpolated in dBm versus frequency offset.                   |                               |                       |                    |
| NOTE 2: The EIRP requirement in regulation is converted to conducted requirement using a 0dBi antenna. |                               |                       |                    |

The normative reference for this requirement is TS 38.101-5 [11] clause 6.5.2.3.

#### 6.5.2.3.4 Test description

##### 6.5.2.3.4.1 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, 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 6.2.3.4.1-5 and Table 6.2.3.4.1-6 depending on the network signalling value under test. 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.

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 6.2.3.4.1-5 and Table 6.2.3.4.1-6 depending on the network signalling value under test..
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 6.5.2.3.4.3.

#### 6.5.2.3.4.2 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 Table 6.2.3.4.1-5 and Table 6.2.3.4.1-6 depending on the network signalling value under test.. 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. 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 average power of the transmitted signal with a measurement filter of bandwidths according to table 6.5.2.3.5-1. 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 and  $\Delta f_{\text{OoB}}$  range. The measurement period shall capture the active TSs.
5. Repeat steps 1, 2, 3 and 4 for all applicable network signalled values.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.3.4.1-1, 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.

#### 6.5.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and 5.4 with additional exceptions described in 6.5.2.2.4.3 and the ones described in 6.2.3.4.3 associated to each applicable network signalled value used in additional spectrum emission mask measurements.

#### 6.5.2.3.5 Test requirement

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.

##### 6.5.2.3.5.1 Test Requirements for network signalling value "NS\_04N" and "NS\_11N"

When "NS\_04N" or "NS\_11N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.2.3.5.1-1 for any channel bandwidth configured within 1610-1618.25MHz.

**Table 6.5.2.3.5.1-1: Additional spectrum emission mask Test Requirements for "NS\_04N" and "NS\_11N"**

| $\Delta f_{\text{OoB}}$ (kHz)                                                                          | Spectrum emission limit (dBm) | Measurement bandwidth | Measurement method |
|--------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------|--------------------|
| $\pm 0\text{-}160$                                                                                     | -2 + TT                       | 30kHz                 | Average            |
| $\pm 160\text{-}2300$                                                                                  | -2 to -26 + TT                |                       |                    |
| $\pm 2300\text{-}18500$                                                                                | -26 + TT                      |                       |                    |
| NOTE 1: Spectrum emissions are linearly interpolated in dBm versus frequency offset.                   |                               |                       |                    |
| NOTE 2: The EIRP requirement in regulation is converted to conducted requirement using a 0dBi antenna. |                               |                       |                    |

**Table 6.5.2.3.5.1-2: Additional spectrum emission mask Test Tolerances for "NS\_04N" and "NS\_11N"**

| $\Delta f_{\text{OoB}}$ (kHz) | Test Tolerance (dB) |
|-------------------------------|---------------------|
| $\pm 0\text{-}160$            | FFS                 |
| $\pm 160\text{-}2300$         | FFS                 |
| $\pm 2300\text{-}18500$       | FFS                 |

#### 6.5.2.3.5.2 Requirements for network signalling value "NS\_05N" and "NS\_12N"

When "NS\_05N" or "NS\_12N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.2.3.5.2-1 for any channel bandwidth configured within 1618.25-1626.5MHz.

**Table 6.5.2.3.5.2-1: Additional spectrum emission mask Test Requirements for "NS\_05N" and "NS\_12N"**

| $\Delta f_{\text{OoB}}$ (kHz)                                                                          | Spectrum emission limit (dBm) | Measurement bandwidth | Measurement method |
|--------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------|--------------------|
| $\pm 0\text{-}160$                                                                                     | -5                            | 30kHz                 | Average            |
| $\pm 160\text{-}225$                                                                                   | -5 to -8.5                    |                       |                    |
| $\pm 225\text{-}650$                                                                                   | -8.5 to -15                   |                       |                    |
| $\pm 650\text{-}1365$                                                                                  | -15                           |                       |                    |
| $\pm 1365\text{-}1800$                                                                                 | -23 to -26                    |                       |                    |
| $\pm 1800\text{-}16500$                                                                                | -26                           |                       |                    |
| NOTE 1: Spectrum emissions are linearly interpolated in dBm versus frequency offset.                   |                               |                       |                    |
| NOTE 2: The EIRP requirement in regulation is converted to conducted requirement using a 0dBi antenna. |                               |                       |                    |

**Table 6.5.2.3.5.1-2: Additional spectrum emission mask Test Tolerances for "NS\_05N" and "NS\_12N"**

| $\Delta f_{\text{OoB}}$ (kHz) | Test Tolerance (dB) |
|-------------------------------|---------------------|
| $\pm 0\text{-}160$            | FFS                 |
| $\pm 160\text{-}225$          | FFS                 |
| $\pm 225\text{-}650$          | FFS                 |
| $\pm 650\text{-}1365$         | FFS                 |
| $\pm 1365\text{-}1800$        | FFS                 |
| $\pm 1800\text{-}16500$       | FFS                 |

#### 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

##### 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**

|                                      |       |                                             |
|--------------------------------------|-------|---------------------------------------------|
| <b>Channel bandwidth</b>             | (MHz) | 3, 5, 10, 15, 20                            |
| <b>REF_SCS</b>                       | (kHz) | 15                                          |
| <b>NR ACLR measurement bandwidth</b> | (MHz) | $MBW = REF\_SCS * (12 * N_{RB} + 1) / 1000$ |

**Table 6.5.2.4.1.3-2: NR ACLR requirement**

|                |                      |
|----------------|----------------------|
|                | <b>Power class 3</b> |
| <b>NR ACLR</b> | 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 6.2.2.4.1-1.
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 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 6.5.2.4.1.4.3.

#### 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 6.2.2.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
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: Void**

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 27-29 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 {               |              |         |           |
| 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) | 3, 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)**

|                                | $f \leq 3.0\text{GHz}$ | $3.0\text{GHz} < f \leq 4.2\text{GHz}$ | $4.2\text{GHz} < f \leq 6.0\text{GHz}$ |
|--------------------------------|------------------------|----------------------------------------|----------------------------------------|
| $\text{BW} \leq 100\text{MHz}$ | 0.8 dB                 | 0.8 dB                                 | 0.8 dB                                 |

#### 6.5.2.4.1\_1 NR Adjacent channel leakage ratio for UEs supporting 2Tx Tx Diversity

##### 6.5.2.4.1\_1.1 Test purpose

Same as 6.5.2.4.1.

##### 6.5.2.4.1\_1.2 Test applicability

The requirements of this test apply to all types of NR Power Class 2 UE release 19 and forward that support satellite access operation and 2Tx Tx Diversity.

##### 6.5.2.4.1\_1.3 Minimum conformance requirements

NR Adjacent Channel Leakage power Ratio ( $\text{NR}_{\text{ACLR}}$ ) 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\_1.3-1.

If the measured adjacent channel power is greater than  $-50$  dBm then the  $\text{NR}_{\text{ACLR}}$  shall be higher than the value specified in Table 6.5.2.4.1\_1.3-2.

**Table 6.5.2.4.1\_1.3-1: NR ACLR measurement bandwidth**

|                                      |       |                                                                                 |
|--------------------------------------|-------|---------------------------------------------------------------------------------|
| <b>Channel bandwidth</b>             | (MHz) | 3, 5,10,15,20                                                                   |
| <b>REF_SCS</b>                       | (kHz) | 15                                                                              |
| <b>NR ACLR measurement bandwidth</b> | (MHz) | $\text{MBW} = \text{REF\_SCS} \cdot (12 \cdot \text{N}_{\text{RB}} + 1) / 1000$ |

**Table 6.5.2.4.1\_1.3-2: NR ACLR requirement**

|                | <b>Power class 2</b> |
|----------------|----------------------|
| <b>NR ACLR</b> | 31 dB                |

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

##### 6.5.2.4.1\_1.4 Test description

##### 6.5.2.4.1\_1.4.1 Initial conditions

Same as the initial condition given in clause 6.2.2\_1.4.1

##### 6.5.2.4.1\_1.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0\_1 for  $\text{C\_RNTI}$  to schedule the UL RMC according to the test configuration tables in clause 6.2.2\_1.4.1. 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  $\text{P}_{\text{UMAX}}$  level. Allow at least 200ms for the UE to reach  $\text{P}_{\text{UMAX}}$  level.

3. Measure the sum of the mean power of the UE at each antenna connector in the channel bandwidth of the radio access mode according to the test configuration, as measured in step 3 of 6.2.2\_1.4.2, which shall meet the requirements described in clause 6.2.2\_1.5 as appropriate.
4. Measure the sum of the rectangular filtered mean power at each antenna connector for the assigned NR channel using a rms detector. If the sweep count is higher than one, the trace mode shall be average.
5. Measure the sum of the rectangular filtered mean power at each antenna connector of the first NR adjacent channel on both lower and upper side of the assigned NR channel using a rms detector, respectively. If the sweep count is higher than one, the trace mode shall be average.
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 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration tables in clause 6.2.2\_1.4.1, send an NR RRCReconfiguration message according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

#### 6.5.2.4.1\_1.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and 5.6.

#### 6.5.2.4.1\_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\_1.5-2.

**Table 6.5.2.4.1\_1.5-1: NR ACLR measurement bandwidth**

|                                      |       |                                             |
|--------------------------------------|-------|---------------------------------------------|
| <b>Channel bandwidth</b>             | (MHz) | 3, 5,10,15,20                               |
| <b>REF_SCS</b>                       | (kHz) | 15                                          |
| <b>NR ACLR measurement bandwidth</b> | (MHz) | $MBW = REF\_SCS * (12 * N_{RB} + 1) / 1000$ |

**Table 6.5.2.4.1\_1.5-2: NR ACLR requirement**

|                |                      |
|----------------|----------------------|
|                | <b>Power class 2</b> |
| <b>NR ACLR</b> | 31 - TT dB           |

**Table 6.5.2.4.1\_1.5-3: Test Tolerance (NR ACLR)**

|             |                   |
|-------------|-------------------|
|             | <b>f ≤ 3.0GHz</b> |
| BW ≤ 100MHz | 0.8 dB            |

#### 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  $\pm 2.5$  MHz from NR channel edge and for the 2<sup>nd</sup> adjacent UTRA channel ( $UTRA_{ACLR2}$ ) which center frequency is  $\pm 7.5$  MHz from NR channel edge.

The UTRA channel power is measured with a RRC filter with roll-off factor  $\alpha = 0.22$  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  $F_{\text{OOB}}$  (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 ( $N_{\text{RB}}$ ) 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 $F_{\text{OOB}}$ (MHz) |
|-----------------------|-------------------------------------|
| $BW_{\text{Channel}}$ | $BW_{\text{Channel}} + 5$           |

**Table 6.5.3.1.3-2: Requirement for general spurious emissions limits**

| Frequency Range                                                                                             | Maximum Level | Measurement bandwidth | NOTE |
|-------------------------------------------------------------------------------------------------------------|---------------|-----------------------|------|
| $9 \text{ kHz} \leq f < 150 \text{ kHz}$                                                                    | -36 dBm       | 1 kHz                 |      |
| $150 \text{ kHz} \leq f < 30 \text{ MHz}$                                                                   | -36 dBm       | 10 kHz                |      |
| $30 \text{ MHz} \leq f < 1,000 \text{ MHz}$                                                                 | -36 dBm       | 100 kHz               |      |
| $1 \text{ GHz} \leq f < 5^{\text{th}}$ 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 |
|-------------------------------------------------------------------------------------------------------------|---------------|-----------------------|------|
| $9 \text{ kHz} \leq f < 150 \text{ kHz}$                                                                    | -36 dBm       | 1 kHz                 |      |
| $150 \text{ kHz} \leq f < 30 \text{ MHz}$                                                                   | -36 dBm       | 10 kHz                |      |
| $30 \text{ MHz} \leq f < 1,000 \text{ MHz}$                                                                 | -36 dBm       | 100 kHz               |      |
| $1 \text{ GHz} \leq f < 5^{\text{th}}$ 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<br>satellite<br>Band                                                                                                                                                                                                                                                | Spurious emission for UE co-existence                                                                                                                                                                                                                             |                       |   |                      |                           |              |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---|----------------------|---------------------------|--------------|------|
|                                                                                                                                                                                                                                                                            | Protected band                                                                                                                                                                                                                                                    | Frequency range (MHz) |   |                      | Maximum<br>Level<br>(dBm) | MBW<br>(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 <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                                                                                                                                                                                                                                                                            | NR Band n77, n78, n79                                                                                                                                                                                                                                             | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -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 <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                                                                                                                                                                                                                                                                            | E-UTRA Band 33, 35                                                                                                                                                                                                                                                | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                                                                                                                                                                                                                                                                            | NR Band n77                                                                                                                                                                                                                                                       | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            | 2    |
|                                                                                                                                                                                                                                                                            | NR Band n2, n25, n70                                                                                                                                                                                                                                              | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | NA                        | NA           | 3    |
| n252                                                                                                                                                                                                                                                                       | NR Band n1, n3, n5, n7, n8, n12, n13, n14, n18, n20, n24, n26, n28, n29, n30, n31, n38, n39, n40, n41, n48, n50, n51, n53, n54, n65, n66, n67, n68, n71, n72, n74, n75, n76, n78, n79, n85, n87, n88, n90, n91, n92, n93, n94, n100, n101, n105, n106, n109, n110 | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                                                                                                                                                                                                                                                                            | E-UTRA Band 33, 35                                                                                                                                                                                                                                                | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                                                                                                                                                                                                                                                                            | NR Band n77                                                                                                                                                                                                                                                       | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            | 2    |
|                                                                                                                                                                                                                                                                            | NR Band n70                                                                                                                                                                                                                                                       | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | NA                        | NA           | 4    |
|                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                   |                       |   |                      |                           |              |      |
| 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 <sub>DL_low</sub> and F <sub>DL_high</sub> refer to each frequency band specified in Table 5.2.-1 in 3GPP TS 38.101-1 [5] or 3GPP TS 36.101 [10]. |                                                                                                                                                                                                                                                                   |                       |   |                      |                           |              |      |

| NR NTN<br>satellite<br>Band                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Spurious emission for UE co-existence |                       |                     |           |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------|---------------------|-----------|------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Protected band                        | Frequency range (MHz) | Maximum Level (dBm) | MBW (MHz) | NOTE |
| 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 $(2 \text{ MHz} + N \times L_{CRB} \times R_{B_{size}} \text{ kHz})$ , 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 4: The co-existence between n252 and band 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) |
|                                                                                                             |                        | CP-OFDM QPSK                     | Outer_Full             |
|                                                                                                             |                        | CP-OFDM QPSK                     | Edge_1RB_Left          |
|                                                                                                             |                        | 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  $P_{\text{MAX}}$  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  $F_{\text{OOB}}$  (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 ( $N_{\text{RB}}$ ) 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<br>satellite<br>Band | Spurious emission for UE co-existence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                       |   |                      |                           |              |      |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---|----------------------|---------------------------|--------------|------|
|                             | Protected band                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Frequency range (MHz) |   |                      | Maximum<br>Level<br>(dBm) | MBW<br>(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 <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                             | NR Band n77, n78, n79                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -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 <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                             | E-UTRA Band 33, 35, 54                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                             | NR Band n77                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            | 2    |
|                             | NR Band n2, n25, n70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | NA                        | NA           | 3    |
| n252                        | NR Band n1, n3, n5, n7, n8, n12, n13, n14, n18, n20, n24, n26, n28, n29, n30, n31, n38, n39, n40, n41, n48, n50, n51, n53, n54, n65, n66, n67, n68, n71, n72, n74, n75, n76, n78, n79, n85, n87, n88, n90, n91, n92, n93, n94, n100, n101, n105, n106, n109, n110                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                             | E-UTRA Band 33, 35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            |      |
|                             | NR Band n77                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | -50                       | 1            | 2    |
|                             | NR Band n70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | F <sub>DL_low</sub>   | - | F <sub>DL_high</sub> | NA                        | NA           | 4    |
| 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 <sub>DL_low</sub> and F <sub>DL_high</sub> 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 <sub>CRB</sub> x R <sub>Bsize</sub> 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 4:                     | The co-existence between n252 and band n70 is subject to regional/national regulation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |   |                      |                           |              |      |

### 6.5.3.3 Additional Spurious emissions

#### 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  $F_{\text{OOB}}$  (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 range<br>(MHz)                                                                                 | Channel bandwidth /<br>Spectrum emission<br>limit <sup>1</sup> (dBm) | Measurement<br>bandwidth | NOTE                                                               |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------|
|                                                                                                          | 5 MHz, 10 MHz, 15<br>MHz, 20 MHz                                     |                          |                                                                    |
| 1,559≤ f < 1,605                                                                                         | -50                                                                  | 700 Hz                   | Averaged over any 2<br>millisecond active<br>transmission interval |
| 1,605≤ f ≤ 1,610                                                                                         | -50 + 24/5 (f-1605)                                                  | 700Hz                    |                                                                    |
| 1,559 ≤ f < 1,605                                                                                        | -40                                                                  | 1MHz                     | Averaged over any 2<br>millisecond active<br>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<br>a 0 dBi antenna. |                                                                      |                          |                                                                    |

#### 6.5.3.3.3.2 Minimum conformance requirements (network signalling value "NS\_03N")

When "NS\_03N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.2-1. This requirement also applies for the frequency ranges that are less than  $F_{\text{OOB}}$  (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth.

**Table 6.5.3.3.3.2-1: Additional out-of-band requirements for "NS\_03N"**

| Frequency range (MHz)                                                                                | Channel bandwidth / Spectrum emission limit <sup>1</sup> (dBm) | Measurement bandwidth | NOTE                                                                            |
|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------|
|                                                                                                      | 5 MHz, 10 MHz, 15 MHz                                          |                       |                                                                                 |
| 1559 ≤ f < 1605                                                                                      | -50                                                            | 700 Hz                | Discreet emissions averaged over any 2 millisecond active transmission interval |
| 1605 ≤ f ≤ 1610                                                                                      | -50 + 60/5 (f-1605)                                            | 700 Hz                |                                                                                 |
| 1559 ≤ f < 1605                                                                                      | -40                                                            | 1MHz                  | Averaged over any 2 millisecond active transmission interval                    |
| 1605 ≤ f ≤ 1610                                                                                      | -40 + 60/5 (f-1605)                                            | 1MHz                  |                                                                                 |
| NOTE: The EIRP requirement in regulation is converted to conducted requirement using a 0dBi antenna. |                                                                |                       |                                                                                 |

#### 6.5.3.3.3.3 Minimum conformance requirements (network signalling value "NS\_04N", "NS\_05N", "NS\_11N" and "NS\_12N")

When "NS\_04N" or "NS\_05N" or "NS\_11N" or "NS\_12N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.3-1. This requirement also applies for the frequency ranges that are less than  $F_{\text{OOB}}$  (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth.

**Table 6.5.3.3.3-1: Additional out-of-band requirements for "NS\_04N", "NS\_05N", "NS\_11N" and "NS\_12N"**

| Frequency range<br>(MHz)                                                                             | Channel bandwidth /<br>Spectrum emission<br>limit <sup>1</sup> (dBm) | Measurement<br>bandwidth | Measurement method |
|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------|--------------------|
|                                                                                                      | 5 MHz, 10 MHz, 15 MHz                                                |                          |                    |
| 1559 ≤ f < 1605                                                                                      | -40                                                                  | 1MHz                     | Average (note 2) I |
| 1605 ≤ f ≤ 1610                                                                                      | -40 + 60/5 (f-1605)                                                  | 1MHz                     |                    |
|                                                                                                      |                                                                      |                          | Average            |
| 1628.5 ≤ f < 1631.5                                                                                  | -30                                                                  | 30kHz                    |                    |
| 1631.5 ≤ f < 1636.5                                                                                  | -30                                                                  | 100kHz                   |                    |
| 1636.5 ≤ f < 1646.5                                                                                  | -30                                                                  | 300kHz                   |                    |
| 1646.5 ≤ f < 1666.5                                                                                  | -30                                                                  | 1MHz                     |                    |
| 1666.5 ≤ f ≤ 2200                                                                                    | -30                                                                  | 3MHz                     |                    |
| NOTE: The EIRP requirement in regulation is converted to conducted requirement using a 0dBi antenna. |                                                                      |                          |                    |
| NOTE 2: In the sub-band 1573.42MHz to 1580.42 MHz the average measurement time is 20ms.              |                                                                      |                          |                    |

**6.5.3.3.3.4 Minimum conformance requirements (network signalling value "NS\_06N")**

When "NS\_06N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.4-1. 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 6.5.3.3.3.4-1: Additional out-of-band requirements for "NS\_06N"**

| Frequency range (MHz) | Channel bandwidth / Spectrum emission limit (dBm) | Measurement bandwidth | NOTE                                                         |
|-----------------------|---------------------------------------------------|-----------------------|--------------------------------------------------------------|
|                       | 5 MHz, 10 MHz, 15 MHz, 20MHz                      |                       |                                                              |
| $1559 \leq f < 1610$  | -50                                               | 700 Hz                | Averaged over any 2 millisecond active transmission interval |
| $1559 \leq f < 1610$  | -40                                               | 1MHz                  |                                                              |

**6.5.3.3.3.5 Minimum conformance requirements (network signalling value "NS\_07N")**

When "NS\_07N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.5-1. 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 6.5.3.3.3.5-1: Additional out-of-band requirements for "NS\_07N"**

| Frequency range (MHz)   | Channel bandwidth / Spectrum emission limit (dBm) | Measurement bandwidth | NOTE                                                         |
|-------------------------|---------------------------------------------------|-----------------------|--------------------------------------------------------------|
|                         | 5 MHz, 10 MHz, 15 MHz, 20MHz                      |                       |                                                              |
| $1559 \leq f < 1610$    | -50                                               | 700 Hz                | Averaged over any 2 millisecond active transmission interval |
| $1559 \leq f < 1610$    | -40                                               | 1MHz                  |                                                              |
| $1930 \leq f \leq 1995$ | -40                                               | 1MHz                  |                                                              |

**6.5.3.3.3.6 Minimum conformance requirements (network signalling value "NS\_08N")**

When "NS\_08N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.6-1. 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 6.5.3.3.6-1: Additional out-of-band requirements for "NS\_08N"**

| Frequency range (MHz)   | Channel bandwidth / Spectrum emission limit (dBm) | Measurement bandwidth | NOTE                                                         |
|-------------------------|---------------------------------------------------|-----------------------|--------------------------------------------------------------|
|                         | 5 MHz, 10 MHz, 15 MHz, 20MHz                      |                       |                                                              |
| $1559 \leq f < 1610$    | -50                                               | 700 Hz                | Averaged over any 2 millisecond active transmission interval |
| $1559 \leq f < 1610$    | -40                                               | 1MHz                  |                                                              |
| $1930 \leq f \leq 1995$ | -30                                               | 1MHz                  |                                                              |

#### 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" with PC3)**

|                                                                                                                 |         |                           | Initial Conditions                          |                        |
|-----------------------------------------------------------------------------------------------------------------|---------|---------------------------|---------------------------------------------|------------------------|
| Test Environment as specified in TS 38.508-1 [12] subclause 4.1                                                 |         |                           | Normal, TL/VL, TL/VH, TH/VL, TH/VH (NOTE 2) |                        |
| Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1                                               |         |                           | Low 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                                      |                        |
| Test Parameters for Channel Bandwidths                                                                          |         |                           |                                             |                        |
| Test ID                                                                                                         | Freq    | Downlink Configuration    | Uplink Configuration                        |                        |
|                                                                                                                 |         |                           | Modulation                                  | RB allocation (NOTE 1) |
| 1 <sup>3</sup>                                                                                                  | Default | N/A for Maximum Power     | DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS       | Outer_Full             |
| 2 <sup>3</sup>                                                                                                  | Default | Reduction (MPR) test case | DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS       | Edge_1RB_Left          |
| 3 <sup>3</sup>                                                                                                  | Default |                           | DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS       | Edge_1RB_Right         |
| 4 <sup>4</sup>                                                                                                  | Default |                           | DFT-s-OFDM QPSK                             | Outer Full             |
| 5 <sup>4</sup>                                                                                                  | Default |                           | DFT-s-OFDM QPSK                             | Inner Full             |
| 6 <sup>4</sup>                                                                                                  | Default |                           | DFT-s-OFDM QPSK                             | Edge_1RB_Left          |
| 7 <sup>4</sup>                                                                                                  | Default |                           | DFT-s-OFDM QPSK                             | Edge_1RB_Right         |
| 8                                                                                                               | Default |                           | CP-OFDM QPSK                                | Outer Full             |
| 9                                                                                                               | Default |                           | CP-OFDM QPSK                                | Inner Full             |
| 10                                                                                                              | Default |                           | CP-OFDM QPSK                                | Edge_1RB_Left          |
| 11                                                                                                              | Default |                           | CP-OFDM QPSK                                | Edge_1RB_Right         |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.                             |         |                           |                                             |                        |
| NOTE 2: For TL/VL, TL/VH, TH/VL, TH/VH, step 4 of the test procedure is skipped.                                |         |                           |                                             |                        |
| NOTE 3: Applicable to UEs indicating support for UE capability <i>lowPAPR-DMRS-PUSCHwithPrecoding-r16</i> .     |         |                           |                                             |                        |
| NOTE 4: Applicable to UEs not indicating support for UE capability <i>lowPAPR-DMRS-PUSCHwithPrecoding-r16</i> . |         |                           |                                             |                        |

**Table 6.5.3.3.4.1-2: Test Configuration Table (network signalling value "NS\_03N")**

Same test configuration as listed in Table 6.2.3.4.1-4 shall be used.

**Table 6.5.3.3.4.1-3: Test Configuration Table (network signalling value "NS\_04N")**

Same test configuration as listed in Table 6.2.3.4.1-5 shall be used.

**Table 6.5.3.3.4.1-4: Test Configuration Table (network signalling value "NS\_05N")**

Same test configuration as listed in Table 6.2.3.4.1-6 shall be used.

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 6.5.3.3.4.3.

#### 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  $P_{\text{UMAX}}$  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 in clause 6.5.3.3.4.1, . The mean power shall meet the requirements in Table 6.5.3.3.5.1-0 for NS\_02N and in clause 6.2.3.5 for the other NS values. 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.

#### 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 6.5.3.4.3.1-1: AdditionalSpectrumEmission: Additional 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)   |         |           |

#### 6.5.3.4.3.2 Message contents exceptions (network signalling value "NS\_03N")

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\_03N. 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 6.5.3.4.3.2-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_03N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 1 (NS_03N)   |         |           |

#### 6.5.3.4.3.3 Message contents exceptions (network signalling value "NS\_04N")

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\_04N. 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 6.5.3.4.3.3-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_04N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 2 (NS_04N)   |         |           |

#### 6.5.3.4.3.4 Message contents exceptions (network signalling value "NS\_05N")

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\_05N. 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 6.5.3.4.3.4-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_05N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 3 (NS_05N)   |         |           |

#### 6.5.3.4.3.5 Message contents exceptions (network signalling value "NS\_06N")

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\_06N. 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 6.5.3.3.4.3.5-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_06N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 1 (NS_06N)   |         |           |

#### 6.5.3.3.4.3.6 Message contents exceptions (network signalling value "NS\_07N")

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\_07N. 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 6.5.3.3.4.3.6-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_07N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 2 (NS_07N)   |         |           |

#### 6.5.3.3.4.3.7 Message contents exceptions (network signalling value "NS\_08N")

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\_08N. 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 6.5.3.3.4.3.7-1: AdditionalSpectrumEmission: Additional spurious emissions test requirement for "NS\_08N"**

| Derivation Path: TS 38.508-1 [12], Table 4.6.3-1 |              |         |           |
|--------------------------------------------------|--------------|---------|-----------|
| Information Element                              | Value/remark | Comment | Condition |
| additionalSpectrumEmission                       | 3 (NS_08N)   |         |           |

### 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 mean power, derived in step 3 shall be within the range prescribed by the nominal maximum output power and tolerance in Table 6.5.3.3.5.1-0.

Table 6.5.3.3.5.1-0: Output power test requirement for "NS\_02N"

| Test ID | P <sub>PowerClass</sub> (dBm) | ΔP <sub>PowerClass</sub> (dB) | MPR (dB) | ΔT <sub>C,c</sub> (dB) | P <sub>CMAX_L,f,c</sub> (dBm) | T(P <sub>CMAX_L,f,c</sub> ) (dB) | T <sub>L,c</sub> (dB) | Upper limit (dBm) | Lower limit (dBm) |
|---------|-------------------------------|-------------------------------|----------|------------------------|-------------------------------|----------------------------------|-----------------------|-------------------|-------------------|
| 1       | 23                            | 0                             | 0        | 0                      | 23                            | 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                             | 1        | 0                      | 22.0                          | 2.0                              | 2                     | 25.0 + TT         | 20.0 - 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                             | 3        | 0                      | 20.0                          | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 9       | 23                            | 0                             | 1.5      | 0                      | 21.5                          | 2.0                              | 2                     | 25.0 + TT         | 19.5 - TT         |
| 10      | 23                            | 0                             | 3        | 0                      | 20.0                          | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |
| 11      | 23                            | 0                             | 3        | 0                      | 20.0                          | 2.5                              | 2                     | 25.0 + TT         | 17.5 - TT         |

NOTE 1: P<sub>PowerClass</sub> 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.

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<sub>OOB</sub> (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 range (MHz) | Channel bandwidth / Spectrum emission limit <sup>1</sup> (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.

#### 6.5.3.3.5.2 Test requirement (network signalling value "NS\_03N")

When "NS\_03N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.2-1. This requirement also applies for the frequency ranges that are less than F<sub>OOB</sub> (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth.

Table 6.5.3.3.5.2-1: Additional requirements for "NS\_03N"

| Frequency range (MHz) | Channel bandwidth / Spectrum emission limit <sup>1</sup> (dBm) | Measurement bandwidth | NOTE                                                                            |
|-----------------------|----------------------------------------------------------------|-----------------------|---------------------------------------------------------------------------------|
|                       | 5 MHz, 10 MHz, 15 MHz                                          |                       |                                                                                 |
| 1559 ≤ f < 1605       | -50                                                            | 700 Hz                | Discreet emissions averaged over any 2 millisecond active transmission interval |
| 1605 ≤ f ≤ 1610       | -50 + 60/5 (f-1605)                                            | 700 Hz                |                                                                                 |
| 1559 ≤ f < 1605       | -40                                                            | 1MHz                  | Averaged over any 2 millisecond active transmission interval                    |
| 1605 ≤ f ≤ 1610       | -40 + 60/5 (f-1605)                                            | 1MHz                  |                                                                                 |

NOTE: The EIRP requirement in regulation is converted to conducted requirement using a 0dBi antenna.

### 6.5.3.3.5.3 Test requirement (network signalling value "NS\_03N" and "NS\_05N")

When "NS\_04N" or "NS\_05N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.3-1. 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 6.5.3.3.5.3-1: Additional out-of-band requirements for "NS\_04N" and "NS\_05N"**

| Frequency range (MHz)     | Channel bandwidth / Spectrum emission limit <sup>1</sup> (dBm) | Measurement bandwidth | NOTE                                                         |
|---------------------------|----------------------------------------------------------------|-----------------------|--------------------------------------------------------------|
|                           | 5 MHz, 10 MHz, 15 MHz                                          |                       |                                                              |
| $1559 \leq f < 1605$      | -40                                                            | 1MHz                  | Averaged over any 2 millisecond active transmission interval |
| $1605 \leq f \leq 1610$   | $-40 + 60/5 (f-1605)$                                          | 1MHz                  |                                                              |
|                           |                                                                |                       |                                                              |
| $1628.5 \leq f < 1631.5$  | -30                                                            | 30kHz                 |                                                              |
| $1631.5 \leq f < 1636.5$  | -30                                                            | 100kHz                |                                                              |
| $1636.5 \leq f < 1646.5$  | -30                                                            | 300kHz                |                                                              |
| $1646.5 \leq f < 1666.5$  | -30                                                            | 1MHz                  |                                                              |
| $1666.5 \leq f \leq 2200$ | -30                                                            | 3MHz                  |                                                              |

### 6.5.3.3.5.4 Test requirement (network signalling value "NS\_06N")

When "NS\_06N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.4-1. 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 6.5.3.3.5.4-1: Additional out-of-band requirements for "NS\_06N"**

| Frequency range (MHz) | Channel bandwidth / Spectrum emission limit (dBm) | Measurement bandwidth | NOTE                                                         |
|-----------------------|---------------------------------------------------|-----------------------|--------------------------------------------------------------|
|                       | 5 MHz, 10 MHz, 15 MHz, 20MHz                      |                       |                                                              |
| $1559 \leq f < 1610$  | -50                                               | 700 Hz                | Averaged over any 2 millisecond active transmission interval |
| $1559 \leq f < 1610$  | -40                                               | 1MHz                  |                                                              |

### 6.5.3.3.5.5 Test requirement (network signalling value "NS\_07N")

When "NS\_07N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.5-1. 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 6.5.3.3.5.5-1: Additional out-of-band requirements for "NS\_07N"**

| Frequency range (MHz)   | Channel bandwidth / Spectrum emission limit (dBm) | Measurement bandwidth | NOTE                                                         |
|-------------------------|---------------------------------------------------|-----------------------|--------------------------------------------------------------|
|                         | 5 MHz, 10 MHz, 15 MHz, 20MHz                      |                       |                                                              |
| $1559 \leq f < 1610$    | -50                                               | 700 Hz                | Averaged over any 2 millisecond active transmission interval |
| $1559 \leq f < 1610$    | -40                                               | 1MHz                  |                                                              |
| $1930 \leq f \leq 1995$ | -40                                               | 1MHz                  |                                                              |

#### 6.5.3.3.5.6 Test requirement (network signalling value "NS\_08N")

When "NS\_08N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.6-1. This requirement also applies for the frequency ranges that are less than  $F_{\text{OOB}}$  (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth.

**Table 6.5.3.3.5.6-1: Additional out-of-band requirements for "NS\_08N"**

| Frequency range (MHz)   | Channel bandwidth / Spectrum emission limit (dBm) | Measurement bandwidth | NOTE                                                         |
|-------------------------|---------------------------------------------------|-----------------------|--------------------------------------------------------------|
|                         | 5 MHz, 10 MHz, 15 MHz, 20MHz                      |                       |                                                              |
| $1559 \leq f < 1610$    | -50                                               | 700 Hz                | Averaged over any 2 millisecond active transmission interval |
| $1559 \leq f < 1610$    | -40                                               | 1MHz                  |                                                              |
| $1930 \leq f \leq 1995$ | -30                                               | 1MHz                  |                                                              |

### 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                          | $BW_{\text{Channel}}$                                                                                                         |                                                                 |
| Interference signal frequency offset from channel center | $BW_{\text{Channel}}$                                                                                                         | $2 \cdot BW_{\text{Channel}}$                                   |
| 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                   | $BW_{\text{Channel}}$ and $2 \cdot BW_{\text{Channel}}$                                                                       | $2 \cdot BW_{\text{Channel}}$ and $4 \cdot BW_{\text{Channel}}$ |

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                                                                                                  | $BW_{\text{Channel}}$                                                                                                         |                                                                 |
| Interference signal frequency offset from channel center                                                                         | $BW_{\text{Channel}}$                                                                                                         | $2 \cdot BW_{\text{Channel}}$                                   |
| 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                                                                                           | $BW_{\text{Channel}}$ and $2 \cdot BW_{\text{Channel}}$                                                                       | $2 \cdot BW_{\text{Channel}}$ and $4 \cdot BW_{\text{Channel}}$ |
| 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.

All Rx requirements are verified with default Tx-Rx separation specified in Table 5.4.4-1. Additional Tx-Rx frequency separations specified in clause 7.3.2 do not apply to other requirements.

## 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 for default Tx-Rx frequency separation.

#### 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  $\geq 95$  % 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        | -93.3        |
|                                                                              | 30        |             | -96.6        | -94.6        | -93.5        |
|                                                                              | 60        |             | -97.0        | -94.9        | -93.7        |
| n255                                                                         | 15        | -100.0      | -96.8        | -95.0        | -93.8        |
|                                                                              | 30        |             | -97.1        | -95.1        | -94.0        |
|                                                                              | 60        |             | -97.5        | -95.4        | -94.2        |
| n254                                                                         | 15        | -99.5       | -96.3        | -94.5        |              |
|                                                                              | 30        |             | -96.6        | -94.6        |              |
|                                                                              | 60        |             | -97.0        | -94.9        |              |
| n253                                                                         | 15        | -100.0      |              |              |              |
|                                                                              | 30        |             |              |              |              |
|                                                                              | 60        |             |              |              |              |
| n252                                                                         | 15        | -99.5       | -96.3        | -94.5        | -93.3        |
|                                                                              | 30        |             | -96.6        | -94.6        | -93.5        |
|                                                                              | 60        |             | -97.0        | -94.9        | -93.7        |
| n251                                                                         | 15        | -100.0      | -96.8        | -95.0        | -93.8        |
|                                                                              | 30        |             | -97.1        | -95.1        | -94.0        |
|                                                                              | 60        |             | -97.5        | -95.4        | -94.2        |
| n250                                                                         | 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 and with default Tx-Rx carrier center frequency separation except for cases specified in Table 7.3.2.3-3.

**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 <sup>2</sup><br>50 <sup>3</sup> | FDD         |
|                                                                    | 30  |    | 24              | 36              | 36 <sup>2</sup><br>24 <sup>3</sup> |             |
|                                                                    | 60  |    | 10              | 18              | 18 <sup>2</sup><br>10 <sup>3</sup> |             |
| n254                                                               | 15  | 25 | 50              | 75              |                                    | FDD         |
|                                                                    | 30  |    | 24              | 36              |                                    |             |
|                                                                    | 60  |    | 10              | 18              |                                    |             |
| n253                                                               | 15  | 25 |                 |                 |                                    | FDD         |
|                                                                    | 30  |    |                 |                 |                                    |             |
|                                                                    | 60  |    |                 |                 |                                    |             |
| n252                                                               | 15  | 25 | 50              | 75              | 100                                | FDD         |
|                                                                    | 30  |    | 24              | 36              | 50                                 |             |
|                                                                    | 60  |    | 10              | 18              | 24                                 |             |
| n251                                                               | 15  | 25 | 50              | 75              | 75 <sup>2</sup><br>50 <sup>3</sup> | FDD         |
|                                                                    | 30  |    | 24              | 36              | 36 <sup>2</sup><br>24 <sup>3</sup> |             |
|                                                                    | 60  |    | 10              | 18              | 18 <sup>2</sup><br>10 <sup>3</sup> |             |
| n250                                                               | 15  | 25 | 25 <sup>4</sup> | 25 <sup>4</sup> | 25 <sup>4</sup>                    | FDD         |

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.

NOTE 2: Applicable for Tx-Rx frequency separation of -101.5 MHz and -115.5 MHz.

NOTE 3: Applicable for Tx-Rx frequency separation of -87.5 MHz.

NOTE 4: For this DL channel bandwidth, the UL configuration of the highest UL channel bandwidth specified in Table 5.3.6-1 and the default Tx-Rx frequency separation specified in Table 5.4.4-1 shall be used.

**Table 7.3.2.3-3: TX – RX carrier centre frequency separation for REFSENS verification**

| Operating Band | Channel bandwidth   |                  | TX – RX carrier centre frequency separation for REFSENS verification |
|----------------|---------------------|------------------|----------------------------------------------------------------------|
| n256           | 5 MHz               |                  | 165 MHz, 215 MHz                                                     |
|                | 20 MHz              |                  | 180 MHz, 200 MHz                                                     |
| n255           | 5 MHz               |                  | -72.5 MHz, -130.5 MHz                                                |
|                | 20 MHz              |                  | -87.5 MHz, -115.5 MHz                                                |
| n254           | 5 MHz               |                  | 862 MHz, 885 MHz                                                     |
|                | 15 MHz              |                  | 872MHz, 875MHz                                                       |
| n253           | 5 MHz               | -148MHz, -152MHz |                                                                      |
| n252           | 5 MHz               |                  | 165 MHz, 195 MHz                                                     |
|                | 15 MHz              |                  | 175 MHz, 185 MHz                                                     |
| n251           | 5 MHz               |                  | -72.5 MHz, -137.5 MHz                                                |
|                | 20 MHz              |                  | -87.5 MHz, -122.5MHz                                                 |
| n250           | 5 MHz               |                  | -114 MHz, -152 MHz                                                   |
|                | 20 MHz <sup>1</sup> |                  | -129 MHz, -137 MHz                                                   |

NOTE 1: For this DL channel bandwidth, the highest UL channel bandwidth is specified in Table 5.3.6-1

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] 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               |                  |
|                                                                                                                                               | 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   |
| n254           | 15      | 25@0  | 50@0   | 75@0   |        |
|                | 30      |       | 24@0   | 36@0   |        |
|                | 60      |       | 10@0   | 18@0   |        |
| n253           | 15      | 25@0  |        |        |        |
| n252           | 15      | 25@0  | 50@0   | 75@0   | 100@0  |
|                | 30      |       | 24@0   | 36@0   | 50@0   |
|                | 60      |       | 10@0   | 18@0   | 24@0   |
| n251           | 15      | 25@0  | 50@0   | 75@0   | 75@0   |
|                | 30      |       | 24@0   | 36@0   | 36@0   |
|                | 60      |       | 10@0   | 18@0   | 18@0   |
| n250           | 15      | 25@0  | 25@0   | 25@0   | 25@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  $\geq 95\%$  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.

: Two antenna port Reference sensitivity QPSK  $P_{\text{REFSENS}}$  for FDD bands for PC3

| Operating band / SCS / Channel bandwidth / Duplex-mode |                   |                    |                    |                    |             |
|--------------------------------------------------------|-------------------|--------------------|--------------------|--------------------|-------------|
|                                                        | 5<br>MHz<br>(dBm) | 10<br>MHz<br>(dBm) | 15<br>MHz<br>(dBm) | 20<br>MHz<br>(dBm) | Duplex Mode |
|                                                        | -99.5 +TT         | -96.3 +TT          | -94.5 +TT          | -93.3 +TT          | FDD         |
|                                                        |                   | -96.6 +TT          | -94.6 +TT          | -93.5 +TT          |             |
|                                                        |                   | -97.0 +TT          | -94.9 +TT          | -93.7 +TT          |             |
|                                                        | -100.0 +TT        | -96.8 +TT          | -95.0 +TT          | -93.8 +TT          | FDD         |
|                                                        |                   | -97.1 +TT          | -95.1 +TT          | -94.0 +TT          |             |
|                                                        |                   | -97.5 +TT          | -95.4 +TT          | -94.2 +TT          |             |
|                                                        | -99.5 +TT         | -96.3 +TT          | -94.5 +TT          |                    | FDD         |
|                                                        |                   | -96.6 +TT          | -94.6 +TT          |                    |             |
|                                                        |                   | -97.0 +TT          | -94.9 +TT          |                    |             |
|                                                        | -100 +TT          |                    |                    |                    | FDD         |
|                                                        | -99.5 +TT         | -96.3 +TT          | -94.5 +TT          | -93.3 +TT          | FDD         |
|                                                        |                   | -96.6 +TT          | -94.6 +TT          | -93.5 +TT          |             |
|                                                        |                   | -97.0 +TT          | -94.9 +TT          | -93.7 +TT          |             |
|                                                        | -100.0 +TT        | -96.8 +TT          | -95.0 +TT          | -93.8 +TT          | FDD         |
|                                                        |                   | -97.1 +TT          | -95.1 +TT          | -94.0 +TT          |             |
|                                                        |                   | -97.5 +TT          | -95.4 +TT          | -94.2 +TT          |             |
|                                                        | -100.0 +TT        | -96.8 +TT          | -95.0 +TT          | -93.8 +TT          |             |
| t to PUMAX as defined in subclause 6.2.4               |                   |                    |                    |                    |             |
| channel bandwidth is specified in Table 7.3.2.5-2.     |                   |                    |                    |                    |             |

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

|                   |
|-------------------|
| <b>f ≤ 3.0GHz</b> |
| 0.7 dB            |

## 7.3.2\_1 Reference sensitivity power level for flexible Tx-Rx frequency separation

### 7.3.2\_1.1 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 for Tx-Rx frequency separation other than the default value.

### 7.3.2\_1.2 Test applicability

Same as in clause 7.3.2.2.

### 7.3.2\_1.3 Minimum conformance requirements

Same as in clause 7.3.2.3.

### 7.3.2\_1.4 Test description

#### 7.3.2\_1.4.1 Initial conditions

Same as in Clause 7.3.2.4.1 with test configuration as listed in Tables 7.3.2\_1.4.1-1, 7.3.2.4.2-1 and 7.3.2.4.3-1.

**Table 7.3.2\_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 for flexible Tx-Rx separation as specified in TS 38.508-1 [12] subclause 4.3.1.9                                             |                        |                  | 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                             |                  |
| 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. |                        |                  |                                    |                  |

#### 7.3.2\_1.4.2 Test procedure.

Same as in 7.3.2.4.2.

#### 7.3.2\_1.4.3 Message contents

Same as in 7.3.2.4.3.

### 7.3.2\_1.5 Test requirement

The throughput shall be  $\geq 95\%$  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\_1.4.1-1, Tables 7.3.2.4.1-2 and Tables 7.3.2.4.1-3.

The Test Tolerances in Table 7.3.2.5-2 shall be applied.

### 7.3.2\_2 Reference sensitivity power level for UEs supporting 2Tx Tx Diversity

#### 7.3.2\_2.1 Test purpose

Same test purpose as in clause 7.3.2.1.

#### 7.3.2\_2.2 Test applicability

The requirements of this test apply to all types of NR Power Class 2 UE release 19 and forward that support satellite access operation and 2Tx Tx Diversity.

#### 7.3.2\_2.3 Minimum conformance requirements

The throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annex A3.2, with parameters specified in Table 7.3.2\_2.3-1.

**Table 7.3.2\_2.3-1: Two antenna port reference sensitivity QPSK PREFSENS for FDD bands**

| Operating band / SCS / Channel bandwidth |         |             |             |              |              |              |              |              |              |              |              |              |
|------------------------------------------|---------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Operating Band                           | SCS kHz | 3 MHz (dBm) | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | 25 MHz (dBm) | 30 MHz (dBm) | 35 MHz (dBm) | 40 MHz (dBm) | 45 MHz (dBm) | 50 MHz (dBm) |
| n256                                     | 15      | -101.7      | -99.5       | -96.3        | -94.5        | -93.3        |              |              |              |              |              |              |
|                                          | 30      |             |             | -96.6        | -94.6        | -93.5        |              |              |              |              |              |              |
|                                          | 60      |             |             | -97.0        | -94.9        | -93.7        |              |              |              |              |              |              |
| n255                                     | 15      | -101.7      | -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  $P_{\text{UMAX}}$  as defined in clause 6.2.4.

For power class 2 UEs, certain degradation of the reference sensitivity in Table 7.3.2\_2.3-1 is allowed. For a power class 2 UE the maximum amount of degradation is specified in Table 7.3.2\_2.3-1a for a UE that indicates *txDiversity-r16* or *txDiversity2Tx-r18*.

**Table 7.3.2\_2.3-1a Reference Sensitivity Degradation from PC3 to PC2 for FDD bands for UE with 2Tx**

| Operating Band | 5 MHz (dB) | 10 MHz (dB) | 15 MHz (dB) | 20 MHz (dB) | 25 MHz (dB) | 30 MHz (dB) | 35 MHz (dB) | 40 MHz (dB) | 45 MHz (dB) | 50 MHz (dB) |
|----------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| n256           | 0          | 0           | 0           | 0           |             |             |             |             |             |             |
| n255           | 1.6        | 1.6         | 1.7         | 1.7         |             |             |             |             |             |             |

NOTE 1: The transmitter shall be set to  $P_{\text{UMAX}}$  as defined in clause 6.2.4.

The reference receiver sensitivity (REFSENS) requirement specified in Table 7.3.2\_2.3-1 shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3.2\_2.3-2 and with default Tx-Rx carrier center frequency separation except for cases specified in Table 7.3.2\_2.3-3.

**Table 7.3.2\_2.3-2: Uplink configuration for reference sensitivity**

| Operating band / SCS (kHz) / Channel bandwidth (MHz) / Duplex mode                                                                                                                                       |     |    |    |    |    |                                    |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|----|----|----|------------------------------------|-------------|
| Operating Band                                                                                                                                                                                           | SCS | 3  | 5  | 10 | 15 | 20                                 | Duplex Mode |
| n256                                                                                                                                                                                                     | 15  | 15 | 25 | 50 | 75 | 100                                | FDD         |
|                                                                                                                                                                                                          | 30  |    |    | 24 | 36 | 50                                 |             |
|                                                                                                                                                                                                          | 60  |    |    | 10 | 18 | 24                                 |             |
| n255                                                                                                                                                                                                     | 15  | 15 | 25 | 50 | 75 | 75 <sup>2</sup><br>50 <sup>3</sup> | FDD         |
|                                                                                                                                                                                                          | 30  |    |    | 24 | 36 | 36 <sup>2</sup><br>24 <sup>3</sup> |             |
|                                                                                                                                                                                                          | 60  |    |    | 10 | 18 | 18 <sup>2</sup><br>10 <sup>3</sup> |             |
| NOTE 1: 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. |     |    |    |    |    |                                    |             |
| NOTE 2: Applicable for Tx-Rx frequency separation of -101.5 MHz and -115.5 MHz.                                                                                                                          |     |    |    |    |    |                                    |             |
| NOTE 3: Applicable for Tx-Rx frequency separation of -87.5 MHz.                                                                                                                                          |     |    |    |    |    |                                    |             |

**Table 7.3.2\_2.3-3: TX – RX carrier centre frequency separation for REFSSENS verification**

| Operating Band | Channel bandwidth | TX – RX carrier centre frequency separation for REFSSENS verification |
|----------------|-------------------|-----------------------------------------------------------------------|
| n256           | 5 MHz             | 165 MHz, 215 MHz                                                      |
|                | 20 MHz            | 180 MHz, 200 MHz                                                      |
| n255           | 5 MHz             | -72.5 MHz, -130.5 MHz                                                 |
|                | 20 MHz            | -87.5 MHz, -115.5 MHz                                                 |

The minimum requirements specified in Table 7.3.2-1 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\_2.4 Test description

##### 7.3.2\_2.4.1 Initial conditions

Same test description as specified in clause 7.3.2.4.1 with following exceptions:

For initial condition in 7.3.2.4.1:

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.2a for TE diagram and section A.3.2 for UE diagram.

Step 3 of Test procedure as in 7.3.2.4.2 is replaced by:

3. Set the Downlink signal level to the appropriate REFSSENS value defined in Table 7.3.2\_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.

#### 7.3.2\_2.5 Test requirement

The throughput shall be  $\geq 95\%$  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\_2.5-1 and parameters specified Tables 7.3.2\_2.3-1, Tables 7.3.2\_2.3-2 and Tables 7.3.2\_2.3-3.

**Table 7.3.2\_2.5-1: Two antenna port reference sensitivity QPSK PREFSENS for FDD bands for UE supporting Tx Diversity**

| Operating band / SCS / Channel bandwidth                                                                                                                                                                                                                                                                                                                        |         |             |             |              |              |              |              |              |              |              |              |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Operating Band                                                                                                                                                                                                                                                                                                                                                  | SCS kHz | 3 MHz (dBm) | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) | 25 MHz (dBm) | 30 MHz (dBm) | 35 MHz (dBm) | 40 MHz (dBm) | 45 MHz (dBm) | 50 MHz (dBm) |
| n256                                                                                                                                                                                                                                                                                                                                                            | 15      | -101.7 +TT  | -99.5 +TT   | -96.3 +TT    | -94.5 +TT    | -93.3 +TT    |              |              |              |              |              |              |
|                                                                                                                                                                                                                                                                                                                                                                 | 30      |             |             | -96.6 +TT    | -94.6 +TT    | -93.5 +TT    |              |              |              |              |              |              |
|                                                                                                                                                                                                                                                                                                                                                                 | 60      |             |             | -97.0 +TT    | -94.9 +TT    | -93.7 +TT    |              |              |              |              |              |              |
| n255                                                                                                                                                                                                                                                                                                                                                            | 15      | -101.7 +TT  | -98.4 +TT   | -95.2 +TT    | -93.3 +TT    | -92.1 +TT    |              |              |              |              |              |              |
|                                                                                                                                                                                                                                                                                                                                                                 | 30      |             |             | -95.5 +TT    | -93.4 +TT    | -92.3 +TT    |              |              |              |              |              |              |
|                                                                                                                                                                                                                                                                                                                                                                 | 60      |             |             | -95.9 +TT    | -93.7 +TT    | -92.5 +TT    |              |              |              |              |              |              |
| NOTE 1: Void.<br>NOTE 2: The transmitter shall be set to P <sub>UMAX</sub> as defined in clause 6.2.4.<br>NOTE 3: The requirement is modified by -0.5 dB when the assigned NR channel bandwidth is confined within 1475.9-1510.9 MHz.<br>NOTE 4: Void<br>NOTE 5: Void<br>NOTE 6: TT for each frequency and channel bandwidth is specified in Table 7.3.2_2.5-2. |         |             |             |              |              |              |              |              |              |              |              |              |

**Table 7.3.2\_2.5-2: Test Tolerance (TT) for RX sensitivity level**

|                   |
|-------------------|
| <b>f ≤ 3.0GHz</b> |
| 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 <sup>3</sup>                                                                                                                                             | dBm | -40 <sup>2</sup> |
| NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX\_L,f,c}}$ at the minimum uplink configuration specified in Table 7.3.2.3-2 with $P_{\text{CMAX\_L,f,c}}$ 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  $-(\text{MU} + \text{Uplink power control window size})$  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  $\geq 95\%$  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 <sup>3</sup>                                                                                                                               | 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)**

|                        |
|------------------------|
| $f \leq 3.0\text{GHz}$ |
| 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  $\geq 95$  % 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) |    |    |
|--------------|-------|-------------------------|----|----|
|              |       | 3, 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) |       |    |    |
|--------------|-------|-------------------------|-------|----|----|
|              |       | 3                       | 5, 10 | 15 | 20 |

|                                                                                                                                                                                                                                                                                                     |     |                   |                                                                        |                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------|------------------------------------------------------------------------|-------------------------------------|
| Power in transmission bandwidth configuration                                                                                                                                                                                                                                                       | dBm | REFSENS + 14 dB   |                                                                        |                                     |
| $P_{\text{interferer}}$                                                                                                                                                                                                                                                                             | dBm | REFSENS + 45.5 dB |                                                                        | REFSENS + 42.5 dB<br>REFSENS + 39.5 |
| $BW_{\text{interferer}}$                                                                                                                                                                                                                                                                            | MHz | 3                 | 5                                                                      |                                     |
| $F_{\text{interferer}} \text{ (offset)}^2$                                                                                                                                                                                                                                                          | MHz | 3 /- 3            | $BW_{\text{Channel}}/2 + 2.5$<br>/<br>$-(BW_{\text{Channel}}/2 + 2.5)$ |                                     |
| NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX\_L,f,c}}$ at the minimum UL configuration specified in clause 7.3.2 with $P_{\text{CMAX\_L,f,c}}$ defined in clause 6.2.4.                                                                                                        |     |                   |                                                                        |                                     |
| NOTE 2: The absolute value of the interferer offset $F_{\text{interferer}} \text{ (offset)}$ shall be further adjusted to $(\lceil F_{\text{interferer}} / SCS \rceil + 0.5) SCS$ 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: $P_{\text{interferer}}$ shall be rounded to the next higher 0.5dB value.                                                                                                                                                                                                                    |     |                   |                                                                        |                                     |

**Table 7.5.3-3: Test parameters for NR bands with  $F_{\text{DL\_high}} < 2,700$  MHz and  $F_{\text{UL\_high}} < 2,700$  MHz, case 2**

| RX parameter                                                                                                                                                                                                                                                                                | Units | Channel bandwidth (MHz) |                                                                         |       |       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------|-------------------------------------------------------------------------|-------|-------|
|                                                                                                                                                                                                                                                                                             |       | 3                       | 5, 10                                                                   | 15    | 20    |
| Power in transmission bandwidth configuration                                                                                                                                                                                                                                               | dBm   | -71.5                   |                                                                         | -68.5 | -65.5 |
| $P_{\text{interferer}}$                                                                                                                                                                                                                                                                     | dBm   | -40                     |                                                                         |       |       |
| $BW_{\text{interferer}}$                                                                                                                                                                                                                                                                    | MHz   | 3                       | 5                                                                       |       |       |
| $F_{\text{interferer}}$ (offset)                                                                                                                                                                                                                                                            | MHz   | 3 /- 3                  | $BW_{\text{Channel}}/2 + 2.5$<br>/<br>- $(BW_{\text{Channel}}/2 + 2.5)$ |       |       |
| NOTE 1: The transmitter shall be set to 24 dB below $P_{\text{CMAX\_L,f,c}}$ at the minimum UL configuration specified in clause 7.3.2 with $P_{\text{CMAX\_L,f,c}}$ defined in clause 6.2.4.                                                                                               |       |                         |                                                                         |       |       |
| NOTE 2: The absolute value of the interferer offset $F_{\text{interferer}}$ (offset) shall be further adjusted to $(\lceil F_{\text{interferer}} / SCS \rceil + 0.5) SCS$ 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] Annex 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: $P_{\text{interferer}}$ 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  $-(\text{MU} + \text{Uplink power control window size})$  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  $-(MU - \text{Uplink power control window size})$  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  $\geq 95\%$  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) |    |    |
|--------------|-------|-------------------------|----|----|
|              |       | 3, 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) |       |    |    |
|--------------|-------|-------------------------|-------|----|----|
|              |       | 3                       | 5, 10 | 15 | 20 |

|                                                                                                                                                                                                                                                                                                     |     |                   |                                                                        |                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------|------------------------------------------------------------------------|-------------------------------------|
| Power in transmission bandwidth configuration                                                                                                                                                                                                                                                       | dBm | REFSENS + 14 dB   |                                                                        |                                     |
| $P_{\text{interferer}}$                                                                                                                                                                                                                                                                             | dBm | REFSENS + 45.5 dB |                                                                        | REFSENS + 42.5 dB<br>REFSENS + 39.5 |
| $BW_{\text{interferer}}$                                                                                                                                                                                                                                                                            | MHz | 3                 | 5                                                                      |                                     |
| $F_{\text{interferer}} \text{ (offset)}^2$                                                                                                                                                                                                                                                          | MHz | 3 /- 3            | $BW_{\text{Channel}}/2 + 2.5$<br>/<br>$-(BW_{\text{Channel}}/2 + 2.5)$ |                                     |
| NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX\_L,f,c}}$ at the minimum UL configuration specified in clause 7.3.2 with $P_{\text{CMAX\_L,f,c}}$ defined in clause 6.2.4.                                                                                                        |     |                   |                                                                        |                                     |
| NOTE 2: The absolute value of the interferer offset $F_{\text{interferer}} \text{ (offset)}$ shall be further adjusted to $(\lceil F_{\text{interferer}} / SCS \rceil + 0.5) SCS$ 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: $P_{\text{interferer}}$ shall be rounded to the next higher 0.5dB value.                                                                                                                                                                                                                    |     |                   |                                                                        |                                     |

**Table 7.5.5-3: Test parameters for NR bands with  $F_{\text{DL\_high}} < 2,700$  MHz and  $F_{\text{UL\_high}} < 2,700$  MHz, case 2**

| RX parameter                                                                                                                                                                                                                                                                                | Units | Channel bandwidth (MHz) |                                                                      |       |       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------|----------------------------------------------------------------------|-------|-------|
|                                                                                                                                                                                                                                                                                             |       | 3                       | 5, 10                                                                | 15    | 20    |
| Power in transmission bandwidth configuration                                                                                                                                                                                                                                               | dBm   | -71.5                   |                                                                      | -68.5 | -65.5 |
| $P_{\text{interferer}}$                                                                                                                                                                                                                                                                     | dBm   | -40                     |                                                                      |       |       |
| $BW_{\text{interferer}}$                                                                                                                                                                                                                                                                    | MHz   | 3                       | 5                                                                    |       |       |
| $F_{\text{interferer}}$ (offset)                                                                                                                                                                                                                                                            | MHz   | 3 /- 3                  | $\frac{BW_{\text{Channel}}/2 + 2.5}{-(BW_{\text{Channel}}/2 + 2.5)}$ |       |       |
| NOTE 1: The transmitter shall be set to 24 dB below $P_{\text{CMAX\_L,f,c}}$ at the minimum UL configuration specified in clause 7.3.2 with $P_{\text{CMAX\_L,f,c}}$ defined in clause 6.2.4.                                                                                               |       |                         |                                                                      |       |       |
| NOTE 2: The absolute value of the interferer offset $F_{\text{interferer}}$ (offset) shall be further adjusted to $(\lceil F_{\text{interferer}} / SCS \rceil + 0.5) SCS$ 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] Annex 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: $P_{\text{interferer}}$ shall be rounded to the next higher 0.5dB 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

#### 7.6.2.1 Test purpose

In-band blocking is defined for an unwanted interfering signal falling into the range from 15 MHz below to 15 MHz above the UE receive band, with  $F_{\text{DL\_high}} < 2700$  MHz and  $F_{\text{UL\_high}} < 2700$  MHz, or into an immediately adjacent

frequency range up to  $3 \cdot BW_{\text{Channel}}$  below or above the UE receive band, with  $F_{\text{DL\_low}} \geq 3300$  MHz and  $F_{\text{UL\_low}} \geq 3300$  MHz, at which the relative throughput shall meet or exceed the requirement for the specified measurement channel.

### 7.6.2.2 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.

### 7.6.2.3 Minimum conformance requirements

For NR satellite bands with  $F_{\text{DL\_high}} < 2700$  MHz and  $F_{\text{UL\_high}} < 2700$  MHz in-band blocking (IBB) is defined for an unwanted interfering signal falling into the UE receive band or into the first 15 MHz below or above the UE receive band.

The throughput of the wanted signal shall be  $\geq 95$  % 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 7.6.2-1 and Table 7.6.2-2. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

**Table 7.6.2-1: In-band blocking parameters for NR satellite bands with  $F_{\text{DL\_high}} < 2700$  MHz and  $F_{\text{UL\_high}} < 2700$  MHz**

|                                                                                                                                                                                            |     | 3              | 5, 10 | 15             | 20             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------------|-------|----------------|----------------|
| Power in transmission bandwidth configuration                                                                                                                                              | dBm | REFSENS + 6 dB |       | REFSENS + 7 dB | REFSENS + 9 dB |
| BW <sub>interferer</sub>                                                                                                                                                                   | MHz | 3              | 5     |                |                |
| F <sub>offset, case 1</sub>                                                                                                                                                                | MHz | 4.5            | 7.5   |                |                |
| F <sub>offset, case 2</sub>                                                                                                                                                                | MHz | 7.5            | 12.5  |                |                |
| NOTE 1: The transmitter shall be set to 4 dB below P <sub>CMAX_L,f,c</sub> at the minimum UL configuration specified in clause 7.3.2 with P <sub>CMAX_L,f,c</sub> defined in clause 6.2.4. |     |                |       |                |                |
| NOTE 2: The interferer consists of the RMC specified in Annex 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 3: Power in transmission bandwidth configuration shall be rounded to the next higher 0.5dB value.                                                                                     |     |                |       |                |                |

**Table 7.6.2-2: In-band blocking for NR satellite bands with  $F_{\text{DL\_high}} < 2700$  MHz and  $F_{\text{UL\_high}} < 2700$  MHz**

| Operating Band                                                                                                                                                                                                                                                                  | Parameter                        | Unit | Case 1                                                                                                             | Case 2                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                 | $P_{\text{interferer}}$          | dBm  | -56                                                                                                                | -44                                                                                                                          |
| n252, n254, n255, n256                                                                                                                                                                                                                                                          | $F_{\text{interferer (offset)}}$ | MHz  | $-BW_{\text{Channel}}/2 - F_{\text{offset, case 1}}$<br>and<br>$BW_{\text{Channel}}/2 + F_{\text{offset, case 1}}$ | $\leq -BW_{\text{Channel}}/2 - F_{\text{offset, case 2}}$<br>and<br>$\geq BW_{\text{Channel}}/2 + F_{\text{offset, case 2}}$ |
|                                                                                                                                                                                                                                                                                 | $F_{\text{interferer}}$          | MHz  | NOTE 2                                                                                                             | $F_{\text{DL\_low}} - 15$<br>to<br>$F_{\text{DL\_high}} + 15$                                                                |
| NOTE 1: The absolute value of the interferer offset $F_{\text{interferer (offset)}}$ shall be further adjusted to $( F_{\text{interferer}}  / SCS) + 0.5$ 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 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: $-BW_{\text{Channel}}/2 - F_{\text{offset, case 1}}$ ; b: $BW_{\text{Channel}}/2 + F_{\text{offset, case 1}}$                                                            |                                  |      |                                                                                                                    |                                                                                                                              |

The normative reference for this requirement is TS 38.101-5 [11] clause 7.6.2.

## 7.6.2.4 Test description

### 7.6.2.4.1 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 NTN 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 7.6.2.4.1-1. 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 7.6.2.4.1-1: 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                                                                            |                        |               | Lowest               |               |
| Test Parameters                                                                                                   |                        |               |                      |               |
|                                                                                                                   | Downlink Configuration |               | Uplink Configuration |               |
| Test ID                                                                                                           | Mod'n                  | RB allocation | Mod'n                | RB allocation |
| 1                                                                                                                 | CP-OFDM QPSK           | NOTE 1        | DFT-s-OFDM QPSK      | NOTE 1        |
| NOTE 1: The specific configuration of downlink and uplink are defined in Table 7.3.2.4.1-2 and 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, in Figure A.3.1.4.1 for TE diagram and section 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 7.6.2.4.1-1.
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 38.508-1 [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 the 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 7.6.2.4.3.

### 7.6.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 7.6.2.4.1-1. 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 7.6.2.4.1-1. 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 parameters of the signal generator for an interfering signal below the wanted signal in Case 1 according to Tables 7.6.2.5-1 and 7.6.2.5-2.
4. Set the downlink signal level according to the table 7.6.2.5-1. 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  $-\text{MU}$  to  $-(\text{MU} + \text{Uplink power control window size})$  dB of the target power level in Table 7.6.2.5-1 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.
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 in Case 1 at step 3.
7. Repeat steps from 3 to 6, using interfering signals in Case 2 at step 3 and 6. The ranges of case 2 are covered in steps equal to the interferer bandwidth. Interferer frequencies should be chosen starting with an offset nearest to the centre frequency and sweep outwards towards the band edges. In order to ensure that full range is tested for interferer frequency, run last test steps at frequency equal to  $F_{\text{Interferer}}$  range limit defined at the corresponding band edge.
8. If applicable based on NR band, repeat steps from 3 to 5, using interfering signals in Case 3 at step 3.
9. If applicable based on NR band, repeat steps from 3 to 5, using interfering signals in Case 4 at step 3.

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.

#### 7.6.2.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

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

#### 7.6.2.5 Test requirement

For NR bands with  $F_{\text{DL\_high}} < 2700$  MHz and  $F_{\text{UL\_high}} < 2700$  MHz, the throughput measurement derived in test procedure shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annex in Annexes A.3.2 with parameters specified in Tables 7.6.2.5-1 and 7.6.2.5-2.

**Table 7.6.2.5-1: In-band blocking parameters for NR satellite bands with  $F_{DL\_high} < 2700$  MHz and  $F_{UL\_high} < 2700$  MHz**

|                                                                                                                                                                                            |     | 3              | 5, 10 | 15             | 20             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------------|-------|----------------|----------------|
| Power in transmission bandwidth configuration                                                                                                                                              | dBm | REFSENS + 6 dB |       | REFSENS + 7 dB | REFSENS + 9 dB |
| BW <sub>interferer</sub>                                                                                                                                                                   | MHz | 3              | 5     |                |                |
| F <sub>offset, case 1</sub>                                                                                                                                                                | MHz | 4.5            | 7.5   |                |                |
| F <sub>offset, case 2</sub>                                                                                                                                                                | MHz | 7.5            | 12.5  |                |                |
| NOTE 1: The transmitter shall be set to 4 dB below P <sub>CMAX_L,f,c</sub> at the minimum UL configuration specified in clause 7.3.2 with P <sub>CMAX_L,f,c</sub> defined in clause 6.2.4. |     |                |       |                |                |
| NOTE 2: The interferer consists of the RMC specified in Annex 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 3: Power in transmission bandwidth configuration shall be rounded to the next higher 0.5dB value.                                                                                     |     |                |       |                |                |

**Table 7.6.2.5-2: In-band blocking for NR satellite bands with  $F_{DL\_high} < 2700$  MHz and  $F_{UL\_high} < 2700$  MHz**

| Operating Band                                                                                                                                                                                                                                                    | Parameter                 | Unit | Case 1                                                                                 | Case 2                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                   | $P_{interferer}$          | dBm  | -56                                                                                    | -44                                                                                              |
| n252,<br>n254,<br>n255,<br>n256                                                                                                                                                                                                                                   | $F_{interferer}$ (offset) | MHz  | $-BW_{Channel}/2 - F_{offset, case 1}$<br>and<br>$BW_{Channel}/2 + F_{offset, case 1}$ | $\leq -BW_{Channel}/2 - F_{offset, case 2}$<br>and<br>$\geq BW_{Channel}/2 + F_{offset, case 2}$ |
|                                                                                                                                                                                                                                                                   | $F_{interferer}$          | MHz  | NOTE 2                                                                                 | $F_{DL\_low} - 15$<br>to<br>$F_{DL\_high} + 15$                                                  |
| NOTE 1: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $( F_{interferer}  / SCS + 0.5) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. |                           |      |                                                                                        |                                                                                                  |
| NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: $-BW_{Channel}/2 - F_{offset, case 1}$ ; b: $BW_{Channel}/2 + F_{offset, case 1}$                                                                          |                           |      |                                                                                        |                                                                                                  |

## 7.6.3 Out of Band Blocking

### 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  $\geq 95\%$  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 <sup>2</sup>                                                                                                                     | 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                                                                              |
| n252                                                                                                                                                                           | $F_{interferer}$ (CW) | MHz  | $-110 < f - F_{DL\_low} < -15$<br>or<br>$15 < f - F_{DL\_high} < 60$ | $-155 < f - F_{DL\_low} \leq -110$<br>or<br>$60 \leq f - F_{DL\_high} < 85$ | $1 \leq f \leq F_{DL\_low} - 155$<br>or<br>$F_{DL\_high} + 85 \leq f \leq 12750$ |
| n254 <sup>2</sup>                                                                                                                                                              | $F_{interferer}$ (CW) | MHz  | $-60 < f - F_{DL\_low} < -15$<br>or<br>$15 < f - F_{DL\_high} < 60$  | $-85 < f - F_{DL\_low} \leq -60$<br>or<br>$60 \leq f - F_{DL\_high} < 85$   | $1 \leq f \leq F_{DL\_low} - 85$<br>or<br>$F_{DL\_high} + 85 \leq f \leq 12750$  |
| n255                                                                                                                                                                           | $F_{interferer}$ (CW) | MHz  | $-60 < f - F_{DL\_low} < -15$<br>or<br>$15 < f - F_{DL\_high} < 60$  | $-85 < f - F_{DL\_low} \leq -60$<br>or<br>$60 \leq f - F_{DL\_high} < 85$   | $1 \leq f \leq F_{DL\_low} - 85$<br>or<br>$F_{DL\_high} + 85 \leq f \leq 12750$  |
| n256 <sup>1</sup>                                                                                                                                                              | $F_{interferer}$ (CW) | MHz  | $-100 < f - F_{DL\_low} < -15$<br>or<br>$15 < f - F_{DL\_high} < 60$ | $-145 < f - F_{DL\_low} \leq -100$<br>or<br>$60 \leq f - F_{DL\_high} < 85$ | $1 \leq f \leq F_{DL\_low} - 145$<br>or<br>$F_{DL\_high} + 85 \leq f \leq 12750$ |
| NOTE 1: Band n256 lower frequency ranges are modified to enable specific implementations                                                                                       |                       |      |                                                                      |                                                                             |                                                                                  |
| NOTE 2: Band n254 power level of the interferer ( $P_{interferer}$ ) for Range 3 shall be modified to -20 dBm for $F_{interferer} > 2585$ MHz and $F_{interferer} < 2775$ MHz. |                       |      |                                                                      |                                                                             |                                                                                  |
| 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 and downlink reference measurement channels (RMCs) are specified in TS 38.521-1 [2] clause A.2 and A.3. 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**

| Default Conditions                                                                                                                                          |                        |               |                                                                                   |               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------|-----------------------------------------------------------------------------------|---------------|
| Test Environment as specified in TS 38.508-1 [5] subclause 4.1                                                                                              |                        |               | Normal                                                                            |               |
| Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1                                                                                            |                        |               | Low range                                                                         |               |
| Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1                                                                                     |                        |               | Lowest, Mid, Highest<br>Lowest UL / Lowest DL, Lowest UL / Highest DL<br>(NOTE 3) |               |
| Test SCS as specified in TS 38.508-1 [5] subclause 4.3.1                                                                                                    |                        |               | Lowest                                                                            |               |
| Test Parameters                                                                                                                                             |                        |               |                                                                                   |               |
|                                                                                                                                                             | Downlink Configuration |               | Uplink Configuration                                                              |               |
| Test ID                                                                                                                                                     | Mod'n                  | RB allocation | Mod'n                                                                             | 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.                                                                 |                        |               |                                                                                   |               |
| NOTE 2: Void.                                                                                                                                               |                        |               |                                                                                   |               |
| NOTE 3: Additional test points selected according to asymmetric channel bandwidths specified in clause 5.3.6. DL channel bandwidth shall be selected first. |                        |               |                                                                                   |               |

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.1, C.2, C.3 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 Channel is set according to Table 7.6.3.4.1-1.
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. Optionally, for GSO only device to reduce the test time, preconfigure the UE by any means to deactivate ephemeris consistency check so that the UE accepts NGSO (LEO-600) ephemeris.
- 8a. In case the ephemeris consistency check on the UE can be deactivated as described in step 7, the test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] Table 5.6.2.1-2 for NGSO (LEO-600).
- 8b. In case the ephemeris consistency check on the UE cannot be deactivated as described in step 7, the 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 satellites and Table 5.6.2.1-2 for NGSO (LEO-600) if UE supports only NGSO satellites or both GSO and 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
9. Deactivate UE prediction of satellite trajectory by any preconfigured means.
10. 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 7.6.3.4.3.

#### 7.6.3.4.2 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 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 below the wanted signal according to Table 7.6.3.5-2 or 7.6.3.5-4. The frequency step size is  $\min(BW_{channel}/2, 5)$  MHz.
4. Set the downlink signal level according to the table 7.6.3.5-1 or 7.6.3.5-3. 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 7.6.3.5-1 or Table 7.6.3.5-3 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 [2], 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. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.
6. Record the frequencies for which the throughput doesn't meet the requirements.
7. Repeat steps from 3 to 6, using an interfering signal above the wanted signal at step 3.

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.

#### 7.6.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-118 with condition TRANSFORM\_PRECODER\_ENABLED.

#### 7.6.3.5 Test requirement

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  $\geq 95\%$  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 <sup>2</sup>                                                                                                                     | 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                                                                              |
| n252                                                                                                                                                                           | $F_{interferer}$ (CW) | MHz  | $-110 < f - F_{DL\_low} < -15$<br>or<br>$15 < f - F_{DL\_high} < 60$ | $-155 < f - F_{DL\_low} \leq -110$<br>or<br>$60 \leq f - F_{DL\_high} < 85$ | $1 \leq f \leq F_{DL\_low} - 155$<br>or<br>$F_{DL\_high} + 85 \leq f \leq 12750$ |
| n254 <sup>2</sup>                                                                                                                                                              | $F_{interferer}$ (CW) | MHz  | $-60 < f - F_{DL\_low} < -15$<br>or<br>$15 < f - F_{DL\_high} < 60$  | $-85 < f - F_{DL\_low} \leq -60$<br>or<br>$60 \leq f - F_{DL\_high} < 85$   | $1 \leq f \leq F_{DL\_low} - 85$<br>or<br>$F_{DL\_high} + 85 \leq f \leq 12750$  |
| n255                                                                                                                                                                           | $F_{interferer}$ (CW) | MHz  | $-60 < f - F_{DL\_low} < -15$<br>or<br>$15 < f - F_{DL\_high} < 60$  | $-85 < f - F_{DL\_low} \leq -60$<br>or<br>$60 \leq f - F_{DL\_high} < 85$   | $1 \leq f \leq F_{DL\_low} - 85$<br>or<br>$F_{DL\_high} + 85 \leq f \leq 12750$  |
| n256 <sup>1</sup>                                                                                                                                                              | $F_{interferer}$ (CW) | MHz  | $-100 < f - F_{DL\_low} < -15$<br>or<br>$15 < f - F_{DL\_high} < 60$ | $-145 < f - F_{DL\_low} \leq -100$<br>or<br>$60 \leq f - F_{DL\_high} < 85$ | $1 \leq f \leq F_{DL\_low} - 145$<br>or<br>$F_{DL\_high} + 85 \leq f \leq 12750$ |
| NOTE 1: Band n256 lower frequency ranges are modified to enable specific implementations                                                                                       |                       |      |                                                                      |                                                                             |                                                                                  |
| NOTE 2: Band n254 power level of the interferer ( $P_{interferer}$ ) for Range 3 shall be modified to -20 dBm for $F_{interferer} > 2585$ MHz and $F_{interferer} < 2775$ MHz. |                       |      |                                                                      |                                                                             |                                                                                  |
| 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.

## 7.6.4 Narrow band blocking

### 7.6.4.1 Test Purpose

Verifies a receiver's ability to receive a NR signal at its assigned channel frequency in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

The lack of narrow-band blocking ability will decrease the coverage area when other NR Node B transmitters exist (except in the adjacent channels and spurious response).

### 7.6.4.2 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.

### 7.6.4.3 Minimum Conformance Requirements

The relative throughput shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.4.3-1.

**Table 7.6.4.3-1: Narrow Band Blocking**

| Operating Band                                                                                                                                                                                                 | Parameter                                         | Unit | Channel Bandwidth (MHz)                                                                        |    |    |    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------|------------------------------------------------------------------------------------------------|----|----|----|----|
|                                                                                                                                                                                                                |                                                   |      | 3                                                                                              | 5  | 10 | 15 | 20 |
| n251,<br>n252,<br>n253,<br>n254,<br>n255,<br>n256                                                                                                                                                              | P <sub>w</sub>                                    | dBm  | P <sub>REFSENS</sub> + channel-bandwidth specific value below                                  |    |    |    |    |
|                                                                                                                                                                                                                |                                                   |      | 18                                                                                             | 16 | 13 | 14 | 16 |
|                                                                                                                                                                                                                | P <sub>UW</sub> (CW)                              | dBm  | -55                                                                                            |    |    |    |    |
|                                                                                                                                                                                                                | F <sub>UW</sub> (offset SCS= 15 kHz) <sup>3</sup> | MHz  | $\left(\left\lceil\frac{\frac{BW_{channel}}{2} + 0.2}{SCS} + 0.5\right\rceil + 0.5\right) SCS$ |    |    |    |    |
|                                                                                                                                                                                                                | F <sub>UW</sub> (offset SCS= 30 kHz) <sup>3</sup> | MHz  | NA                                                                                             |    |    |    |    |
| NOTE 1: The transmitter shall be set a 4 dB below P <sub>C<sub>MAX</sub>_L,f,c</sub> at the minimum UL configuration specified in clause 7.3.2 with P <sub>C<sub>MAX</sub>_L,f,c</sub> defined in clause 6.2.4 |                                                   |      |                                                                                                |    |    |    |    |
| NOTE 2: The P <sub>REFSENS</sub> power level is specified in clause 7.3.2.                                                                                                                                     |                                                   |      |                                                                                                |    |    |    |    |
| NOTE 3: F <sub>UW</sub> shall be rounded to half of SCS.                                                                                                                                                       |                                                   |      |                                                                                                |    |    |    |    |

The normative reference for this requirement is TS 38.101-5 [11] clause 7.6.4.

### 7.6.4.4 Test Description

#### 7.6.4.4.1 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, and channel bandwidths based on NR NTN 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 7.6.4.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3 respectively. 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 7.6.4.4.1-1: 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 and Highest                   |               |
| Test SCS as specified in TS 38.508-1 [12] subclause 4.3.1                                                         |                        |               | According to CH BW SCS in table 7.6.4.3-1 |               |
| Test Parameters                                                                                                   |                        |               |                                           |               |
|                                                                                                                   | Downlink Configuration |               | Uplink Configuration                      |               |
| Test ID                                                                                                           | Mod'n                  | RB allocation | Mod'n                                     | RB allocation |
| 1                                                                                                                 | CP-OFDM QPSK           | NOTE 1        | DFT-s-OFDM QPSK                           | NOTE 1        |
| NOTE 1: The specific configuration of downlink and uplink are defined in Table 7.3.2.4.1-2 and 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, in Figure A.3.1.4.2 for TE diagram and section 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, 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 UL and DL Reference Measurement channels are set according to Table 7.6.4.4.1-1.
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 38.508-1 [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 the 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 according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 7.6.4.4.3.

#### 7.6.4.4.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 7.6.4.4.1-1. 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 Table 7.6.4.4.1-1. 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 below the wanted signal according to Table 7.6.4.5-1.
4. Set the downlink signal level according to the table 7.6.4.5-1. 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 7.6.4.5-1 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.

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 3.

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.

#### 7.6.4.4.3 Message Contents

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

#### 7.6.4.5 Test Requirement

The throughput measurement derived in test procedure shall be  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 with parameters specified in Table 7.6.4.5-1.

**Table 7.6.4.5-1: Narrow Band Blocking**

| Operating Band                                                                                                                                                                           | Parameter                                         | Unit | Channel Bandwidth (MHz)                                                              |                                                               |    |    |    |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------|--------------------------------------------------------------------------------------|---------------------------------------------------------------|----|----|----|--|
|                                                                                                                                                                                          |                                                   |      | 3                                                                                    | 5                                                             | 10 | 15 | 20 |  |
| n251,<br>n252,<br>n253,<br>n254,<br>n255,<br>n256                                                                                                                                        | P <sub>w</sub>                                    | dBm  |                                                                                      | P <sub>REFSENS</sub> + channel-bandwidth specific value below |    |    |    |  |
|                                                                                                                                                                                          |                                                   |      | 18                                                                                   | 16                                                            | 13 | 14 | 16 |  |
|                                                                                                                                                                                          | P <sub>UW</sub> (CW)                              | dBm  | -55                                                                                  |                                                               |    |    |    |  |
|                                                                                                                                                                                          | F <sub>UW</sub> (offset SCS= 15 kHz) <sup>3</sup> | MHz  | $\left(\left(\frac{\frac{BW_{channel}}{2} + 0.2}{SCS} + 0.5\right) + 0.5\right) SCS$ |                                                               |    |    |    |  |
|                                                                                                                                                                                          | F <sub>UW</sub> (offset SCS= 30 kHz) <sup>3</sup> | MHz  | NA                                                                                   |                                                               |    |    |    |  |
| NOTE 1: The transmitter shall be set a 4 dB below P <sub>CMAX_L,f,c</sub> at the minimum UL configuration specified in clause 7.3.2 with P <sub>CMAX_L,f,c</sub> defined in clause 6.2.4 |                                                   |      |                                                                                      |                                                               |    |    |    |  |
| NOTE 2: The P <sub>REFSENS</sub> power level is specified in clause 7.3.2.                                                                                                               |                                                   |      |                                                                                      |                                                               |    |    |    |  |
| NOTE 3: F <sub>UW</sub> shall be rounded to half of SCS.                                                                                                                                 |                                                   |      |                                                                                      |                                                               |    |    |    |  |

## 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  $\geq 95$  % 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 <sup>2</sup>                                                                                                                        | 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  $-\text{MU}$  to  $-(\text{MU} + \text{Uplink power control window size})$  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  $\geq 95\%$  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  $F_{\text{DL\_high}} < 2,700$  MHz and  $F_{\text{UL\_high}} < 2,700$  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  $F_{\text{DL\_high}} < 2,700$  MHz and  $F_{\text{UL\_high}} < 2,700$  MHz**

| RX parameter                                                                                                                                                                                    | Units | Channel bandwidth (MHz) |                |                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------|----------------|----------------|
|                                                                                                                                                                                                 |       | 5, 10                   | 15             | 20             |
| Power in transmission bandwidth configuration <sup>2</sup>                                                                                                                                      | dBm   | REFSENS + 6 dB          | REFSENS + 7 dB | REFSENS + 9 dB |
| NOTE 1: The transmitter shall be set to 4 dB below $P_{\text{CMAX\_L,f,c}}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{\text{CMAX\_L,f,c}}$ 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                         |
|--------------------------------------|------|-------------------------------|
| $P_{\text{Interferer}} \text{ (CW)}$ | dBm  | -44                           |
| $F_{\text{Interferer}}$              | 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  $\geq 95\%$  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 <sup>5</sup>                                                                                                                                                                                                                                                                                                      | dBm   | REFSENS + 6 dB                                        | REFSENS + 7 dB | REFSENS + (9 + 10log <sub>10</sub> (BW <sub>Channel</sub> /20)) dB |
| $P_{Interferer\ 1}$ (CW)                                                                                                                                                                                                                                                                                                                                                | dBm   | -46                                                   |                |                                                                    |
| $P_{Interferer\ 2}$ (Modulated)                                                                                                                                                                                                                                                                                                                                         | dBm   | -46                                                   |                |                                                                    |
| BW <sub>Interferer 2</sub>                                                                                                                                                                                                                                                                                                                                              | MHz   | 5                                                     |                |                                                                    |
| $F_{Interferer\ 1}$ (Offset)                                                                                                                                                                                                                                                                                                                                            | MHz   | $\frac{-BW_{channel}/2 - 7.5}{+BW_{channel}/2 + 7.5}$ |                |                                                                    |
| $F_{Interferer\ 2}$ (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] Annex 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: 10log <sub>10</sub> (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  $-(\text{MU} + \text{Uplink power control window size})$  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  $\geq 95\%$  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 <sup>5</sup>                                                                                                                                                                                                                                                                                                                  | dBm   | REFSENS + 6 dB                                        | REFSENS + 7 dB | REFSENS + (9 + 10log <sub>10</sub> (BW <sub>Channel</sub> /20)) dB |
| $P_{Interferer\ 1}$ (CW)                                                                                                                                                                                                                                                                                                                                                            | dBm   | -46                                                   |                |                                                                    |
| $P_{Interferer\ 2}$ (Modulated)                                                                                                                                                                                                                                                                                                                                                     | dBm   | -46                                                   |                |                                                                    |
| BW <sub>Interferer 2</sub>                                                                                                                                                                                                                                                                                                                                                          | MHz   | 5                                                     |                |                                                                    |
| $F_{Interferer\ 1}$ (Offset)                                                                                                                                                                                                                                                                                                                                                        | MHz   | $\frac{-BW_{channel}/2 - 7.5}{+BW_{channel}/2 + 7.5}$ |                |                                                                    |
| $F_{Interferer\ 2}$ (Offset)                                                                                                                                                                                                                                                                                                                                                        | MHz   | 2*F <sub>Interferer 1</sub>                           |                |                                                                    |
| NOTE 1: The transmitter shall be set to 4 dB below P <sub>CMAX_L,f,c</sub> at the minimum UL configuration specified in Table 7.3.2.3-3 with P <sub>CMAX_L,f,c</sub> 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 <sub>Interferer 1</sub> (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 <sub>Interferer 2</sub> (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: 10log <sub>10</sub> (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 |
|---------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------|
| $30 \text{ MHz} \leq f < 1 \text{ GHz}$                                                                                         | 100 kHz               | -57 dBm       |      |
| $1 \text{ GHz} \leq f \leq 12.75 \text{ GHz}$                                                                                   | 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 |
|---------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------|
| $30 \text{ MHz} \leq f < 1 \text{ GHz}$                                                                                         | 100 kHz               | -57 dBm       |      |
| $1 \text{ GHz} \leq f \leq 12.75 \text{ GHz}$                                                                                   | 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

### 8.1 General

#### 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  $E_s$  is transmitted.
  - External white noise source with power spectral density  $N_{oc}$  is used.
  - $E_s$  and  $N_{oc}$  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,  $E_s$  and  $N_{oc}$  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  $N_{oc}$  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  $N_{oc}$  power spectrum density shall be larger or equal to the minimum  $N_{oc}$  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  $N_{oc}$  power level of -145 dBm/Hz shall be used for all operating bands.

##### 8.1.3.4.2.1 Derivation of $N_{oc}$ values for NR operating bands in FR1

The minimum  $N_{oc}$  power level for an operating band, subcarrier spacing and channel bandwidth is derived based on the following equation:

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

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 <i>ntn-ScenarioSupport-r17</i> 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<br>$l_0 = 10$ 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 ( $\rho$ )                                                               |         | 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:<br>10 for CSI-RS resource 1 and 2<br>11 for CSI-RS resource 3 and 4                                                                                         |
|                                | Frequency Occupation                                                             |         | Start PRB 0<br>Number of PRB = $\text{ceil}(\text{BWP size}/4)*4$                                                                                                       |
|                                | 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<br>'FD-CDM2' for 2 and 4 transmit antenna                                                                                               |
|                                | Density ( $\rho$ )                                                               |         | 1                                                                                                                                                                       |
|                                | CSI-RS periodicity                                                               | Slots   | 15 kHz SCS: 20                                                                                                                                                          |
|                                | CSI-RS offset                                                                    | Slots   | 0                                                                                                                                                                       |
|                                | Frequency Occupation                                                             |         | Start PRB 0<br>Number of PRB = $\text{ceil}(\text{BWP size}/4)*4$                                                                                                       |
|                                | 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 ( $\rho$ )                                  |                 |       | 1                                                                                                                                                                                                                                 |
|                                                                                                                                                           | CSI-RS periodicity                                  |                 | Slots | 15 kHz SCS: 20                                                                                                                                                                                                                    |
|                                                                                                                                                           | CSI-RS offset                                       |                 | Slots | 0                                                                                                                                                                                                                                 |
|                                                                                                                                                           | Frequency Occupation                                |                 |       | Start PRB 0<br>Number of PRB = $\text{ceil}(\text{BWP size}/4)*4$                                                                                                                                                                 |
| 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                                                                                                                |                                                     |                 |       | For number of TX = 1: No precoding;<br>For number of TX > 1: 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

FFS

### 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<br>11 for CSI-RS resource 3 and 4.                                                                                                                                                                            |
| Number of HARQ Processes                                                 |                                                         |       | 16 for Test 1-1, Test 1-2<br>32 for Test 1-3<br>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<br>N/A for Test 1-4                                                                                                                                                                                      |
| Maximum number of HARQ transmission                                      |                                                         |       | 4 for Test 1-1, Test 1-2, Test 1-3<br>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

##### 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

Test 1-1 and Test 1-2 applies to all types of NTN UE release 17 and forward supporting satellite access.

Test 1-3 applies to all types of NTN UE release 17 and forward supporting satellite access and supporting max-HARQ-ProcessNumber-r17 with 32 DL HARQ process.

Test 1-4 applies to all types of NTN UE release 17 and forward supporting satellite access and supporting harq-FeedbackDisabled-r17.

##### 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 5.6.2.1-2 for NGSO (LEO-600) if UE supports only NGSO satellites or both GSO and NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in clause 8.2.1.2.2.1.1\_1.3.3.
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 clause G.1. 5.
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 with following exceptions:

SIB19 contents as TS 38.508-1 [12] clause 5.6.2.1 with exceptions in Table 8.2.1.2.2.1.1\_1.3.3-4:

**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<br>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 {<br>slots20 | 10 (for CSI-RS resources 1 and 2)<br>11 (for CSI-RS resources 3 and 4) |         |           |
| }                                                        |                                                                        |         |           |

**Table 8.2.1.2.2.1.1\_1.3.3-4: SIB19**

| Derivation Path: TS 38.508-1 [6], Table 5.6.3.1-1 |              |         |           |
|---------------------------------------------------|--------------|---------|-----------|
| Information Element                               | Value/remark | Comment | Condition |
| SIB19-r17 ::= SEQUENCE {                          |              |         |           |
| ntn-Config-r17 ::= SEQUENCE {                     |              |         |           |
| cellSpecificKoffset-r17                           | 8            |         |           |
| }                                                 |              |         |           |
| }                                                 |              |         |           |

**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        |

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# 9

# 10

## 11 Demodulation performance requirements (Radiated requirements)

### 11.1 General

#### 11.1.2 Applicability of minimum requirements

The conducted minimum requirements specified in this specification shall be met in all applicable scenarios for FR2-NTN.

#### 11.1.3 Radiated requirements

##### 11.1.3.1 Introduction

The requirements are defined for the following modes:

- Mode 1: Conditions with external noise source
  - Wanted signal with power level  $E_s$  is transmitted.
  - External white noise source with power spectral density  $N_{oc}$  is used.
  - $E_s$  and  $N_{oc}$  levels are selected to achieve target SNR as described in Clause 11.1.3.3.

##### 11.1.3.2 Reference point

The reference point for SNR,  $E_s$  and  $N_{oc}$  of DL signal is the UE antenna connector or connectors.

##### 11.1.3.3 SNR definition

For Mode 1 conditions UE demodulation and CSI requirements, the Minimum performance requirement in clause 11 are defined relative to the baseband SNR level  $SNR_{BB}$ . The SNR at the reference point is defined as

$$SNR = SNR_{BB} + \Delta_{BB}$$

where  $\Delta_{BB}$  is specified in clause 4.5.3.

The reference point SNR is defined as:

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

- $N_{RX}$  denotes the number of receiver reference points, and the super script receiver reference point  $j$ .
- 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.

#### 11.1.3.4 Noc

##### 11.1.3.4.1 Introduction

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

##### 11.1.3.4.2 Noc for operating bands in FR2-NTN

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

## 11.2 Demodulation performance requirements

### 11.2.1 General

#### 11.2.1.1 Applicability of requirements

##### 11.2.1.1.1 General

The minimum performance requirements are applicable to all FR2-NTN operating bands defined in clause 5.2.

If same test is listed for different UE features/capabilities in Clauses 11.2.1.1.2, then this test shall apply for UEs which support all corresponding UE features/capabilities.

##### 11.2.1.1.2 Applicability of requirements for optional UE features

The performance requirements in Table 11.2.1.1.2-1 shall apply for UEs which support optional UE features only.

**Table 11.2.1.1.2-1: Requirements applicability for optional UE features**

| UE feature/capability [11]                                                   | Test type |       | Test list                                                    | Applicability notes                                                                             |
|------------------------------------------------------------------------------|-----------|-------|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| NR NTN access (nonTerrestrialNetwork-r17)                                    | FR2-NTN   | PDCCH | Clause 11.2.3.1.1.1 (Test 1-1, Test 1-2)                     |                                                                                                 |
| NR NTN scenario support (ntn-ScenarioSupport-r17)                            | FR2-NTN   | PDSCH | Clause 11.2.2.1.1.1 (Test 2-1, Test 2-2, Test 2-3, Test 2-4) | The requirements apply only when <i>ntn-ScenarioSupport-r17</i> is "gso"                        |
|                                                                              | FR2-NTN   | PDSCH | Clause 11.2.2.1.1.1 (Test 1-1, Test 1-2, Test 1-3, Test 1-4) | The requirements apply only when <i>ntn-ScenarioSupport-r17</i> is "ngso" or is not configured. |
| Increasing the number of HARQ processes (max-HARQ-ProcessNumber-r17)         | FR2-NTN   | PDSCH | Clause 11.2.1.2.2.1 (Test 1-3, 2-3)                          |                                                                                                 |
| Disabled HARQ feedback for downlink transmission (harq-FeedbackDisabled-r17) | FR2-NTN   | PDSCH | Clause 11.2.1.2.2.1 (Test 1-4, 2-4)                          |                                                                                                 |

### 11.2.2 PDSCH demodulation requirements

The parameters specified in Table 11.2.2-1 are valid for all PDSCH tests unless otherwise stated.

Table 11.2.2-1: 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     | 120                                                                                                                                               |
| 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 38.101-2 [15] 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                                                                                                                                                 |
|                                | Number of PRBs in CORESET                                                        |         | Table 7.2-2 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                                       |         | No precoding                                                                                                                                      |
| 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<br>$l_0 = 10$ 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 ( $\rho$ )                                                               |         | 3 for CSI-RS resource 1,2,3,4                                                                                                                     |
|                                | CSI-RS periodicity                                                               | Slots   | 160 for CSI-RS resource 1,2,3,4                                                                                                                   |
|                                | CSI-RS offset                                                                    | Slots   | 80 for CSI-RS resource 1 and 2<br>81 for CSI-RS resource 3 and 4                                                                                  |
|                                | Frequency Occupation                                                             |         | Start PRB 0<br>Number of PRB = $\text{ceil}(\text{BWP size}/4)*4$                                                                                 |
|                                | 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)                                                       |         | 1                                                                                                                                                 |
|                                | CDM Type                                                                         |         | No CDM                                                                                                                                            |
|                                | Density ( $\rho$ )                                                               |         | 1                                                                                                                                                 |
|                                | CSI-RS periodicity                                                               | Slots   | 160                                                                                                                                               |
|                                | CSI-RS offset                                                                    | Slots   | 0                                                                                                                                                 |
|                                | Frequency Occupation                                                             |         | Start PRB 0<br>Number of PRB = $\text{ceil}(\text{BWP size}/4)*4$                                                                                 |
| 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 ( $\rho$ )                                                               |         | 1                                                                                                                                                 |
|                                | CSI-RS periodicity                                                               | Slots   | 160                                                                                                                                               |
|                                | CSI-RS offset                                                                    | Slots   | 0                                                                                                                                                 |

|                                                           |                                                                                                                                                    |                 |              |                                                                                      |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------|--------------------------------------------------------------------------------------|
|                                                           | Frequency Occupation                                                                                                                               |                 |              | Start PRB 0<br>Number of PRB = ceil(BWP size/4)*4                                    |
| ZP CSI-RS for CSI acquisition                             | First subcarrier index in the PRB used for CSI-RS                                                                                                  |                 |              | k <sub>0</sub> = 0 for CSI-RS resource 1,2                                           |
|                                                           | First OFDM symbol in the PRB used for CSI-RS                                                                                                       |                 |              | l <sub>0</sub> = 8 for CSI-RS resource 1<br>l <sub>0</sub> = 9 for CSI-RS resource 2 |
|                                                           | Number of CSI-RS ports (X)                                                                                                                         |                 |              | 1 for CSI-RS resource 1,2                                                            |
|                                                           | CDM Type                                                                                                                                           |                 |              | 'No CDM' for CSI-RS resource 1,2                                                     |
|                                                           | Density (ρ)                                                                                                                                        |                 |              | 3 for CSI-RS resource 1,2                                                            |
|                                                           | CSI-RS periodicity                                                                                                                                 |                 | Slots        | 160 for CSI-RS resource 1,2                                                          |
|                                                           | CSI-RS offset                                                                                                                                      |                 | Slots        | 0 for CSI-RS resource 1,2                                                            |
|                                                           | Frequency Occupation                                                                                                                               |                 |              | Start PRB 0<br>Number of PRB = ceil(BWP size/4)*4                                    |
|                                                           | Repetition                                                                                                                                         |                 |              | ON                                                                                   |
| QCL info                                                  |                                                                                                                                                    |                 | TCI state #1 |                                                                                      |
| 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       |              | SSB #0                                                                               |
|                                                           |                                                                                                                                                    | QCL Type        |              | Type D                                                                               |
| 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 |              | CSI-RS resource 1 from 'CSI-RS for tracking' configuration                           |
|                                                           |                                                                                                                                                    | QCL Type        |              | Type D                                                                               |
| PT-RS configuration                                       |                                                                                                                                                    |                 |              | Not configured                                                                       |
| Maximum number of code block groups for ACK/NACK feedback |                                                                                                                                                    |                 |              | 1                                                                                    |
| Maximum number of HARQ transmission                       |                                                                                                                                                    |                 |              | 4                                                                                    |
| HARQ ACK/NACK bundling                                    |                                                                                                                                                    |                 |              | Not configured                                                                       |
| Redundancy version coding sequence                        |                                                                                                                                                    |                 |              | {0,2,3,1}                                                                            |
| PDSCH & PDSCH DMRS Precoding configuration                |                                                                                                                                                    |                 |              | No precoding                                                                         |
| 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 38.101-2 [15] for tested channel bandwidth and subcarrier spacing. |                 |              |                                                                                      |
| Note 3:                                                   | Refer to Table 7.4.1.5.3-1 in [9]                                                                                                                  |                 |              |                                                                                      |

## 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.

The active uplink slots for FR1-NTN FDD configurations for NGSO are specified in Table A.2.1-1. FR1-NTN FDD slot patterns defined for reference sensitivity tests will be used for FR1-NTN FDD UL RMCs, unless otherwise stated.

**Table A.2.1-1: FR1-NTN FDD active uplink slots for NGSO**

| SCS                                                                                                                                | Active Uplink slots                                     |
|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 15 kHz                                                                                                                             | 0,1,2,3,4,5,8,9 in every frame                          |
| 30 kHz                                                                                                                             | 0,1,2,3,4,5,6,7,8,9,34,35,36,37,38,39 in every 2 frames |
| 60 kHz                                                                                                                             |                                                         |
| NOTE 1: Due to lack of HARQ processes for PUSCH and considering CellSpecificKoffset, all Uplink slots cannot be activated for NTN. |                                                         |
| NOTE 2: Assuming K2 is 2, CellSpecificKoffset is 14                                                                                |                                                         |

The active uplink slots for FR1-NTN FDD configurations for GSO are specified in Table A.2.1-2. FR1-NTN FDD slot patterns defined for reference sensitivity tests will be used for FR1-NTN FDD UL RMCs, unless otherwise stated.

**Table A.2.1-2: FR1-NTN FDD active uplink slots for GSO**

| SCS                                                                                                                                | Active Uplink slots                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 15 kHz                                                                                                                             | 262,263,264,265,266,267,268,269, 272,273,274, 275, 276, 277, 278, 279 in every 32 frames |
| 30 kHz                                                                                                                             | 522,523,524,525,526,527,528,529,530,531,532,53 3,534,535,536,537 in every 32 frames      |
| 60 kHz                                                                                                                             |                                                                                          |
| NOTE 1: The active slots are counted from the 0 <sup>th</sup> slot in the 1 <sup>st</sup> frame of the periodicity.                |                                                                                          |
| NOTE 2: Due to lack of HARQ processes for PUSCH and considering CellSpecificKoffset, all Uplink slots cannot be activated for NTN. |                                                                                          |
| NOTE 3: Assuming K2 is 2, CellSpecificKoffset is 258                                                                               |                                                                                          |

## 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 <sub>CRB</sub> ) | 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 <sub>CRB</sub> ≤ N <sub>RB</sub> .                                                                                                                                             |                                               |                                      |            |                    |              |                     |                 |                                         |                               |                                  |

## A.2.2.5 Void

## A.2.2.6 CP-OFDM QPSK

Table A.2.2.6-1: Reference Channels for CP-OFDM QPSK

| Parameter | Allocated resource blocks (L <sub>CRB</sub> ) | 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                            |

| 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 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------|------------|--------------------|--------------|---------------------|-----------------|-----------------------------------------|-------------------------------|----------------------------------|
|                                                                                                                                                                                                                                        | 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                            |
|                                                                                                                                                                                                                                        | 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                             |

| 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 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------|------------|--------------------|--------------|---------------------|-----------------|-----------------------------------------|-------------------------------|----------------------------------|
|                                                                                                                                                                                                                                        | 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                             |
|                                                                                                                                                                                                                                        | 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 eVoid

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## 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 $i = 1, \dots, 19$                                           | Bits  | 4,096             |  |  |  |  |
| Transport block CRC per Slot                                           |       |                   |  |  |  |  |
| For Slot $i = 0$                                                       | Bits  | N/A               |  |  |  |  |
| For Slots $i = 1, \dots, 19$                                           | Bits  | 24                |  |  |  |  |
| Number of Code Blocks per Slot                                         |       |                   |  |  |  |  |
| For Slot $i = 0$                                                       | CBs   | N/A               |  |  |  |  |
| For Slots $i = 1, \dots, 19$                                           | CBs   | 1                 |  |  |  |  |
| Binary Channel Bits Per Slot                                           |       |                   |  |  |  |  |
| For Slot $i = 0$                                                       | Bits  | N/A               |  |  |  |  |
| For Slots $i = 10, 11$                                                 | Bits  | 13,104            |  |  |  |  |
| For Slots $i = 1, \dots, 9, 12, \dots, 19$                             | 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 $i = 1, \dots, 19$                                           | Bits  | 13,064            |  |  |  |  |  |
| Transport block CRC per Slot                                           |       |                   |  |  |  |  |  |
| For Slot $i = 0$                                                       | Bits  | N/A               |  |  |  |  |  |
| For Slots $i = 1, \dots, 19$                                           | Bits  | 24                |  |  |  |  |  |
| Number of Code Blocks per Slot                                         |       |                   |  |  |  |  |  |
| For Slot $i = 0$                                                       | CBs   | N/A               |  |  |  |  |  |
| For Slots $i = 1, \dots, 19$                                           | CBs   | 2                 |  |  |  |  |  |
| Binary Channel Bits Per Slot                                           |       |                   |  |  |  |  |  |
| For Slot $i = 0$                                                       | Bits  | N/A               |  |  |  |  |  |
| For Slots $i = 10, 11$                                                 | Bits  | 26,208            |  |  |  |  |  |
| For Slots $i = 1, \dots, 9, 12, \dots, 19$                             | 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.3.2.1.2 Reference measurement channels for SCS 60 kHz FR2-NTN

Editor's note: RMC for performance requirements is FFS.

Table A.3.2.1.2-1: Void

Table A.3.2.1.2-2: Void

Table A.3.2.1.2-3: Void

## A.3.2.1.3 Reference measurement channels for SCS 120 kHz FR2-NTN

Table A.3.2.1.3-1: Void

Table A.3.2.1.3-2: Void

Table A.3.2.1.3-3: PDSCH Reference Channel for FDD (QPSK)

| Parameter                                                              | Unit  | Value             |  |  |  |  |
|------------------------------------------------------------------------|-------|-------------------|--|--|--|--|
| Reference channel                                                      |       | R.PDSCH.3-3.1 FDD |  |  |  |  |
| Channel bandwidth                                                      | MHz   | 200               |  |  |  |  |
| Subcarrier spacing                                                     | kHz   | 120               |  |  |  |  |
| Number of allocated resource blocks                                    | PRBs  | 132               |  |  |  |  |
| Number of consecutive PDSCH symbols                                    |       | 13                |  |  |  |  |
| Allocated slots per 2 frames                                           | Slots | 159               |  |  |  |  |
| 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,..., 159                                               | Bits  | 11528             |  |  |  |  |
| Transport block CRC per Slot                                           |       |                   |  |  |  |  |
| For Slot i = 0                                                         | Bits  | N/A               |  |  |  |  |
| For Slots i = 1,..., 159                                               | Bits  | 24                |  |  |  |  |
| Number of Code Blocks per Slot                                         |       |                   |  |  |  |  |
| For Slot i = 0                                                         | CBs   | N/A               |  |  |  |  |
| For Slots i = 1,..., 159                                               | CBs   | 2                 |  |  |  |  |
| Binary Channel Bits Per Slot                                           |       |                   |  |  |  |  |
| For Slot i = 0                                                         | Bits  | N/A               |  |  |  |  |
| For Slots i = 80, 81                                                   | Bits  | 36432             |  |  |  |  |
| For Slots i = 1,..., 79, 82, ..., 159                                  | Bits  | 38016             |  |  |  |  |
| Max. Throughput averaged over 2 frames                                 | Mbps  | 91.648            |  |  |  |  |
| 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.3.2.1.3-4: PDSCH Reference Channel for FDD (16QAM)**

| Parameter                                                              | Unit  | Value             |  |  |  |  |
|------------------------------------------------------------------------|-------|-------------------|--|--|--|--|
| Reference channel                                                      |       | R.PDSCH.3-4.1 FDD |  |  |  |  |
| Channel bandwidth                                                      | MHz   | 200               |  |  |  |  |
| Subcarrier spacing                                                     | kHz   | 120               |  |  |  |  |
| Number of allocated resource blocks                                    | PRBs  | 132               |  |  |  |  |
| Number of consecutive PDSCH symbols                                    |       | 13                |  |  |  |  |
| Allocated slots per 2 frames                                           | Slots | 159               |  |  |  |  |
| 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,..., 159                                               | Bits  | 36896             |  |  |  |  |
| Transport block CRC per Slot                                           |       |                   |  |  |  |  |
| For Slot i = 0                                                         | Bits  | N/A               |  |  |  |  |
| For Slots i = 1,..., 159                                               | Bits  | 24                |  |  |  |  |
| Number of Code Blocks per Slot                                         |       |                   |  |  |  |  |
| For Slot i = 0                                                         | CBs   | N/A               |  |  |  |  |
| For Slots i = 1,..., 159                                               | CBs   | 5                 |  |  |  |  |
| Binary Channel Bits Per Slot                                           |       |                   |  |  |  |  |
| For Slot i = 0                                                         | Bits  | N/A               |  |  |  |  |
| For Slots i = 80, 81                                                   | Bits  | 72864             |  |  |  |  |
| For Slots i = 1,..., 79, 82, ..., 159                                  | Bits  | 76032             |  |  |  |  |
| Max. Throughput averaged over 2 frames                                 | Mbps  | 293.323           |  |  |  |  |
| 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.3.2.1.3-5: Void**

## A.3.3

## A.3.4 Reference measurement channels for receiver requirements

### A.3.4.1 FDD

#### A.3.4.1.1 Fixed reference channels for SCS 15kHz FR1-NTN

In addition to general description, no user data is scheduled on slot #1 within 20 ms in order to avoid SIB and PDSCH transmissions in one slot and simplify test configuration.

**Table A.3.4.1.1-1: Fixed reference channel for receiver requirements (SCS 15kHz, FDD, QPSK 1/3, NGSO)**

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Unit | Value |       |       |       |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-------|-------|-------|--|--|--|--|
| Channel bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                 | MHz  | 5     | 10    | 15    | 20    |  |  |  |  |
| Subcarrier spacing                                                                                                                                                                                                                                                                                                                                                                                                                                                | kHz  | 15    | 15    | 15    | 15    |  |  |  |  |
| Subcarrier spacing configuration $\mu$                                                                                                                                                                                                                                                                                                                                                                                                                            |      | 0     | 0     | 0     | 0     |  |  |  |  |
| Allocated resource blocks                                                                                                                                                                                                                                                                                                                                                                                                                                         |      | 25    | 52    | 79    | 106   |  |  |  |  |
| Subcarriers per resource block                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | 12    | 12    | 12    | 12    |  |  |  |  |
| Allocated slots per 2 frames                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | 16    | 16    | 16    | 16    |  |  |  |  |
| MCS Index                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      | 4     | 4     | 4     | 4     |  |  |  |  |
| MCS Table for TBS determination                                                                                                                                                                                                                                                                                                                                                                                                                                   |      | 64QAM |       |       |       |  |  |  |  |
| Modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      | QPSK  | QPSK  | QPSK  | QPSK  |  |  |  |  |
| Target Coding Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                |      | 1/3   | 1/3   | 1/3   | 1/3   |  |  |  |  |
| Maximum number of HARQ transmissions                                                                                                                                                                                                                                                                                                                                                                                                                              |      | 1     | 1     | 1     | 1     |  |  |  |  |
| Information Bit Payload per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |       |       |       |       |  |  |  |  |
| For Slots 0, 1, 10, 11                                                                                                                                                                                                                                                                                                                                                                                                                                            | Bits | N/A   | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                                                                                                                                                                                                                                                                                                                                  | Bits | 1672  | 3368  | 5120  | 6912  |  |  |  |  |
| Transport block CRC                                                                                                                                                                                                                                                                                                                                                                                                                                               | Bits | 16    | 16    | 24    | 24    |  |  |  |  |
| LDPC base graph                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      | 2     | 2     | 1     | 1     |  |  |  |  |
| Number of Code Blocks per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |       |       |       |       |  |  |  |  |
| For Slots 0, 1, 10, 11                                                                                                                                                                                                                                                                                                                                                                                                                                            | CBs  | N/A   | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                                                                                                                                                                                                                                                                                                                                  | CBs  | 1     | 1     | 1     | 1     |  |  |  |  |
| Binary Channel Bits per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |       |       |       |       |  |  |  |  |
| For Slots 0, 1, 10, 11                                                                                                                                                                                                                                                                                                                                                                                                                                            | Bits | N/A   | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                                                                                                                                                                                                                                                                                                                                  | Bits | 5400  | 11232 | 17064 | 22896 |  |  |  |  |
| Max. Throughput averaged over 2 frame                                                                                                                                                                                                                                                                                                                                                                                                                             | Mbps | 1.338 | 2.694 | 4.096 | 5.530 |  |  |  |  |
| Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].<br>Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).<br>Note 3: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms.<br>Note 4: Slot i is slot index per 2 frames.<br>Note 5: PDSCHs are scheduled from 1 <sup>st</sup> frame of the periodicity. |      |       |       |       |       |  |  |  |  |

**Table A.3.4.1.1-2: Fixed reference channel for receiver requirements (SCS 15kHz, FDD, 64QAM, NGSO)**

| Parameter                                                                                                                                       | Unit | Value  |            |            |            |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|------------|------------|------------|--|--|--|--|
| Channel bandwidth                                                                                                                               | MHz  | 5      | 10         | 15         | 20         |  |  |  |  |
| Subcarrier spacing                                                                                                                              | kHz  | 15     | 15         | 15         | 15         |  |  |  |  |
| Subcarrier spacing configuration $\mu$                                                                                                          |      | 0      | 0          | 0          | 0          |  |  |  |  |
| Allocated resource blocks                                                                                                                       |      | 25     | 52         | 79         | 106        |  |  |  |  |
| Subcarriers per resource block                                                                                                                  |      | 12     | 12         | 12         | 12         |  |  |  |  |
| Allocated slots per 2 frames                                                                                                                    |      | 16     | 16         | 16         | 16         |  |  |  |  |
| MCS Index                                                                                                                                       |      | 24     | 24         | 24         | 24         |  |  |  |  |
| MCS Table for TBS determination                                                                                                                 |      | 64QAM  |            |            |            |  |  |  |  |
| Modulation                                                                                                                                      |      | 64 QAM | 64 QAM     | 64 QAM     | 64 QAM     |  |  |  |  |
| Target Coding Rate                                                                                                                              |      | 3/4    | 3/4        | 3/4        | 3/4        |  |  |  |  |
| Maximum number of HARQ transmissions                                                                                                            |      | 1      | 1          | 1          | 1          |  |  |  |  |
| Information Bit Payload per Slot                                                                                                                |      |        |            |            |            |  |  |  |  |
| For Slots 0, 1, 10, 11                                                                                                                          | Bits | N/A    | N/A        | N/A        | N/A        |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                | Bits | 12296  | 25608      | 38936      | 52224      |  |  |  |  |
| Transport block CRC                                                                                                                             | Bits | 24     | 24         | 24         | 24         |  |  |  |  |
| LDPC base graph                                                                                                                                 |      | 1      | 1          | 1          | 1          |  |  |  |  |
| Number of Code Blocks per Slot                                                                                                                  |      |        |            |            |            |  |  |  |  |
| For Slots 0, 1, 10, 11                                                                                                                          | CBs  | N/A    | N/A        | N/A        | N/A        |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                | CBs  | 2      | 4          | 5          | 7          |  |  |  |  |
| Binary Channel Bits per Slot                                                                                                                    |      |        |            |            |            |  |  |  |  |
| For Slots 0, 1, 10, 11                                                                                                                          | Bits | N/A    | N/A        | N/A        | N/A        |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                | Bits | 16200  | 33696      | 51192      | 68688      |  |  |  |  |
| Max. Throughput averaged over 2 frame                                                                                                           | Mbps | 9.837  | 20.48<br>6 | 31.14<br>9 | 41.77<br>9 |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].                                          |      |        |            |            |            |  |  |  |  |
| NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). |      |        |            |            |            |  |  |  |  |
| NOTE 3: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms.                                                                         |      |        |            |            |            |  |  |  |  |
| NOTE 4: Slot i is slot index per 2 frames.                                                                                                      |      |        |            |            |            |  |  |  |  |
| NOTE 5: PDSCHs are scheduled from 1 <sup>st</sup> frame of the periodicity.                                                                     |      |        |            |            |            |  |  |  |  |

**Table A.3.4.1.1-3: Fixed reference channel for receiver requirements (SCS 15kHz, FDD, QPSK 1/3, GSO)**

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Unit | Value |       |       |       |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-------|-------|-------|--|--|--|--|
| Channel bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                  | MHz  | 5     | 10    | 15    | 20    |  |  |  |  |
| Subcarrier spacing                                                                                                                                                                                                                                                                                                                                                                                                                                                 | kHz  | 15    | 15    | 15    | 15    |  |  |  |  |
| Subcarrier spacing configuration $\mu$                                                                                                                                                                                                                                                                                                                                                                                                                             |      | 0     | 0     | 0     | 0     |  |  |  |  |
| Allocated resource blocks                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 25    | 52    | 79    | 106   |  |  |  |  |
| Subcarriers per resource block                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | 12    | 12    | 12    | 12    |  |  |  |  |
| Allocated slots per 32 frames                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | 16    | 16    | 16    | 16    |  |  |  |  |
| MCS Index                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 4     | 4     | 4     | 4     |  |  |  |  |
| MCS Table for TBS determination                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | 64QAM |       |       |       |  |  |  |  |
| Modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      | QPSK  | QPSK  | QPSK  | QPSK  |  |  |  |  |
| Target Coding Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      | 1/3   | 1/3   | 1/3   | 1/3   |  |  |  |  |
| Maximum number of HARQ transmissions                                                                                                                                                                                                                                                                                                                                                                                                                               |      | 1     | 1     | 1     | 1     |  |  |  |  |
| Information Bit Payload per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |       |       |       |       |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, ..., 319                                                                                                                                                                                                                                                                                                                                                                                                                               | Bits | N/A   | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                                                                                                                                                                                                                                                                                                                                   | Bits | 1672  | 3368  | 5120  | 6912  |  |  |  |  |
| Transport block CRC                                                                                                                                                                                                                                                                                                                                                                                                                                                | Bits | 16    | 16    | 24    | 24    |  |  |  |  |
| LDPC base graph                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | 2     | 2     | 1     | 1     |  |  |  |  |
| Number of Code Blocks per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |       |       |       |       |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, ..., 319                                                                                                                                                                                                                                                                                                                                                                                                                               | CBs  | N/A   | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                                                                                                                                                                                                                                                                                                                                   | CBs  | 1     | 1     | 1     | 1     |  |  |  |  |
| Binary Channel Bits per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |       |       |       |       |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, ..., 319                                                                                                                                                                                                                                                                                                                                                                                                                               | Bits | N/A   | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                                                                                                                                                                                                                                                                                                                                   | Bits | 5400  | 11232 | 17064 | 22896 |  |  |  |  |
| Max. Throughput averaged over 2 frame                                                                                                                                                                                                                                                                                                                                                                                                                              | Mbps | 0.084 | 0.168 | 0.256 | 0.346 |  |  |  |  |
| Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].<br>Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).<br>Note 3: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms.<br>Note 4: Slot i is slot index per 32 frames.<br>Note 5: PDSCHs are scheduled from 1 <sup>st</sup> frame of the periodicity. |      |       |       |       |       |  |  |  |  |

**Table A.3.4.1.1-4: Fixed reference channel for receiver requirements (SCS 15kHz, FDD, 64QAM, GSO)**

| Parameter                                                                                                                                       | Unit | Value  |        |        |        |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|--------|--------|--------|--|--|--|--|
| Channel bandwidth                                                                                                                               | MHz  | 5      | 10     | 15     | 20     |  |  |  |  |
| Subcarrier spacing                                                                                                                              | kHz  | 15     | 15     | 15     | 15     |  |  |  |  |
| Subcarrier spacing configuration $\mu$                                                                                                          |      | 0      | 0      | 0      | 0      |  |  |  |  |
| Allocated resource blocks                                                                                                                       |      | 25     | 52     | 79     | 106    |  |  |  |  |
| Subcarriers per resource block                                                                                                                  |      | 12     | 12     | 12     | 12     |  |  |  |  |
| Allocated slots per 32 frames                                                                                                                   |      | 16     | 16     | 16     | 16     |  |  |  |  |
| MCS Index                                                                                                                                       |      | 24     | 24     | 24     | 24     |  |  |  |  |
| MCS Table for TBS determination                                                                                                                 |      | 64QAM  |        |        |        |  |  |  |  |
| Modulation                                                                                                                                      |      | 64 QAM | 64 QAM | 64 QAM | 64 QAM |  |  |  |  |
| Target Coding Rate                                                                                                                              |      | 3/4    | 3/4    | 3/4    | 3/4    |  |  |  |  |
| Maximum number of HARQ transmissions                                                                                                            |      | 1      | 1      | 1      | 1      |  |  |  |  |
| Information Bit Payload per Slot                                                                                                                |      |        |        |        |        |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, ..., 319                                                                                                            | Bits | N/A    | N/A    | N/A    | N/A    |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                | Bits | 12296  | 25608  | 38936  | 52224  |  |  |  |  |
| Transport block CRC                                                                                                                             | Bits | 24     | 24     | 24     | 24     |  |  |  |  |
| LDPC base graph                                                                                                                                 |      | 1      | 1      | 1      | 1      |  |  |  |  |
| Number of Code Blocks per Slot                                                                                                                  |      |        |        |        |        |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, ..., 319                                                                                                            | CBs  | N/A    | N/A    | N/A    | N/A    |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                | CBs  | 2      | 4      | 5      | 7      |  |  |  |  |
| Binary Channel Bits per Slot                                                                                                                    |      |        |        |        |        |  |  |  |  |
| For Slots 0, 1, 10, 11, 20, ..., 319                                                                                                            | Bits | N/A    | N/A    | N/A    | N/A    |  |  |  |  |
| For Slots 2, ..., 9, 12, ..., 19                                                                                                                | Bits | 16200  | 33696  | 51192  | 68688  |  |  |  |  |
| Max. Throughput averaged over 2 frame                                                                                                           | Mbps | 0.615  | 1.280  | 1.947  | 2.611  |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].                                          |      |        |        |        |        |  |  |  |  |
| NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). |      |        |        |        |        |  |  |  |  |
| NOTE 3: SS/PBCH block is transmitted in slot #0 with 20ms periodicity.                                                                          |      |        |        |        |        |  |  |  |  |
| NOTE 4: Slot i is slot index per 32 frames.                                                                                                     |      |        |        |        |        |  |  |  |  |
| NOTE 5: PDSCHs are scheduled from 1 <sup>st</sup> frame of the periodicity.                                                                     |      |        |        |        |        |  |  |  |  |

**A.3.4.1.1A Fixed reference channels for SCS 30kHz FR1-NTN**

In addition to general description, no user data is scheduled on slot #1 within 20 ms in order to avoid SIB and PDSCH transmissions in one slot and simplify test configuration.

**Table A.3.4.1.1A-1: Fixed reference channel for receiver requirements (SCS 30kHz, FDD, QPSK 1/3, NGSO)**

| Parameter                                                                                                                                       | Unit | Value |       |       |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-------|-------|--|--|--|--|
| Channel bandwidth                                                                                                                               | MHz  | 10    | 15    | 20    |  |  |  |  |
| Subcarrier spacing configuration $\mu$                                                                                                          |      | 1     | 1     | 1     |  |  |  |  |
| Allocated resource blocks                                                                                                                       |      | 24    | 38    | 51    |  |  |  |  |
| Subcarriers per resource block                                                                                                                  |      | 12    | 12    | 12    |  |  |  |  |
| Allocated slots per 2 Frames                                                                                                                    |      | 16    | 16    | 16    |  |  |  |  |
| MCS Index                                                                                                                                       |      | 4     | 4     | 4     |  |  |  |  |
| MCS Table for TBS determination                                                                                                                 |      | 64QAM |       |       |  |  |  |  |
| Modulation                                                                                                                                      |      | QPSK  | QPSK  | QPSK  |  |  |  |  |
| Target Coding Rate                                                                                                                              |      | 1/3   | 1/3   | 1/3   |  |  |  |  |
| Maximum number of HARQ transmissions                                                                                                            |      | 1     | 1     | 1     |  |  |  |  |
| Information Bit Payload per Slot                                                                                                                |      |       |       |       |  |  |  |  |
| For Slots 0,1,2,3, 20,...,39                                                                                                                    | Bits | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | Bits | 1608  | 2472  | 3368  |  |  |  |  |
| Transport block CRC                                                                                                                             | Bits | 16    | 16    | 16    |  |  |  |  |
| LDPC base graph                                                                                                                                 |      | 2     | 2     | 2     |  |  |  |  |
| Number of Code Blocks per Slot                                                                                                                  |      |       |       |       |  |  |  |  |
| For Slots 0,1,2,3, 20,...,39                                                                                                                    | CBs  | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | CBs  | 1     | 1     | 1     |  |  |  |  |
| Binary Channel Bits per Slot                                                                                                                    |      |       |       |       |  |  |  |  |
| For Slots 0,1,2,3, 20,...,39                                                                                                                    | Bits | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | Bits | 5184  | 8208  | 11016 |  |  |  |  |
| Max. Throughput averaged over 2 frames                                                                                                          | Mbps | 1.286 | 1.978 | 2.694 |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].                                          |      |       |       |       |  |  |  |  |
| NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). |      |       |       |       |  |  |  |  |
| NOTE 3: SS/PBCH block is transmitted in slot #0 of each frame                                                                                   |      |       |       |       |  |  |  |  |
| NOTE 4: Slot i is slot index per 2 frames                                                                                                       |      |       |       |       |  |  |  |  |

**Table A.3.4.1.1A-2: Fixed reference channel for receiver requirements (SCS 30kHz, FDD, 64QAM, NGSO)**

| Parameter                                                                                                                                       | Unit | Value     |           |           |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|-----------|-----------|--|--|--|--|
| Channel bandwidth                                                                                                                               | MHz  | 10        | 15        | 20        |  |  |  |  |
| Subcarrier spacing configuration $\mu$                                                                                                          |      | 1         | 1         | 1         |  |  |  |  |
| Allocated resource blocks                                                                                                                       |      | 24        | 38        | 51        |  |  |  |  |
| Subcarriers per resource block                                                                                                                  |      | 12        | 12        | 12        |  |  |  |  |
| Allocated slots per 2 Frames                                                                                                                    |      | 16        | 16        | 16        |  |  |  |  |
| MCS Index                                                                                                                                       |      | 24        | 24        | 24        |  |  |  |  |
| MCS Table for TBS determination                                                                                                                 |      | 64QAM     |           |           |  |  |  |  |
| Modulation                                                                                                                                      |      | 64<br>QAM | 64<br>QAM | 64<br>QAM |  |  |  |  |
| Target Coding Rate                                                                                                                              |      | 3/4       | 3/4       | 3/4       |  |  |  |  |
| Maximum number of HARQ transmissions                                                                                                            |      | 1         | 1         | 1         |  |  |  |  |
| Information Bit Payload per Slot                                                                                                                |      |           |           |           |  |  |  |  |
| For Slots 0,1,2,3, 20,...,39                                                                                                                    | Bits | N/A       | N/A       | N/A       |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | Bits | 11784     | 18432     | 25104     |  |  |  |  |
| Transport block CRC                                                                                                                             | Bits | 24        | 24        | 24        |  |  |  |  |
| LDPC base graph                                                                                                                                 |      | 1         | 1         | 1         |  |  |  |  |
| Number of Code Blocks per Slot                                                                                                                  |      |           |           |           |  |  |  |  |
| For Slots 0,1,2,3, 20,...,39                                                                                                                    | CBs  | N/A       | N/A       | N/A       |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | CBs  | 2         | 3         | 3         |  |  |  |  |
| Binary Channel Bits per Slot                                                                                                                    |      |           |           |           |  |  |  |  |
| For Slots 0,1,2,3, 20,...,39                                                                                                                    | Bits | N/A       | N/A       | N/A       |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | Bits | 15552     | 24624     | 33048     |  |  |  |  |
| Max. Throughput averaged over 2 frames                                                                                                          | Mbps | 9.427     | 14.746    | 20.083    |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].                                          |      |           |           |           |  |  |  |  |
| NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). |      |           |           |           |  |  |  |  |
| NOTE 3: SS/PBCH block is transmitted in slot #0 of each frame                                                                                   |      |           |           |           |  |  |  |  |
| NOTE 4: Slot i is slot index per 2 frames                                                                                                       |      |           |           |           |  |  |  |  |

**Table A.3.4.1.1A-3: Fixed reference channel for receiver requirements (SCS 30kHz, FDD, QPSK 1/3, GSO)**

| Parameter                                                                                                                                       | Unit | Value |       |       |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-------|-------|--|--|--|--|
| Channel bandwidth                                                                                                                               | MHz  | 10    | 15    | 20    |  |  |  |  |
| Subcarrier spacing configuration                                                                                                                |      | 1     | 1     | 1     |  |  |  |  |
| Allocated resource blocks                                                                                                                       |      | 24    | 38    | 51    |  |  |  |  |
| Subcarriers per resource block                                                                                                                  |      | 12    | 12    | 12    |  |  |  |  |
| Allocated slots per 32 Frames                                                                                                                   |      | 16    | 16    | 16    |  |  |  |  |
| MCS Index                                                                                                                                       |      | 4     | 4     | 4     |  |  |  |  |
| MCS Table for TBS determination                                                                                                                 |      | 64QAM |       |       |  |  |  |  |
| Modulation                                                                                                                                      |      | QPSK  | QPSK  | QPSK  |  |  |  |  |
| Target Coding Rate                                                                                                                              |      | 1/3   | 1/3   | 1/3   |  |  |  |  |
| Maximum number of HARQ transmissions                                                                                                            |      | 1     | 1     | 1     |  |  |  |  |
| Information Bit Payload per Slot                                                                                                                |      |       |       |       |  |  |  |  |
| For Slots 0,1,2,3, 20,...,639                                                                                                                   | Bits | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | Bits | 1608  | 2472  | 3368  |  |  |  |  |
| Transport block CRC                                                                                                                             | Bits | 16    | 16    | 16    |  |  |  |  |
| LDPC base graph                                                                                                                                 |      | 2     | 2     | 2     |  |  |  |  |
| Number of Code Blocks per Slot                                                                                                                  |      |       |       |       |  |  |  |  |
| For Slots 0,1,2,3, 20,...,639                                                                                                                   | CBs  | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | CBs  | 1     | 1     | 1     |  |  |  |  |
| Binary Channel Bits per Slot                                                                                                                    |      |       |       |       |  |  |  |  |
| For Slots 0,1,2,3, 20,...,639                                                                                                                   | Bits | N/A   | N/A   | N/A   |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | Bits | 5184  | 8208  | 11016 |  |  |  |  |
| Max. Throughput averaged over 32 frames                                                                                                         | Mbps | 0.080 | 0.124 | 0.168 |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].                                          |      |       |       |       |  |  |  |  |
| NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). |      |       |       |       |  |  |  |  |
| NOTE 3: SS/PBCH block is transmitted in slot #0 of each frame                                                                                   |      |       |       |       |  |  |  |  |
| NOTE 4: Slot i is slot index per 32 frames                                                                                                      |      |       |       |       |  |  |  |  |

**Table A.3.4.1.1A-4: Fixed reference channel for receiver requirements (SCS 30kHz, FDD, 64QAM, GSO)**

| Parameter                                                                                                                                       | Unit | Value     |           |           |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------|-----------|-----------|--|--|--|--|
| Channel bandwidth                                                                                                                               | MHz  | 10        | 15        | 20        |  |  |  |  |
| Subcarrier spacing configuration $\mu$                                                                                                          |      | 1         | 1         | 1         |  |  |  |  |
| Allocated resource blocks                                                                                                                       |      | 24        | 38        | 51        |  |  |  |  |
| Subcarriers per resource block                                                                                                                  |      | 12        | 12        | 12        |  |  |  |  |
| Allocated slots per 32 Frames                                                                                                                   |      | 16        | 16        | 16        |  |  |  |  |
| MCS Index                                                                                                                                       |      | 24        | 24        | 24        |  |  |  |  |
| MCS Table for TBS determination                                                                                                                 |      | 64QAM     |           |           |  |  |  |  |
| Modulation                                                                                                                                      |      | 64<br>QAM | 64<br>QAM | 64<br>QAM |  |  |  |  |
| Target Coding Rate                                                                                                                              |      | 3/4       | 3/4       | 3/4       |  |  |  |  |
| Maximum number of HARQ transmissions                                                                                                            |      | 1         | 1         | 1         |  |  |  |  |
| Information Bit Payload per Slot                                                                                                                |      |           |           |           |  |  |  |  |
| For Slots 0,1,2,3, 20,...,639                                                                                                                   | Bits | N/A       | N/A       | N/A       |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | Bits | 11784     | 18432     | 25104     |  |  |  |  |
| Transport block CRC                                                                                                                             | Bits | 24        | 24        | 24        |  |  |  |  |
| LDPC base graph                                                                                                                                 |      | 1         | 1         | 1         |  |  |  |  |
| Number of Code Blocks per Slot                                                                                                                  |      |           |           |           |  |  |  |  |
| For Slots 0,1,2,3, 20,...,639                                                                                                                   | CBs  | N/A       | N/A       | N/A       |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | CBs  | 2         | 3         | 3         |  |  |  |  |
| Binary Channel Bits per Slot                                                                                                                    |      |           |           |           |  |  |  |  |
| For Slots 0,1,2,3, 20,...,639                                                                                                                   | Bits | N/A       | N/A       | N/A       |  |  |  |  |
| For Slots 4,...,19                                                                                                                              | Bits | 15552     | 24624     | 33048     |  |  |  |  |
| Max. Throughput averaged over 32 frames                                                                                                         | Mbps | 0.589     | 0.922     | 1.255     |  |  |  |  |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 from TS 38.101-1 [5].                                          |      |           |           |           |  |  |  |  |
| NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). |      |           |           |           |  |  |  |  |
| NOTE 3: SS/PBCH block is transmitted in slot #0 of each frame                                                                                   |      |           |           |           |  |  |  |  |
| NOTE 4: Slot i is slot index per 32 frames                                                                                                      |      |           |           |           |  |  |  |  |

## A.3.4.1.1B Fixed reference channels for SCS 60kHz FR1-NTN

## A.3.4.1.2 Fixed reference channels for SCS 60 kHz FR2-NTN

**Table A.3.4.1.2-1: PDSCH Reference Channel for FDD (QPSK)**

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Unit | Value  |        |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|--------|--------|
| Channel bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | MHz  | 50     | 100    | 200    |
| Subcarrier spacing configuration $\mu$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | 2      | 2      | 2      |
| Allocated resource blocks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 66     | 132    | 264    |
| Subcarriers per resource block                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | 12     | 12     | 12     |
| Allocated slots per Frame (NOTE 7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      | 23/24  | 23/24  | 23/24  |
| MCS index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 4      | 4      | 4      |
| Modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      | QPSK   | QPSK   | QPSK   |
| Target Coding Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      | 1/3    | 1/3    | 1/3    |
| Maximum number of HARQ transmissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      | 1      | 1      | 1      |
| Information Bit Payload per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |        |        |        |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 79\}$ (NOTE 5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Bits | N/A    | N/A    | N/A    |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$ (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Bits | 4224   | 8456   | 16896  |
| Transport block CRC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Bits | 24     | 24     | 24     |
| LDPC base graph                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | 1      | 1      | 1      |
| Number of Code Blocks per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      |        |        |        |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 79\}$ (NOTE 5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | CBs  | N/A    | N/A    | N/A    |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$ (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CBs  | 1      | 2      | 3      |
| Binary Channel Bits Per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |        |        |        |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 79\}$ (NOTE 5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Bits | N/A    | N/A    | N/A    |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$ (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Bits | 14256  | 28512  | 57024  |
| Max. Throughput averaged over 1 frame (NOTE 8)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Mbps | 10.138 | 20.294 | 40.550 |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1.<br>NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).<br>NOTE 3: SS/PBCH block is transmitted in slot 0 with periodicity 20 ms.<br>NOTE 4: Slot i is slot index per 2 frames.<br>NOTE 5: When this DL RMC used together with the UL RMC for the transmitter requirements requiring at least one sub frame (1ms) for the measurement period, Slot i, if $\text{mod}(i, 8) = \{3,4,5,6,7\}$ for i from $\{0, \dots, 79\}$ .<br>NOTE 6: When this DL RMC used together with the UL RMC for the transmitter requirements requiring at least one sub frame (1ms) for the measurement period, Slot i, if $\text{mod}(i, 8) = \{0,1,2\}$ for i from $\{0, \dots, 79\}$ .<br>NOTE 7: First number corresponds to the number slots allocated in the first frame of the RMC; second number corresponds to the number slots allocated in the second frame of the RMC.<br>NOTE 8: Throughput is averaged over 2nd frame of RMC. |      |        |        |        |

**Table A.3.4.1.2-2: PDSCH Reference Channel for FDD (16QAM)**

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Unit | Value  |        |         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|--------|---------|
| Channel bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | MHz  | 50     | 100    | 200     |
| Subcarrier spacing configuration $\mu$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      | 2      | 2      | 2       |
| Allocated resource blocks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | 66     | 132    | 264     |
| Subcarriers per resource block                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      | 12     | 12     | 12      |
| Allocated slots per Frame (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | 23/24  | 23/24  | 23/24   |
| MCS index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | 13     | 13     | 13      |
| Modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | 16QAM  | 16QAM  | 16QAM   |
| Target Coding Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | 0.48   | 0.48   | 0.48    |
| Maximum number of HARQ transmissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 1      | 1      | 1       |
| Information Bit Payload per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |        |        |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Bits | N/A    | N/A    | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Bits | 12808  | 25608  | 51216   |
| Transport block CRC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Bits | 24     | 24     | 24      |
| LDPC base graph                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      | 1      | 1      | 1       |
| Number of Code Blocks per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |        |        |         |
| For Slot i, if $\text{mod}(i, 10) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | CBs  | N/A    | N/A    | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CBs  | 2      | 4      | 7       |
| Binary Channel Bits Per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |        |        |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Bits | N/A    | N/A    | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Bits | 27324  | 54648  | 109296  |
| Max. Throughput averaged over 1 frame (NOTE 7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Mbps | 30.739 | 61.459 | 122.918 |
| <p>NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1.</p> <p>NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</p> <p>NOTE 3: SS/PBCH block is transmitted in slot 0 with periodicity 20 ms.</p> <p>NOTE 4: Slot i is slot index per 2 frames.</p> <p>NOTE 5: PTRS is configured on symbols containing PDSCH with 1 port, per 2PRB in frequency domain, per symbol in time domain. Overhead for TBS calculation is assumed to be 6.</p> <p>NOTE 6: First number corresponds to the number slots allocated in the first frame of the RMC; second number corresponds to the number slots allocated in the second frame of the RMC.</p> <p>NOTE 7: Throughput is averaged over 2nd frame of RMC.</p> |      |        |        |         |

**Table A.3.4.1.2-3: PDSCH Reference Channel for FDD (64QAM)**

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Unit | Value  |        |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|--------|---------|
| Channel bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | MHz  | 50     | 100    | 200     |
| Subcarrier spacing configuration $\mu$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 2      | 2      | 2       |
| Allocated resource blocks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      | 66     | 132    | 264     |
| Subcarriers per resource block                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | 12     | 12     | 12      |
| Allocated slots per Frame (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | 23/24  | 23/24  | 23/24   |
| MCS index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      | 19     | 19     | 19      |
| Modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | 64QAM  | 64QAM  | 64QAM   |
| Target Coding Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | 1/2    | 1/2    | 1/2     |
| Maximum number of HARQ transmissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      | 1      | 1      | 1       |
| Information Bit Payload per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |        |        |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Bits | N/A    | N/A    | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Bits | 20496  | 40976  | 81976   |
| Transport block CRC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Bits | 24     | 24     | 24      |
| LDPC base graph                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      | 1      | 1      | 1       |
| Number of Code Blocks per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |        |        |         |
| For Slot i, if $\text{mod}(i, 10) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CBs  | N/A    | N/A    | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | CBs  | 3      | 5      | 10      |
| Binary Channel Bits Per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |        |        |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Bits | N/A    | N/A    | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 79\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Bits | 40986  | 81972  | 163944  |
| Max. Throughput averaged over 1 frame (NOTE 7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Mbps | 49.190 | 98.342 | 196.742 |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1.<br>NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).<br>NOTE 3: SS/PBCH block is transmitted in slot 0 with periodicity 20 ms.<br>NOTE 4: Slot i is slot index per 2 frames.<br>NOTE 5: PTRS is configured on symbols containing PDSCH with 1 port, per 2PRB in frequency domain, per symbol in time domain. Overhead for TBS calculation is assumed to be 6.<br>NOTE 6: First number corresponds to the number slots allocated in the first frame of the RMC; second number corresponds to the number slots allocated in the second frame of the RMC.<br>NOTE 7: Throughput is averaged over 2nd frame of RMC. |      |        |        |         |

**A.3.4.1.3 Fixed reference channels for SCS 120 kHz FR2-NTN****Table A.3.4.1.3-1: PDSCH Reference Channel for FDD (QPSK)**

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Unit | Value  |        |        |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|--------|--------|--------|
| Channel bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | MHz  | 50     | 100    | 200    | 400    |
| Subcarrier spacing configuration $\mu$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      | 3      | 3      | 3      | 3      |
| Allocated resource blocks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | 32     | 66     | 132    | 264    |
| Subcarriers per resource block                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      | 12     | 12     | 12     | 12     |
| Allocated slots per Frame (NOTE 7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 47/48  | 47/48  | 47/48  | 47/48  |
| MCS index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | 4      | 4      | 4      | 4      |
| Modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      | QPSK   | QPSK   | QPSK   | QPSK   |
| Target Coding Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 1/3    | 1/3    | 1/3    | 1/3    |
| Maximum number of HARQ transmissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      | 1      | 1      | 1      | 1      |
| Information Bit Payload per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |        |        |        |        |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 159\}$ (NOTE 5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Bits | N/A    | N/A    | N/A    | N/A    |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 159\}$ (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Bits | 2088   | 4224   | 8456   | 16896  |
| Transport block CRC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Bits | 16     | 24     | 24     | 24     |
| LDPC base graph                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | 2      | 1      | 1      | 1      |
| Number of Code Blocks per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |        |        |        |        |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 159\}$ (NOTE 5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | CBs  | N/A    | N/A    | N/A    | N/A    |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 159\}$ (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CBs  | 1      | 1      | 2      | 3      |
| Binary Channel Bits Per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |        |        |        |        |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 159\}$ (NOTE 5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Bits | N/A    | N/A    | N/A    | N/A    |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 159\}$ (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Bits | 6912   | 14256  | 28512  | 57024  |
| Max. Throughput averaged over 1 frame (NOTE 8)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Mbps | 10.022 | 20.275 | 40.589 | 81.101 |
| <p>NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1.</p> <p>NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).</p> <p>NOTE 3: SS/PBCH block is transmitted in slot 0 with periodicity 20 ms.</p> <p>NOTE 4: Slot i is slot index per 2 frames.</p> <p>NOTE 5: When this DL RMC used together with the UL RMC for the transmitter requirements requiring at least one sub frame (1ms) for the measurement period, Slot i, if <math>\text{mod}(i, 16) = \{7, \dots, 15\}</math> for i from <math>\{0, \dots, 159\}</math>.</p> <p>NOTE 6: When this DL RMC used together with the UL RMC for the transmitter requirements requiring at least one sub frame (1ms) for the measurement period, Slot i, if <math>\text{mod}(i, 16) = \{0, \dots, 6\}</math> for i from <math>\{0, \dots, 159\}</math>.</p> <p>NOTE 7: First number corresponds to the number slots allocated in the first frame of the RMC; second number corresponds to the number slots allocated in the second frame of the RMC.</p> <p>NOTE 8: Throughput is averaged over 2nd frame of RMC.</p> |      |        |        |        |        |

Table A.3.4.1.3-2: PDSCH Reference Channel for FDD (16QAM)

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Unit | Value  |        |         |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|--------|---------|---------|
| Channel bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | MHz  | 50     | 100    | 200     | 400     |
| Subcarrier spacing configuration $\mu$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | 3      | 3      | 3       | 3       |
| Allocated resource blocks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 32     | 66     | 132     | 264     |
| Subcarriers per resource block                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | 12     | 12     | 12      | 12      |
| Allocated slots per Frame (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | 47/48  | 47/48  | 47/48   | 47/48   |
| MCS index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 13     | 13     | 13      | 13      |
| Modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 16QAM  | 16QAM  | 16QAM   | 16QAM   |
| Target Coding Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | 0.48   | 0.48   | 0.48    | 0.48    |
| Maximum number of HARQ transmissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      | 1      | 1      | 1       | 1       |
| Information Bit Payload per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |        |        |         |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Bits | N/A    | N/A    | N/A     | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Bits | 6272   | 12808  | 25608   | 51216   |
| Transport block CRC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Bits | 24     | 24     | 24      | 24      |
| LDPC base graph                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | 1      | 1      | 1       | 1       |
| Number of Code Blocks per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |        |        |         |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | CBs  | N/A    | N/A    | N/A     | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CBs  | 1      | 2      | 4       | 7       |
| Binary Channel Bits Per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |        |        |         |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Bits | N/A    | N/A    | N/A     | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Bits | 13248  | 27324  | 54648   | 109296  |
| Max. Throughput averaged over 1 frame (NOTE 7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Mbps | 30.106 | 61.478 | 122.918 | 245.837 |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1.<br>NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).<br>NOTE 3: SS/PBCH block is transmitted in slot 0 of each frame.<br>NOTE 4: Slot i is slot index per frame.<br>NOTE 5: PTRS is configured on symbols containing PDSCH with 1 port, per 2PRB in frequency domain, per symbol in time domain. Overhead for TBS calculation is assumed to be 6.<br>NOTE 6: First number corresponds to the number slots allocated in the first frame of the RMC; second number corresponds to the number slots allocated in the second frame of the RMC.<br>NOTE 7: Throughput is averaged over 2nd frame of RMC. |      |        |        |         |         |

Table A.3.4.1.3-3: PDSCH Reference Channel for FDD (64QAM)

| Parameter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Unit | Value  |        |         |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|--------|---------|---------|
| Channel bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | MHz  | 50     | 100    | 200     | 400     |
| Subcarrier spacing configuration $\mu$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | 3      | 3      | 3       | 3       |
| Allocated resource blocks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 32     | 66     | 132     | 264     |
| Subcarriers per resource block                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      | 12     | 12     | 12      | 12      |
| Allocated slots per Frame (NOTE 6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | 47/48  | 47/48  | 47/48   | 47/48   |
| MCS index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |      | 19     | 19     | 19      | 19      |
| Modulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      | 64QAM  | 64QAM  | 64QAM   | 64QAM   |
| Target Coding Rate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      | 1/2    | 1/2    | 1/2     | 1/2     |
| Maximum number of HARQ transmissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      | 1      | 1      | 1       | 1       |
| Information Bit Payload per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |        |        |         |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Bits | N/A    | N/A    | N/A     | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Bits | 9992   | 20496  | 40976   | 81976   |
| Transport block CRC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Bits | 24     | 24     | 24      | 24      |
| LDPC base graph                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |      | 1      | 1      | 1       | 1       |
| Number of Code Blocks per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |        |        |         |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | CBs  | N/A    | N/A    | N/A     | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CBs  | 2      | 3      | 5       | 10      |
| Binary Channel Bits Per Slot                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |        |        |         |         |
| For Slots 0 and Slot i, if $\text{mod}(i, 5) = \{3,4\}$ for i from $\{0, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Bits | N/A    | N/A    | N/A     | N/A     |
| For Slot i, if $\text{mod}(i, 5) = \{0,1,2\}$ for i from $\{1, \dots, 159\}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Bits | 19872  | 40986  | 81972   | 163944  |
| Max. Throughput averaged over 1 frame (NOTE 7)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Mbps | 47.962 | 98.381 | 196.685 | 393.485 |
| NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1.<br>NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).<br>NOTE 3: SS/PBCH block is transmitted in slot 0 of each frame.<br>NOTE 4: Slot i is slot index per frame.<br>NOTE 5: PTRS is configured on symbols containing PDSCH with 1 port, per 2PRB in frequency domain, per symbol in time domain. Overhead for TBS calculation is assumed to be 6.<br>NOTE 6: First number corresponds to the number slots allocated in the first frame of the RMC; second number corresponds to the number slots allocated in the second frame of the RMC.<br>NOTE 7: Throughput is averaged over 2nd frame of RMC. |      |        |        |         |         |

## 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.

---

# A.5 OFDMA Channel Noise Generator (OCNG)

## A.5.1 OCNG Patterns for FDD

### A.5.1.1 OCNG FDD pattern 1: Generic OCNG FDD Pattern for all unused REs

**Table A.5.1.1-1: OP.1 FDD: Generic OCNG FDD Pattern for all unused REs**

| OCNG Parameters                                                                                                                                                         | OCNG Appliance | Control Region (Core Set)                      | Data Region                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Resources allocated                                                                                                                                                     |                | All unused REs (Note 1)                        | All unused REs (Note 2)                                                                                |
| Structure                                                                                                                                                               |                | PDCCH                                          | PDSCH                                                                                                  |
| Content                                                                                                                                                                 |                | Uncorrelated pseudo random QPSK modulated data | Uncorrelated pseudo random QPSK modulated data                                                         |
| Transmission scheme for multiple antennas ports transmission                                                                                                            |                | Single Tx port transmission                    | Spatial multiplexing using any precoding matrix with dimensions same as the precoding matrix for PDSCH |
| Subcarrier Spacing                                                                                                                                                      |                | Same as for RMC PDCCH in the active BWP        | Same as for RMC PDSCH in the active BWP                                                                |
| Power Level                                                                                                                                                             |                | Same as for RMC PDCCH                          | Same as for RMC PDSCH                                                                                  |
| NOTE 1: All unused REs in the active CORESETS appointed by the search spaces in use.                                                                                    |                |                                                |                                                                                                        |
| NOTE 2: Unused available REs refer to REs in PRBs not allocated for any physical channels, CORESETs, synchronization signals or reference signals in channel bandwidth. |                |                                                |                                                                                                        |

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## 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

$$\mathbf{H} = [1 \ 1].$$

#### 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 [18] 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                    |
| NTN-TDLC5-1200   | NTN-TDLC5   | 1200Hz                    |

## 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 | $R_{UE} = 1$ | $R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$ |

Table B.2.3.1.1-3 defines the channel spatial correlation matrix  $R_{spat}$ . The parameters,  $\alpha$  and  $\beta$  in Table B.2.3.1.1-3 defines the spatial correlation between the antennas at the gNB and UE.

**Table B.2.3.1.1-3:  $R_{spat}$  correlation matrices**

|                 |                                                                                                                                                                                                                                                                                                                                                            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1x2 case</b> | $R_{spat} = R_{UE} = \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$                                                                                                                                                                                                                                                                               |
| <b>2x1 case</b> | $R_{spat} = R_{gNB} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix}$                                                                                                                                                                                                                                                                            |
| <b>2x2 case</b> | $R_{spat} = R_{gNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix} = \begin{bmatrix} 1 & \beta & \alpha & \alpha\beta \\ \beta^* & 1 & \alpha\beta^* & \alpha \\ \alpha^* & \alpha^*\beta & 1 & \beta \\ \alpha^*\beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$ |

#### B.2.3.1.2 MIMO Correlation Matrices at High, Medium and Low Level

The  $\alpha$  and  $\beta$  for different correlation types are given in Table B.2.3.1.2-1.

**Table B.2.3.1.2-1: The  $\alpha$  and  $\beta$  parameters for ULA MIMO correlation matrices**

| Correlation Model | $\alpha$ | $\beta$ |
|-------------------|----------|---------|
| 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.0 Downlink signal levels

The downlink power settings in Table C.0-1 is used unless otherwise specified in a test case.

If the UE has more than one Rx antenna, the downlink signal is applied to each one. All UE Rx antennas shall be connected.

If the UE has one Rx antenna, the downlink signal is applied to it.

**Table C.0-1: Default Downlink power levels for NR**

| SCS<br>(kHz)                                                                                                                                                                                                                                                                                                                                                                                                                                       |                  | Unit          | Channel bandwidth |          |           |           |           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|-------------------|----------|-----------|-----------|-----------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |               | 3<br>MHz          | 5<br>MHz | 10<br>MHz | 15<br>MHz | 20<br>MHz |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Number of RBs    |               | 15                | 25       | 52        | 79        | 106       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Channel BW power | dBm           | -62               | -60      | -57       | -55       | -54       |
| 30                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Number of RBs    |               | N/A               | 11       | 24        | 38        | 51        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Channel BW power | dBm           | N/A               | -61      | -57       | -55       | -54       |
| 60                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Number of RBs    |               | N/A               | N/A      | 11        | 18        | 24        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Channel BW power | dBm           | N/A               | N/A      | -58       | -56       | -54       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                    | RS EPRE          | dBm/<br>15kHz | -85               | -85      | -85       | -85       | -85       |
| Note 1: The channel bandwidth powers are informative, based on -85dBm/15kHz SS/PBCH SSS EPRE, then scaled according to the number of RBs and rounded to the nearest integer dBm value. Full RE allocation with no boost or deboost is assumed.<br>Note 2: The power level is specified at each UE Rx antenna.<br>Note 3: DL level is applied for any of the Subcarrier Spacing configuration with the same power spectrum density of -85dBm/15kHz. |                  |               |                   |          |           |           |           |

The default signal level uncertainty is +/-3dB at each test port, for any level specified. If the uncertainty value is critical for the test purpose, a tighter uncertainty is specified for the related test case in Annex F.

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   | $-10 \cdot \log_{10}(L)$ (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.

## C.4 Setup (Radiated)

Table C.4-1 describes the downlink Physical Channels that are required for connection set up.

**Table C.4-1: Downlink Physical Channels required for connection set-up**

| Physical Channel |
|------------------|
| PBCH             |
| SSS              |
| PSS              |
| PDCCH            |
| PDSCH            |
| PBCH DMRS        |
| PDCCH DMRS       |
| PDSCH DMRS       |
| CSI-RS           |
| PTRS             |

## C.5 Connection (Radiated)

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

### C.5.1 Measurement of Receiver Characteristics

Table C.5.1-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels, unless otherwise stated.

**Table C.5.1-1: Downlink Physical Channels transmitted during a connection (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   | $-10 \cdot \log_{10}(L)$ (Note 3) |
| EPRE ratio of PTRS to PDSCH                                                                                                                                        | dB   | Test specific                     |
| EPRE ratio of OCNG to SSS                                                                                                                                          | dB   | 0                                 |
| EPRE ratio of PDCCH OCNG to SSS                                                                                                                                    | dB   | 0                                 |
| Note 1: Value is derived from Table 4.1-1 in TS 38.214 [12] 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: Value is derived from Table 4.1-2 in TS 38.214 [12] based on "The number of PDSCH layers" and "epre-Ratio" parameters specified for each test.             |      |                                   |

# 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 <sub>interferer</sub>                                                                                                                 | 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 E (normative): Global In-Channel TX-Test

Same content as defined in Annex E in TS 38.521-1 [2] with the following exceptions:

TDD does not apply to satellite access operation for NR UEs in this release of specification.

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## 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  $\pm 5$  kPa.
- Temperature  $\pm 2$  degrees.
- Relative Humidity  $\pm 5$  %.
- DC Voltage  $\pm 1.0$  %.
- AC Voltage  $\pm 1.5$  %.
- 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                                                                                                                          |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.2.1 UE maximum output power                                                 | Same as clause 6.2.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.   |                                                                                                                                                                |
| 6.2.1_1 UE maximum output power: maximum power density                        | Same as 6.2.1.                                                                                   | Despite the permitted power density limit, MTSU defined under the assumption the UE will not exceed the maximum output power limit verified in test case 6.2.1 |
| 6.2.1_2 UE maximum output power for UEs supporting 2Tx Tx Diversity           | Same as clause 6.2G.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.  |                                                                                                                                                                |
| 6.2.2 Maximum Power Reduction (MPR)                                           | Same as clause 6.2.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.   |                                                                                                                                                                |
| 6.2.2_1 UE maximum output power reduction for UEs supporting 2Tx Tx Diversity | Same as clause 6.2G.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.  |                                                                                                                                                                |
| 6.2.2_2 UE maximum output power reduction for UEs supporting 4Tx Tx Diversity | FFS                                                                                              |                                                                                                                                                                |
| 6.2.3 UE additional maximum output power reduction                            | Same as clause 6.2.3 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.   |                                                                                                                                                                |
| 6.2.4 Configured transmitted power                                            | Same as clause 6.2.4 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.   |                                                                                                                                                                |
| 6.2.4_2 Configured transmitted power for UEs supporting 4Tx Tx Diversity      | FFS                                                                                              |                                                                                                                                                                |
| 6.3.1 Minimum output power                                                    | Same as clause 6.3.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                        |                                                                                                                                                                |
| 6.3.2 Transmit OFF power                                                      | Same as clause 6.3.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                        |                                                                                                                                                                |
| 6.3.3 Transmit on/off time mask                                               | Same as clause 6.3.3 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz                         |                                                                                                                                                                |
| 6.3.4.2 Absolute power tolerance                                              | Same as clause 6.3.4.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz                       |                                                                                                                                                                |
| 6.3.4.3 Relative power tolerance                                              | Same as clause 6.3.4.3 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz                       |                                                                                                                                                                |
| 6.3.4.4 Aggregate power tolerance                                             | Same as clause 6.3.4.4 in TS 38.521-1 [2] for FDD band with $f \leq 3$ 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 $f \leq 3$ 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 $f \leq 3$ GHz.                        |                                                                                                                                                                |
| 6.4.2.1 Error Vector Magnitude                                                | Same as clause 6.4.2.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                      |                                                                                                                                                                |
| 6.4.2.1a Error Vector Magnitude including symbols with transient period       | Same as clause 6.4.2.1a in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                     |                                                                                                                                                                |
| 6.4.2.2 Carrier Leakage                                                       | Same as clause 6.4.2.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz. |                                                                                                                                                                |
| 6.4.2.3 In-band emissions                                                     | Same as clause 6.4.2.3 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz. |                                                                                                                                                                |
| 6.4.2.4 EVM equalizer spectrum flatness                                       | Same as clause 6.4.2.4 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz. |                                                                                                                                                                |
| 6.4.2.5 EVM equalizer spectrum flatness for $\pi/2$ BPSK                      | Same as clause 6.4.2.5 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz. |                                                                                                                                                                |
| 6.5.1 Occupied bandwidth                                                      | Same as clause 6.5.1 in TS 38.521-1 [2].                                                         |                                                                                                                                                                |
| 6.5.2.4.1 NR Adjacent Channel Leakage Ratio                                   | Same as clause 6.5.2.4.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                    |                                                                                                                                                                |
| 6.5.2.4.1_1 NR ACLR for UEs supporting 2Tx Tx Diversity                       | Same as clause 6.5G.2.3.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                   |                                                                                                                                                                |
| 6.5.2.2 Spectrum Emission Mask                                                | Same as clause 6.5.2.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ 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].                                       |                                          |
| 7.3.2_1 Reference sensitivity power level for flexible Tx-Rx frequency separation | Same as clause 7.3.2 in TS 38.521-1 [2].                                       |                                          |
| 7.3.2_2 Reference sensitivity power level for UEs supporting 2Tx Tx Diversity     | 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 $f \leq 3$ GHz.        |                                          |
| 7.5 Adjacent channel selectivity                                                  | Same as clause 7.5 in TS 38.521-1 [2] for FDD band with " $f \leq 3.0$ 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 " $f \leq 3.0$ 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 " $f \leq 3.0$ 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 " $f \leq 3.0$ 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 " $f \leq 3.0$ GHz". | 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] with " $f \leq 12.75$ GHz".              | Same as clause 7.9 in TS 38.521-1 [2].   |

## 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.1 does 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                                                                        |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 6.2.1 UE maximum output power                                                 | Same as clause 6.2.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.   | Upper limit + TT, Lower limit - TT                                                                  |
| 6.2.1_1 UE maximum output power: maximum power density                        | Same as 6.2.1.                                                                                   | Upper limit + TT                                                                                    |
| 6.2.1_2 UE maximum output power for UEs supporting 2Tx Tx Diversity           | Same as clause 6.2G.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.  | Upper limit + TT, Lower limit - TT                                                                  |
| 6.2.2 Maximum Power Reduction (MPR)                                           | Same as clause 6.2.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.   | Upper limit + TT, Lower limit - TT                                                                  |
| 6.2.2_1 UE maximum output power reduction for UEs supporting 2Tx Tx Diversity | Same as clause 6.2G.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.  | Upper limit + TT, Lower limit - TT                                                                  |
| 6.2.2_2 UE maximum output power reduction for UEs supporting 4Tx Tx Diversity | FFS                                                                                              | FFS                                                                                                 |
| 6.2.3 UE additional maximum output power reduction                            | Same as clause 6.2.3 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.   | Upper limit + TT, Lower limit - TT                                                                  |
| 6.2.4 Configured transmitted power                                            | Same as clause 6.2.4 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz.   | Upper limit + TT, Lower limit - TT                                                                  |
| 6.2.4_2 Configured transmitted power for UEs supporting 4Tx Tx Diversity      | FFS                                                                                              | FFS                                                                                                 |
| 6.3.1 Minimum output power                                                    | Same as clause 6.3.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ 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 $f \leq 3$ GHz.                        | Minimum requirement + TT                                                                            |
| 6.3.3 Transmit on/off time mask                                               | Same as clause 6.3.3 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz                         | Minimum requirement + TT                                                                            |
| 6.3.4 Power Control                                                           | Same as clause 6.3.4 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz                         | Upper limit + TT, Lower limit – 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 $f \leq 3$ GHz.                        | Modulated carrier frequency:<br>Upper limit + TT, Lower limit – TT<br><br>DL power:<br>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 $f \leq 3$ GHz.                        | Modulated carrier frequency:<br>Upper limit + TT, Lower limit – TT<br><br>DL power:<br>REFSENS + TT |
| 6.4.2.1 Error Vector Magnitude                                                | Same as clause 6.4.2.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                      | Minimum requirement + TT                                                                            |
| 6.4.2.1a Error Vector Magnitude including symbols with transient period       | Same as clause 6.4.2.1a in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                     | Minimum requirement + TT                                                                            |
| 6.4.2.2 Carrier Leakage                                                       | Same as clause 6.4.2.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz. | Minimum requirement + TT                                                                            |
| 6.4.2.3 In-band emissions                                                     | Same as clause 6.4.2.3 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz. | Minimum requirement + TT                                                                            |
| 6.4.2.4 EVM equalizer spectrum flatness                                       | Same as clause 6.4.2.4 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz. | Minimum requirement + TT                                                                            |
| 6.4.2.5 EVM equalizer spectrum flatness for Pi/2 BPSK                         | Same as clause 6.4.2.5 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz and $BW \leq 30$ MHz. | Minimum requirement + TT                                                                            |
| 6.5.1 Occupied bandwidth                                                      | Same as clause 6.5.1 in TS 38.521-1 [2].                                                         | Minimum requirement + TT                                                                            |
| 6.5.2.2 Spectrum Emission Mask                                                | Same as clause 6.5.2.2 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                      | Minimum requirement + TT                                                                            |
| 6.5.2.4.1 NR Adjacent Channel Leakage Ratio                                   | Same as clause 6.5.2.4.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                    | Minimum requirement - TT                                                                            |
| 6.5.2.4.1_1 NR ACLR for UEs supporting 2Tx Tx Diversity                       | Same as clause 6.5G.2.3.1 in TS 38.521-1 [2] for FDD band with $f \leq 3$ GHz.                   | Minimum requirement - 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                  |
| 7.3.2_1 Reference sensitivity power level for flexible Tx-Rx frequency separation | Same as clause 7.3.2 in TS 38.521-1 [2].                                       | Minimum requirement + TT                  |
| 7.3.2_2 Reference sensitivity power level for UEs supporting 2Tx Tx Diversity     | 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 $f \leq 3\text{GHz}$ . | 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

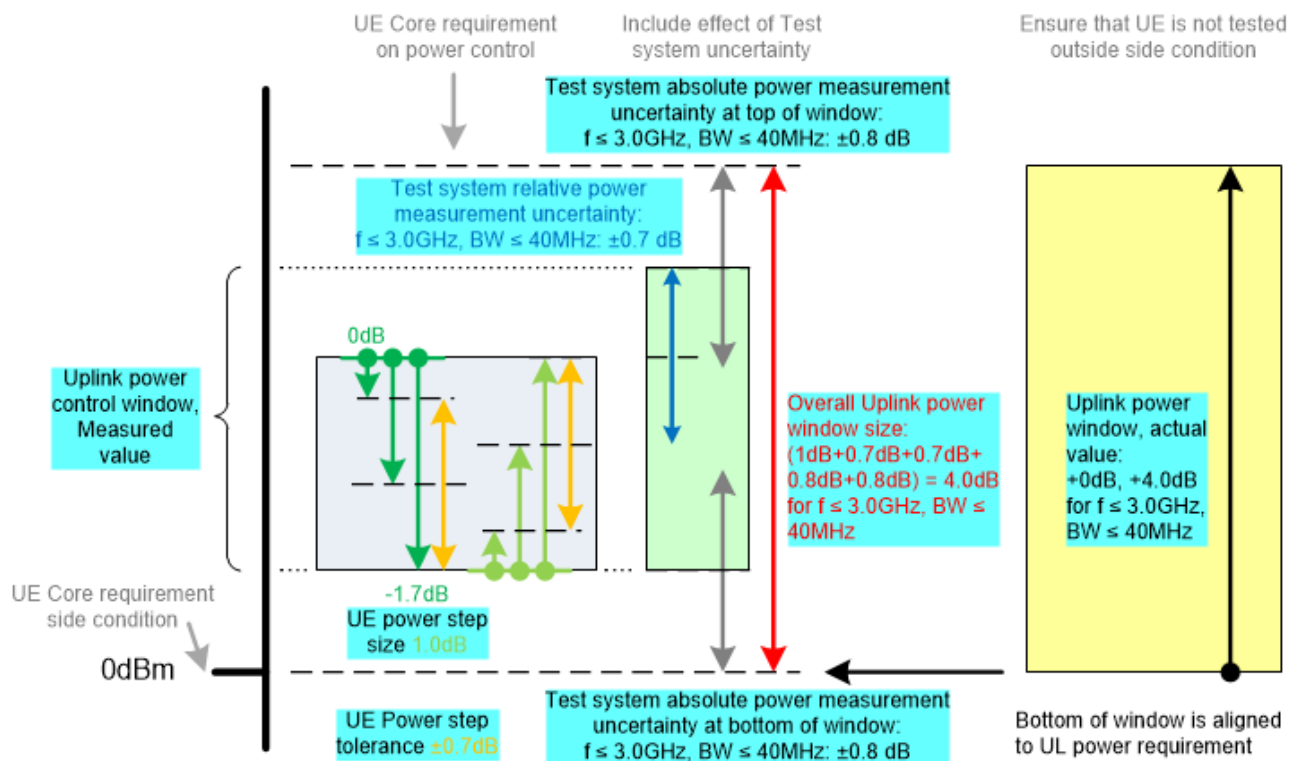
A number of Tx and Rx Test cases set the UE uplink power to be within a defined window to ensure the test is carried out in the intended conditions. This clause gives the method for calculating the uplink power window used in Tx test cases and Rx Test cases.

## 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  $f \leq 3$  GHz and  $BW \leq 40$  MHz and taking an example where the target value is 0dBm (lower end of a UE Core requirement side condition range of  $0 \text{ dBm} \leq \text{Output power} \leq 10 \text{ dBm}$ ):



### UE Uplink power

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  $\delta_{\text{PUSCH},f,c}$ .

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  $\Delta P \leq 1 \text{ dB}$ .

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  $BW \leq 40$  MHz and taking an example where the target value is 4 dB below PCMAX\_L (UE Core requirement side condition):

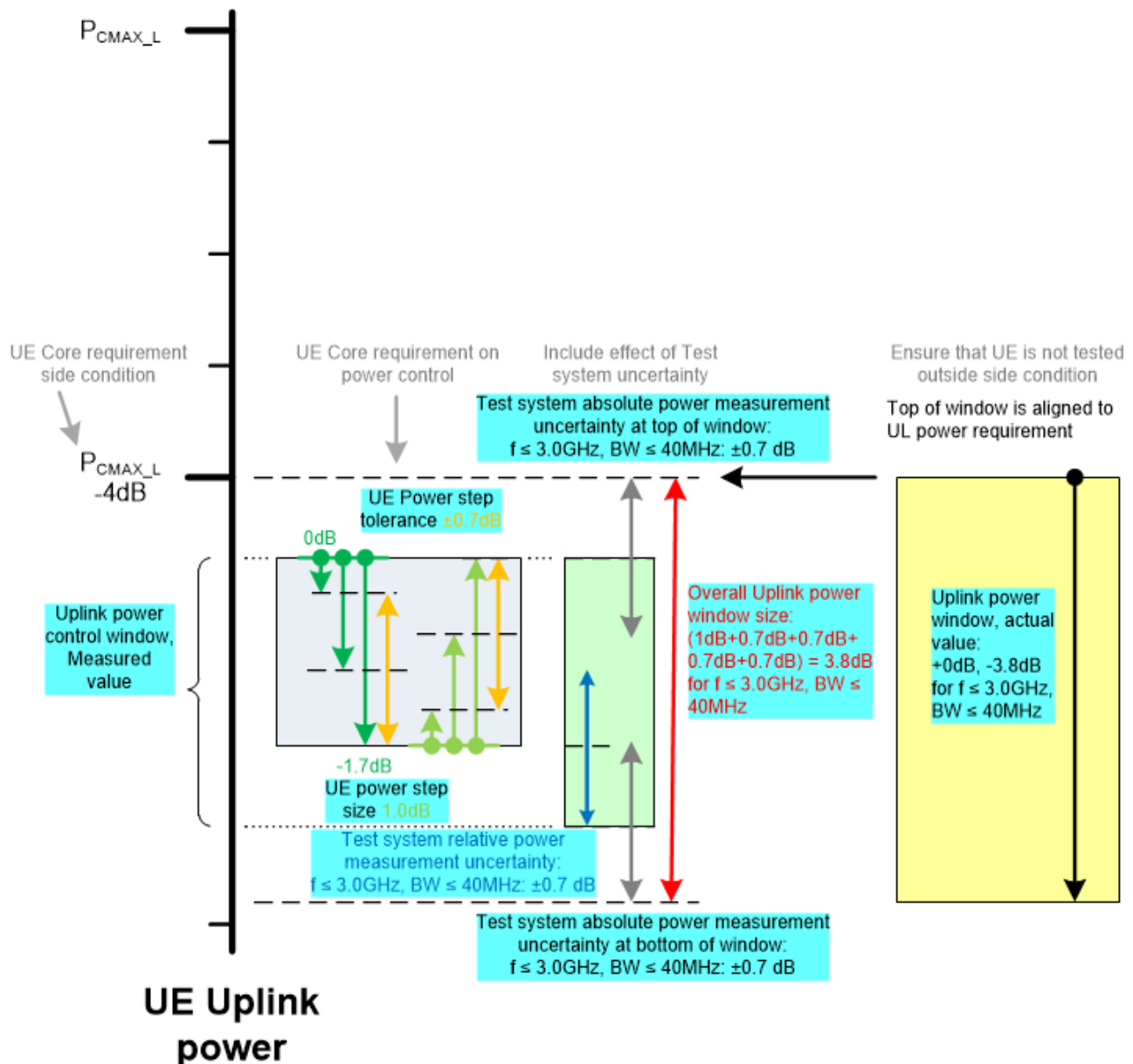


Figure F.4.3-1: Example uplink power setting to be below a requirement

The smallest UE Power step size is defined in TS 38.213 [7] Table 7.1.1-1, for absolute  $\delta_{\text{PUSCH},f,c}$ .

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  $f \leq 3$  GHz and  $BW \leq 40$  MHz and taking an example where the target value is +10 dBm:

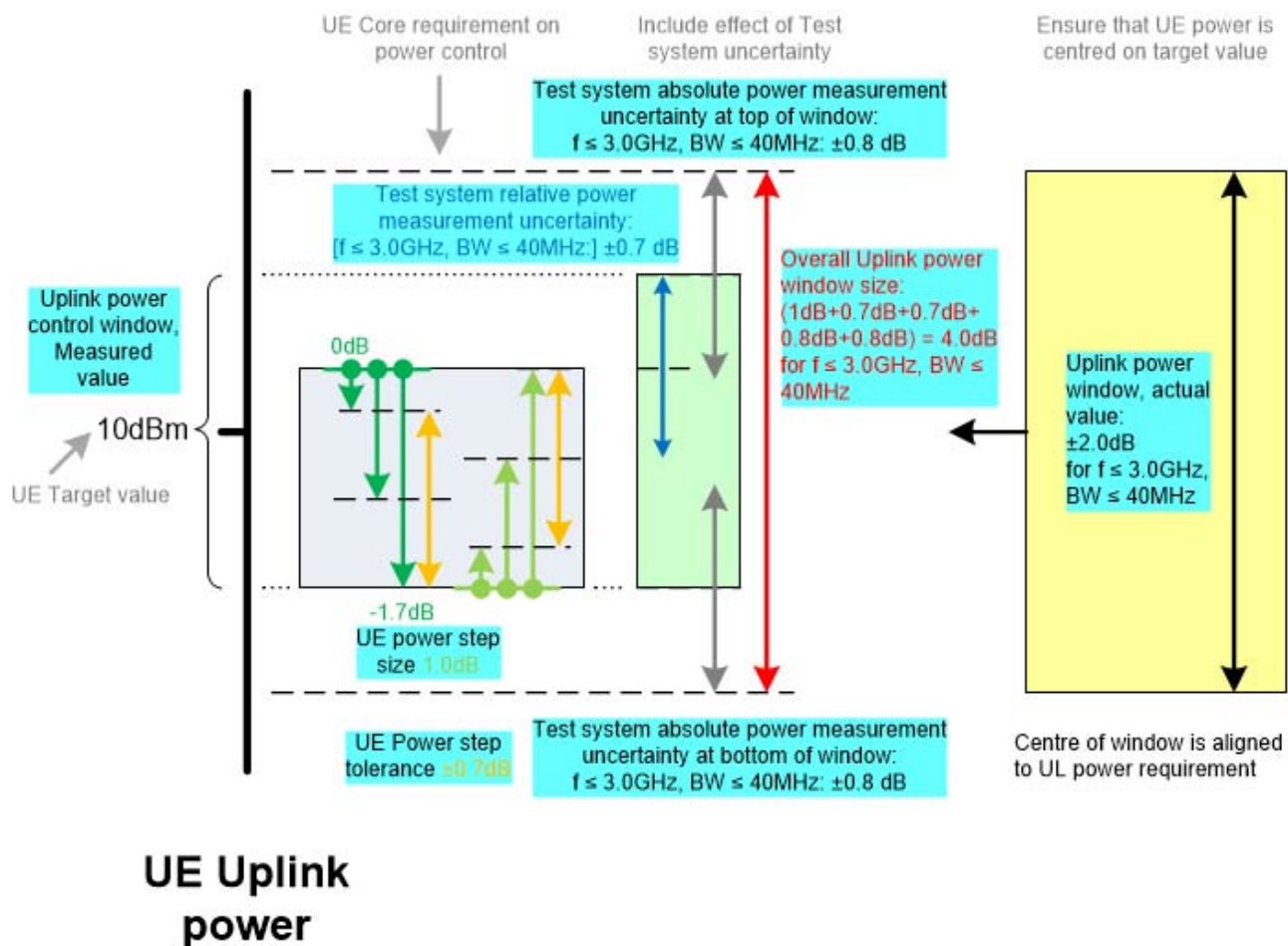


Figure F.4.4-1: Example NR FR1 uplink power setting centred on a target value

The smallest UE Power step size is defined in TS 38.213 [7] Table 7.1.1-1, for absolute  $\delta_{\text{PUSCH},f,c}$ .

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 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.

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## Annex G (normative): Statistical Testing

### G.1 Statistical testing of Performance Requirements with throughput

#### G.1.1 General

The test of receiver performance 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 most receiver performance tests is either 70 % or 30 % of the maximum throughput.

All receiver performance tests are performed in fading conditions. In addition to the statistical considerations, this requires the definition of a minimum test time.

#### G.1.2 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  $(\text{NACK} + \text{statDTX}) / (\text{NACK} + \text{statDTX} + \text{ACK})$  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.

### G.1.3 Design of the test

The test is defined by the following design principles (see clause G.2, Theory):

1. The standard concept is applied. (not the early decision concept)
2. A second limit is introduced: The second limit is different, whether 30 % or 70 % throughput is tested.
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:

- 1a) Limit Error Ratio = 0.3 (in case 70 % Throughput is tested) or
- 1b) Limit Throughput = 0.3 (in case 30 % Throughput is tested) or
- 1c) Limit Error Ratio = 0.01 (in case 1% BLER is tested)
- 2a) Bad DUT factor  $M=1.378$  (selectivity)
- 2b) Bad DUT factor  $m=0.692$  (selectivity)
- 2c) Bad DUT factor  $M=1.5$  (selectivity)  
justification see: TS 34.121 Clause F.6.3.3
- 3) Confidence level CL = 95 % (for specified DUT and Bad DUT-quality)

### G.1.4 Void

### G.1.5 Minimum Test time

The tables below contain the minimum number of slots for FDD and TDD.

By simulations the minimum number of active subframes (carrying DL payload) was derived (MNAS), then adding inactive subframes to the active ones. (for TDD additional subframes contain no DL payload), then rounding up to full thousand.

Simulation method to derive minimum test time:

With a level, corresponding a throughput at the test limit (here 30 % or 70 % of the max. throughput) the preliminary throughput versus time converges towards the final throughput. The allowance of  $\pm 2\%$  throughput variation around the above mentioned level is predefined by RAN5 to find the minimum test time. The allowance of  $\pm 2\%$  maps through the function "final throughput versus level" into a throughput corridor. The minimum test time is achieved when the preliminary throughput escapes the corridor the last time. The two functions "final throughput versus level" and "preliminary throughput versus time" are simulation results, which are done individual for each demodulation scenario.

In the case where the throughput does not converge across all the seeds used in the simulation within a reasonable time duration, then the throughput corridor is expanded to  $\pm 3.5\%$  of the target throughput to see if the all the seeds converge. In order to account for the additional throughput variation, a SNR uncertainty due to finite test time term is added to the overall MU calculation.

The entire procedure is summarized as below.

### G.1.5.0\_1 Minimum Test Time procedure for PDSCH scenarios with 30% or 70% Throughput requirement

1. Run the PDSCH simulations for an extended period of time at the SNR of interest for multiple seeds.
2. The minimum test time is determined by the time it took the throughput curve to settle within  $\pm 2\%$  of the target throughput value across all seeds.
3. If the throughput does not settle within the  $\pm 2\%$  throughput limit within a reasonable amount of time for any seed, expand the threshold to  $\pm 3.5\%$  of the target throughput value.
4. To account for the additional 1.5% throughput variation, determine from the Throughput vs SNR curve, what is the SNR delta corresponding to this 1.5 % throughput increase.
5. That SNR value is the added SNR uncertainty due to finite test time.

### G.1.5.0\_2 Minimum Test Time procedure for PDSCH and PDCCH scenarios with 1% BLER requirement

1. Run the PDSCH simulations for an extended period of time at the SNR of interest for multiple seeds.
2. The minimum test time is determined by the time it took the residual BLER curve to converge within  $\pm 10\%$  of the target 1% residual BLER (i.e. within 0.9% and 1.1% BLER) across all seeds.
3. If the residual BLER does not converge within the  $\pm 10\%$  of the 1% target limit within a reasonable amount of time for any seed, increase SNR in steps of 0.1 dB and rerun the simulations within the same target BLER limit.
4. The additional delta SNR required to meet the residual BLER convergence limit is the added SNR uncertainty due to finite test time.
5. This SNR uncertainty due to finite test time would be one of the MU term in the overall MU calculation

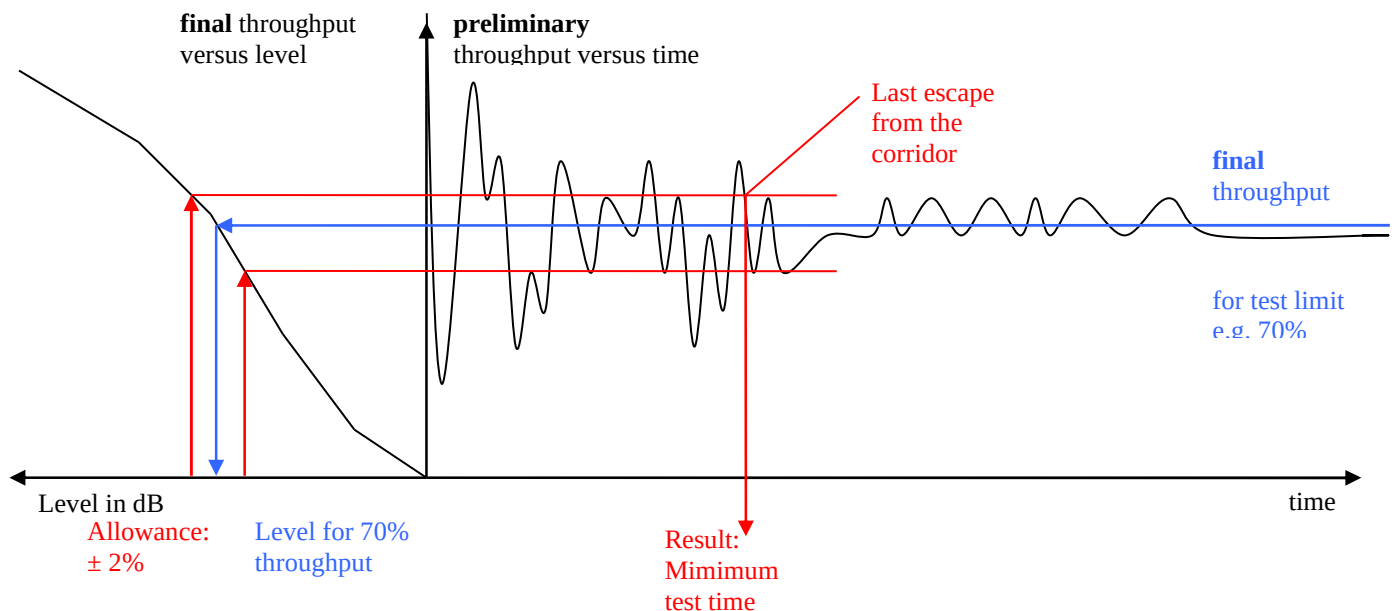


Figure G.1.5-1: Simulation method to derive minimum test time

Table G.1.5-1: Minimum Test time for PDSCH demodulation

| Test number                                                                                                                                                                                                                                                               | Reference Channel | Propagation condition | Minimum number of active subframes (MNAS) | MNAS to MNS Scaling factor (Note 3) | Minimum Number of Subframes (MNS) after rounding up to nearest thousand<br>$MNS = 1000 * \left\lceil \frac{MNAS}{1000} \right\rceil$ |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------|-------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 1-1                                                                                                                                                                                                                                                                       | R.PDSCH.1-1.1 FDD | NTN-TDLA100-200       | 30000 (Note 1)                            | 1.0526                              | 32000                                                                                                                                |
| 1-2                                                                                                                                                                                                                                                                       | R.PDSCH.1-2.1 FDD | NTN-TDLC5-200         | 72000 (Note 1)                            | 1.0526                              | 76000                                                                                                                                |
| 1-3                                                                                                                                                                                                                                                                       | R.PDSCH.1-1.1 FDD | NTN-TDLC5-200         | 80000 (Note 1)                            | 1.0526                              | 85000                                                                                                                                |
| 1-4                                                                                                                                                                                                                                                                       | R.PDSCH.1-1.1 FDD | NTN-TDLA100-200       | 30000 (Note 1)                            | 1.0526                              | 32000                                                                                                                                |
| Note 1: MNAS determined by simulations.<br>Note 2: For cases where MNAS is not determined by simulations, use same MNAS as the similar case simulated (same doppler speed)<br>Note 3: MNS/MNAS ratio decided by scheduling pattern and is ratio of all slots to DL slots. |                   |                       |                                           |                                     |                                                                                                                                      |

## G.2 Theory to derive the numbers for statistical testing (informative)

Editor's note: This clause of the Annex G is for information only and it described the background theory and information for statistical testing.

### G.2.1 Error Ratio (ER)

The Error Ratio (ER) is defined as the ratio of number of errors (ne) to all results, number of samples (ns).

(1-ER is the success ratio).

### G.2.2 Test Design

A statistical test is characterized by:

Test-time, Selectivity and Confidence level.

### G.2.3 Confidence level

The outcome of a statistical test is a decision. This decision may be correct or in-correct. 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.

### G.2.4 Introduction: Supplier Risk versus Customer Risk

There are two targets of decision:

- (a) A measurement on the pass-limit shows, that the DUT has the specified quality or is better with probability CL (CL e.g.95 %). This shall lead to a "pass decision".

The pass-limit is on the good side of the specified DUT-quality. A more stringent CL (CL e.g.99 %) shifts the pass-limit farther into the good direction. Given the quality of the DUTs is distributed, a greater CL passes less and better DUTs.

A measurement on the bad side of the pass-limit is simply "not pass" (undecided or artificial fail).

(aa) Complementary:

A measurement on the fail-limit shows, that the DUT is worse than the specified quality with probability CL.

The fail-limit is on the bad side of the specified DUT-quality. A more stringent CL shifts the fail-limit farther into the bad direction. Given the quality of the DUTs is distributed, a greater CL fails less and worse DUTs.

A measurement on the good side of the fail-limit is simply "not fail".

(b) A DUT, known to have the specified quality, shall be measured and decided pass with probability CL. This leads to the test limit.

For CL e.g. 95 %, the test limit is on the bad side of the specified DUT-quality. CL e.g.99 % shifts the pass-limit farther into the bad direction. Given the DUT-quality is distributed, a greater CL passes more and worse DUTs.

(bb) A DUT, known to be an ( $\varepsilon \rightarrow 0$ ) beyond the specified quality, shall be measured and decided fail with probability CL.

For CL e.g.95 %, the test limit is on the good side of the specified DUT-quality.

NOTE 1: The different sense for CL in (a), (aa) versus (b), (bb).

NOTE 2: For constant CL in all 4 bullets (a) is equivalent to (bb) and (aa) is equivalent to (b).

## G.2.5 Supplier Risk versus Customer Risk

The table below summarizes the different targets of decision.

**Table G.2.5-1: Equivalent statements**

|                            | <b>Equivalent statements, using different cause-to-effect-directions, and assuming CL = constant &gt;1/2</b> |                                                                                                                                   |
|----------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| cause-to-effect-directions | Known measurement result $\rightarrow$ estimation of the DUT's quality                                       | Known DUT's quality $\rightarrow$ estimation of the measurement's outcome                                                         |
| Supplier Risk              | A measurement on the pass-limit shows, that the DUT has the specified quality or is better (a)               | A DUT, known to have an ( $\varepsilon \rightarrow 0$ ) beyond the specified DUT-quality, shall be measured and decided fail (bb) |
| Customer Risk              | A measurement on the fail-limit shall shows, that the DUT is worse than the specified quality (aa)           | A DUT, known to have the specified quality, shall be measured and decided pass (b)                                                |

The shaded area shown the direct interpretation of Supplier Risk and Customer Risk.

The same statements can be based on other DUT-quality-definitions.

## G.2.6 Introduction: Standard test versus early decision concept

In standard statistical tests, a certain number of results (ns) is predefined in advance to the test. After ns results the number of bad results (ne) is counted and the error ratio (ER) is calculated by ne/ns.

Applying statistical theory, a decision limit can be designed, against which the calculated ER is compared to derive the decision. Such a limit is one decision point and is characterized by:

- D: the wrong decision probability (a predefined parameter)

- ns: the number of results (a fixed predefined parameter)
- ne: the number of bad results (the limit based on just ns)

In the formula for the limit, D and ns can be understood as variable parameter and variable. However the standard test execution requires fixed ns and D. The property of such a test is: It discriminates between two states only, depending on the test design:

- pass (with CL) / undecided (undecided in the sense: finally undecided)
- fail (with CL) / undecided (undecided in the sense: finally undecided)
- pass(with CL) / fail (with CL) (however against two limits).

In contrast to the standard statistical tests, the early decision concept predefines a set of (ne,ns) co-ordinates, representing the limit-curve for decision. After each result a preliminary ER is calculated and compared against the limit-curve. After each result one may make the decision or not (undecided for later decision). The parameters and variables in the limit-curve for the early decision concept have a similar but not equal meaning:

- D: the wrong decision probability (a predefined parameter)
- ns: the number of results (a variable parameter)
- ne: the number of bad results (the limit. It varies together with ns)

To avoid a "final undecided" in the standard test, a second limit shall be introduced and the single decision co-ordinate (ne,ns) needs a high ne, leading to a fixed (high) test time. In the early decision concept, having the same selectivity and the same confidence level an "undecided" need not to be avoided, as it can be decided later. A perfect DUT will hit the decision coordinate (ne,ns) with ne=0. This test time is short.

## G.2.7 Standard test versus early decision concept

For Supplier Risk:

The wrong decision probability D in the standard test is the probability, to decide a DUT in-correct in the single decision point. In the early decision concept there is a probability of in-correct decisions d at each point of the limit-curve. The sum of all those wrong decision probabilities accumulate to D. Hence  $d < D$ .

For Customer Risk:

The correct decision probability CL in the standard test is the probability, to decide a DUT correct in the single decision point. In the early decision concept there is a probability of correct decisions cl at each point of the limit-curve. The sum of all those correct decision probabilities accumulate to CL. Hence  $cl < CL$  or  $d > D$ .

## G.2.8 Selectivity

There is no statistical test which can discriminate between a limit DUT and a DUT which is an ( $\epsilon \rightarrow 0$ ) apart from the limit in finite time and high confidence level CL. Either the test discriminates against one limit with the results pass (with CL)/undecided or fail (with CL)/undecided, or the test ends in a result pass (with CL)/fail (with CL) but this requires a second limit.

For  $CL > 1/2$ , a (measurement-result = specified-DUT-quality), generates undecided in test "supplier risk against pass limit" (a, from above) and also in the test "customer risk against the fail limit" (aa)

For  $CL > 1/2$ , a DUT, known to be on the limit, will be decided pass for the test "customer risk against pass limit" (b) and also "supplier risk against fail limit" (bb).

This overlap or undecided area is not a fault or a contradiction, however it can be avoided by introducing a Bad or a Good DUT quality according to:

- Bad DUT quality: specified DUT-quality \* M ( $M > 1$ )
- Good DUT quality: specified DUT-quality \* m ( $m < 1$ )

Using e.g.  $M > 1$  and  $CL = 95\%$  the test for different DUT qualities yield different pass probabilities:

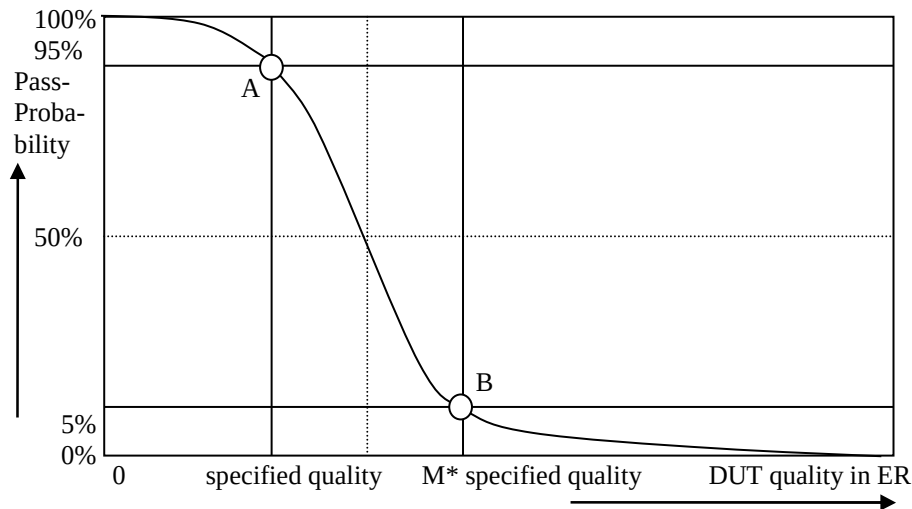


**Figure G.2.8-1: Pass probability versus DUT quality**

## G.2.9 Design of the test

The receiver characteristic test are defined by the following design principles:

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 receiver characteristic test are defined by the following parameters:

1. Limit ER = 0.05
2. Bad DUT factor  $M = 1.5$  (selectivity)
3. Confidence level CL = 95 % (for specified DUT and Bad DUT-quality)

This has the following consequences:

1. A measurement on the fail limit is connected with 2 equivalent statements:

|                                                                                             |                                                                             |
|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| A measurement on the fail-limit shows, that the DUT is worse than the specified DUT-quality | A DUT, known have the specified quality, shall be measured and decided pass |
|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|

2. A measurement on the pass limit is connected with the complementary statements:

|                                                                                         |                                                                              |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| A measurement on the pass limit shows, that the DUT is better than the Bad DUT-quality. | A DUT, known to have the Bad DUT quality, shall be measured and decided fail |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------|

The left column is used to decide the measurement.

The right column is used to verify the design of the test by simulation.

The simulation is based on the two fulcrums A and B only in Figure G.2.8-1

### 3. Test time

The minimum and maximum test time is fixed.

The average test time is a function of the DUT's quality.

The individual test time is not predictable.

4. The number of decision co-ordinates (ne,ns) in the early decision concept is responsible for the selectivity of the test and the maximum test time. Having fixed the number of decision co-ordinates there is still freedom to select the individual decision co-ordinates in many combinations, all leading to the same confidence level.

## G.2.10 Simulation to derive the pass fail limits

There is freedom to design the decision co-ordinates (ne,ns).

The binomial distribution and its inverse is used to design the pass and fail limits. Note that this method is not unique and that other methods exist.

$$\text{fail}(ne, d_f) := \frac{ne}{(ne + \text{qnbinom}(d_f, ne, ER))}$$

$$\text{pass}(ne, cl_p, M) := \frac{ne}{(ne + \text{qnbinom}(cl_p, ne, ER \cdot M))}$$

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 0.05
- ne is the number of bad results. This is the variable in both equations
- M is the Bad DUT factor M=1.5
- d<sub>f</sub> is the wrong decision probability of a single (ne,ns) co-ordinate for the fail limit.  
It is found by simulation to be d<sub>f</sub> = 0.004
- cl<sub>p</sub> is the confidence level of a single (ne,ns) co-ordinate for the pass limit.  
It is found by simulation to be cl<sub>p</sub> = 0.9975
- 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<sub>p</sub> and d<sub>f</sub> 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<sub>p</sub> and d<sub>f</sub> are tuned such that CL (95 %) of the population fails and D (5 %) of the population passes.

- This procedure and the relationship to the measurement is justified in clause G.2.9. The number of DUTs decrease during the simulation, as the decided DUTs leave the population. That number decreases with an approximately exponential characteristics. After 169 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 ( $n_e, n_s$ ), which can be achieved with other formulas or methods as well.

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# 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.

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## 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  $(\text{NACK} + \text{statDTX})/(\text{NACK} + \text{statDTX} + \text{ACK})$  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 <sub>p</sub> | ns <sub>f</sub> | ne | ns <sub>p</sub> | ns <sub>f</sub> | ne  | ns <sub>p</sub> | ns <sub>f</sub> | ne                 | ns <sub>p</sub> | ns <sub>f</sub> |
|----|-----------------|-----------------|----|-----------------|-----------------|-----|-----------------|-----------------|--------------------|-----------------|-----------------|
| 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<sub>p</sub>, ns=Number of Samples= number of NACK + statDTX + ACK).

NOTE 3: The third column is the number of samples for the fail limit (ns<sub>f</sub>).

NOTE 4: The UE could be decided as early pass/fail when at least 67 samples are received. The ns<sub>f</sub> 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 67+ samples, otherwise continue

Having observed 2 errors, pass the test at 95+ samples, otherwise continue

etc.

Having observed 145 errors, pass the test at 2349+ samples, fail the test at 2345- samples, otherwise continue

Having observed 146 errors, pass the test at 2364+ 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 ( $\varepsilon \rightarrow 0$ ), 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.

$$fail(ne, d_f) := \frac{ne}{ns_f} = \frac{ne}{(ne + qnbinom(d_f, ne, ER))}$$

$$pass(ne, cl_p, M) := \frac{ne}{ns_p} = \frac{ne}{(ne + qnbinom(cl_p, ne, ER \cdot M))}$$

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  $ER = M \cdot 0.05$  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 | R<br>ev | Cat | Subject/Comment                                                                                  | New<br>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          |
| 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          |

| Change history |          |           |      |         |     |                                                                                              |                |
|----------------|----------|-----------|------|---------|-----|----------------------------------------------------------------------------------------------|----------------|
| Date           | Meeting  | TDoc      | CR   | R<br>ev | Cat | Subject/Comment                                                                              | New<br>version |
| 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 conformance 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         |
| 2024-06        | RAN#104  | R5-242500 | 0038 | -       | F   | Introduction of new NR NTN test case - 6.5.1 Occupied bandwidth                              | 18.2.0         |
| 2024-06        | RAN#104  | R5-242501 | 0039 | -       | F   | Introduction of new NR NTN test case - 6.4.2.1 Error Vector Magnitude                        | 18.2.0         |
| 2024-06        | RAN#104  | R5-242506 | 0044 | -       | F   | Introduction of new NR NTN test case - 6.4.2.5 EVM equalizer spectrum flatness for Pi2 BPSK  | 18.2.0         |
| 2024-06        | RAN#104  | R5-242508 | 0046 | -       | F   | Update of NR NTN test case - 6.2.2 UE maximum output power reduction                         | 18.2.0         |
| 2024-06        | RAN#104  | R5-242510 | 0048 | -       | F   | Update of NR NTN test case - 6.2.4 Configured transmitted power                              | 18.2.0         |
| 2024-06        | RAN#104  | R5-242947 | 0051 | -       | F   | Updates to additional spurious emissions TC 6.5.3.3                                          | 18.2.0         |
| 2024-06        | RAN#104  | R5-243288 | 0053 | -       | F   | Corrections on 5.1 for NTN FR1 frequency range designation                                   | 18.2.0         |
| 2024-06        | RAN#104  | R5-243289 | 0054 | -       | F   | Corrections on 6.2.3 for NTN UE additional maximum output power reduction                    | 18.2.0         |
| 2024-06        | RAN#104  | R5-243290 | 0055 | -       | F   | Corrections on 6.5.3.3 for NTN UE additional spurious emissions                              | 18.2.0         |
| 2024-06        | RAN#104  | R5-243417 | 0059 | -       | F   | Annex F updates for NTN RF test on ACLR                                                      | 18.2.0         |
| 2024-06        | RAN#104  | R5-243422 | 0063 | -       | F   | REFSENS requirements updates related to NTN band n254                                        | 18.2.0         |
| 2024-06        | RAN#104  | R5-243673 | 0041 | 1       | F   | Introduction of new NR NTN test case - 6.4.2.2 Carrier leakage                               | 18.2.0         |
| 2024-06        | RAN#104  | R5-243674 | 0042 | 1       | F   | Introduction of new NR NTN test case - 6.4.2.3 In-band emissions                             | 18.2.0         |
| 2024-06        | RAN#104  | R5-243675 | 0043 | 1       | F   | Introduction of new NR NTN test case - 6.4.2.4 EVM equalizer spectrum flatness               | 18.2.0         |
| 2024-06        | RAN#104  | R5-243676 | 0045 | 1       | F   | Update of NR NTN test case - 6.2.1 UE maximum output power                                   | 18.2.0         |
| 2024-06        | RAN#104  | R5-243677 | 0047 | 1       | F   | Update of NR NTN test case - 6.2.3 UE additional maximum output power reduction              | 18.2.0         |

| Change history |         |           |      |         |     |                                                                                                                |                |
|----------------|---------|-----------|------|---------|-----|----------------------------------------------------------------------------------------------------------------|----------------|
| Date           | Meeting | TDoc      | CR   | R<br>ev | Cat | Subject/Comment                                                                                                | New<br>version |
| 2024-06        | RAN#104 | R5-243678 | 0049 | 1       | F   | Update MU and TT for NR NTN test cases                                                                         | 18.2.0         |
| 2024-06        | RAN#104 | R5-243679 | 0052 | 1       | F   | Adding new NTN test case 6.3.4 Power control                                                                   | 18.2.0         |
| 2024-06        | RAN#104 | R5-243680 | 0056 | 1       | F   | Updates on Annex for satellite access conformance test                                                         | 18.2.0         |
| 2024-06        | RAN#104 | R5-243681 | 0057 | 1       | F   | Annex F updates for NTN RF test on Tx on-off time mask                                                         | 18.2.0         |
| 2024-06        | RAN#104 | R5-243683 | 0061 | 1       | F   | MOP requirement updates related to NTN band n254                                                               | 18.2.0         |
| 2024-06        | RAN#104 | R5-243684 | 0062 | 1       | F   | A-MPR requirements updates related to NTN band n254                                                            | 18.2.0         |
| 2024-06        | RAN#104 | R5-243685 | 0064 | 1       | F   | IBB requirements updates related to NTN band n254                                                              | 18.2.0         |
| 2024-06        | RAN#104 | R5-243814 | 0058 | 1       | F   | Annex F updates for NTN RF test on Spectrum emission mask                                                      | 18.2.0         |
| 2024-06        | RAN#104 | R5-243896 | 0040 | 1       | F   | Introduction of new NR NTN test case - 6.4.2.1a Error Vector Magnitude including symbols with transient period | 18.2.0         |
| 2024-06        | RAN#104 | R5-243899 | 0065 | 1       | F   | Update to nrn-ntn pdsch demod test case to update min test time                                                | 18.2.0         |
| 2024-06        | RAN#104 | R5-243987 | 0060 | 2       | F   | Common clause updates related to NTN band n254                                                                 | 18.2.0         |
| 2024-09        | RAN#105 | R5-244933 | 0066 | -       | F   | Corrections on 7.3.2 for REFSSENS requirements for NTN band n256                                               | 18.3.0         |
| 2024-09        | RAN#105 | R5-245098 | 0067 | -       | F   | Updates to Tx power control MU TT values                                                                       | 18.3.0         |
| 2024-09        | RAN#105 | R5-245854 | 0071 | 1       | F   | min test time update for nr-ntn pdsch demod test cases                                                         | 18.3.0         |
| 2024-09        | RAN#105 | R5-245856 | 0073 | 1       | F   | Update to Clause 7.6.2 In-band blocking                                                                        | 18.3.0         |
| 2024-09        | RAN#105 | R5-245857 | 0074 | 1       | F   | Update to Clause 7.6.4 Narrow band blocking                                                                    | 18.3.0         |
| 2024-09        | RAN#105 | R5-245858 | 0075 | 1       | F   | Updates to NTN Out of band blocking RF test                                                                    | 18.3.0         |
| 2024-09        | RAN#105 | R5-245863 | 0076 | 1       | F   | Common clause updates related to NTN band n254                                                                 | 18.3.0         |
| 2024-09        | RAN#105 | R5-245864 | 0077 | 1       | F   | A-MPR requirements updates related to NTN band n254                                                            | 18.3.0         |
| 2024-12        | RAN#106 | R5-246434 | 0079 | -       | F   | NTN A-Spurious test - corrections for NS 02N                                                                   | 18.4.0         |
| 2024-12        | RAN#106 | R5-247152 | 0082 | -       | F   | Addition of common clauses for NR-NTN enhancements                                                             | 18.4.0         |
| 2024-12        | RAN#106 | R5-247153 | 0083 | -       | F   | Addition of radiated demodulation clauses for NR-NTN enhancements                                              | 18.4.0         |
| 2024-12        | RAN#106 | R5-247263 | 0085 | -       | F   | Adding receiver requirements for band n254                                                                     | 18.4.0         |
| 2024-12        | RAN#106 | R5-247785 | 0080 | 1       | F   | Updating the test description in NTN performance test case                                                     | 18.4.0         |
| 2024-12        | RAN#106 | R5-247787 | 0081 | 1       | F   | addition of subtest selection criteria for DEMOD NR-NTN test case                                              | 18.4.0         |
| 2024-12        | RAN#106 | R5-247800 | 0086 | 1       | F   | Updates on definition of NTN terms and abbreviations                                                           | 18.4.0         |
| 2024-12        | RAN#106 | R5-247970 | 0084 | 1       | F   | Adding transmitter requirements for band n254                                                                  | 18.4.0         |
| 2025-03        | RAN#107 | R5-250291 | 0087 | -       | F   | NR NTN - Core specs alignment in common clauses                                                                | 18.5.0         |
| 2025-03        | RAN#107 | R5-250632 | 0088 | -       | F   | Update of test conditions for NR NTN out-of-band blocking test case                                            | 18.5.0         |
| 2025-03        | RAN#107 | R5-250948 | 0089 | -       | F   | Correction of statistical testing of receiver characteristics for NR NTN                                       | 18.5.0         |
| 2025-03        | RAN#107 | R5-251085 | 0090 | -       | F   | Corrections on 6.2.3.3.1 for clause number for NS_03N NS_04N and NS_05N                                        | 18.5.0         |
| 2025-06        | RAN#108 | R5-253237 | 0098 | 1       | F   | Rearrangement of RMC tables for FR2 NTN                                                                        | 18.6.0         |
| 2025-06        | RAN#108 | R5-252850 | 0099 | -       | F   | Corrections on clause 5 for FR2-NTN frequency range                                                            | 18.6.0         |
| 2025-06        | RAN#108 | R5-253006 | 0101 | -       | F   | Editorial update to NTN RF test case                                                                           | 18.6.0         |
| 2025-06        | RAN#108 | R5-253473 | 0092 | 1       | F   | NR NTN - Out of band blocking test - Frequency range update                                                    | 18.6.0         |
| 2025-06        | RAN#108 | R5-253474 | 0094 | 1       | F   | Correction of test case 6.4.2.1a                                                                               | 18.6.0         |
| 2025-06        | RAN#108 | R5-253475 | 0096 | 1       | F   | Cleaning up for NR NTN clause 8.2.1.2                                                                          | 18.6.0         |
| 2025-06        | RAN#108 | R5-253603 | 0093 | 1       | F   | NR NTN - Removing 256QAM - Core specs alignment                                                                | 18.6.0         |
| 2025-06        | RAN#108 | R5-253612 | 0095 | 1       | F   | Addition of reference sensitivity test cases with variable Tx-Rx spacing for NR NTN bands                      | 18.6.0         |
| 2025-06        | RAN#108 | R5-253235 | 0097 | 2       | F   | Addition of active UL slots and RMC for RF tests of FR1 NTN                                                    | 18.6.0         |
| 2025-09        | RAN#109 | R5-254263 | 0103 | -       | F   | Updates to complete the reference sensitivity test cases with variable Tx-Rx spacing for NR NTN bands          | 18.7.0         |
| 2025-09        | RAN#109 | R5-254376 | 0105 | -       | F   | Clean up of Tx, Rx and Px test cases                                                                           | 18.7.0         |
| 2025-09        | RAN#109 | R5-254743 | 0107 | -       | F   | Correction to A-MPR for NS_03N NS_04N NS_05N                                                                   | 18.7.0         |
| 2025-09        | RAN#109 | R5-255287 | 0104 | 1       | F   | Corrections on channel bandwidths for NTN satellite band in FR2-NTN and sync raster for band n254              | 18.7.0         |
| 2025-09        | RAN#109 | R5-255288 | 0106 | 1       | F   | Split of power control test cases                                                                              | 18.7.0         |
| 2025-09        | RAN#109 | R5-255397 | 0108 | 1       | F   | Update of RMCs for FR1-NTN TRx testing with SCS 15 kHz and 30 kHz                                              | 18.7.0         |
| 2025-09        | RAN#109 | R5-255408 | 0109 | 1       | F   | Transmit power density and A-MPR updates for band n254                                                         | 18.7.0         |
| 2025-09        | RAN#109 | -         | -    | -       | -   | Corrected superscripts in Table 7.3.2.3-2                                                                      | 18.7.1         |
| 2025-12        | RAN#110 | R5-256189 | 0114 | -       | F   | Update NTN test case 6.5.2.4.1                                                                                 | 18.8.0         |
| 2025-12        | RAN#110 | R5-256263 | 0117 | -       | F   | Correction to scheduling for PUCCH format3 in 6.4.2.1 and 6.4.2.3                                              | 18.8.0         |
| 2025-12        | RAN#110 | R5-256451 | 0119 | -       | F   | Correction of Tx test cases                                                                                    | 18.8.0         |
| 2025-12        | RAN#110 | R5-256457 | 0120 | -       | F   | Addition of Annex C.0                                                                                          | 18.8.0         |
| 2025-12        | RAN#110 | R5-256528 | 0122 | -       | F   | Updates to Tx Rx separation values for n254                                                                    | 18.8.0         |
| 2025-12        | RAN#110 | R5-256848 | 0115 | 1       | F   | Correction to fixed reference channels for SCS 30kHz FR1-NTN                                                   | 18.8.0         |
| 2025-12        | RAN#110 | R5-256993 | 0121 | 1       | F   | New additional spectrum emission mask test case, Transmit power density and other updates for band n254        | 18.8.0         |

| Change history |         |           |      |      |     |                                                                                                                   |             |
|----------------|---------|-----------|------|------|-----|-------------------------------------------------------------------------------------------------------------------|-------------|
| Date           | Meeting | TDoc      | CR   | R ev | Cat | Subject/Comment                                                                                                   | New version |
| 2025-12        | RAN#110 | R5-256958 | 0111 | 1    | B   | Introduction of band n252 to UE conformance Tx/Rx specification – clause 5                                        | 19.0.0      |
| 2025-12        | RAN#110 | R5-256959 | 0112 | 1    | B   | Introduction of band n252 to UE conformance Tx/Rx specification – clause 6                                        | 19.0.0      |
| 2025-12        | RAN#110 | R5-256960 | 0113 | 1    | B   | Introduction of band n252 to UE conformance Tx/Rx specification – clause 7                                        | 19.0.0      |
| 2026-03        | RAN#111 | R5-260322 | 0125 | -    | F   | Correction on MU definition for NR NTN Rx spurious test case 7.9                                                  | 19.1.0      |
| 2026-03        | RAN#111 | R5-260323 | 0126 | -    | F   | NR NTN power density test - MU and TT update                                                                      | 19.1.0      |
| 2026-03        | RAN#111 | R5-260344 | 0127 | -    | F   | Addition of Bandwidth less than 5MHz for Enhanced requirements in NR NTN TX test cases                            | 19.1.0      |
| 2026-03        | RAN#111 | R5-260508 | 0141 | -    | F   | MU TT Update in Annex F for NR NTN for UEs with 2Tx Tx Diversity                                                  | 19.1.0      |
| 2026-03        | RAN#111 | R5-260534 | 0143 | -    | F   | Addition of NTN HPUE to 6.2.2 MPR                                                                                 | 19.1.0      |
| 2026-03        | RAN#111 | R5-260581 | 0146 | -    | F   | Correction of RB allocation for A-MPR                                                                             | 19.1.0      |
| 2026-03        | RAN#111 | R5-260586 | 0147 | -    | F   | Core specs alignment in common sections - removing the thousands separator                                        | 19.1.0      |
| 2026-03        | RAN#111 | R5-260616 | 0154 | -    | F   | Corrections on test requirements for UE maximum power density                                                     | 19.1.0      |
| 2026-03        | RAN#111 | R5-260677 | 0155 | -    | F   | Addition of system parameters for NR NTN bands n250, n251 and n253                                                | 19.1.0      |
| 2026-03        | RAN#111 | R5-260872 | 0158 | -    | F   | Editorial, correction of text for measurement during TDD transient period                                         | 19.1.0      |
| 2026-03        | RAN#111 | R5-260909 | 0159 | -    | F   | Update on random precoder in PDSCH demodulation requirements                                                      | 19.1.0      |
| 2026-03        | RAN#111 | R5-260922 | 0160 | -    | F   | Correction to 6.2.4 Configured transmitted power for NTN UE                                                       | 19.1.0      |
| 2026-03        | RAN#111 | R5-261034 | 0162 | -    | F   | Introduction of AMPR TC for NS07N                                                                                 | 19.1.0      |
| 2026-03        | RAN#111 | R5-261465 | 0148 | 1    | F   | Corrections on message contents for additional spurious emission tests for NS_06N and NS_07N and NS_08N           | 19.1.0      |
| 2026-03        | RAN#111 | R5-261466 | 0142 | 1    | F   | Addition of new test case 6.2.1_3 MOP for 4Tx TxD                                                                 | 19.1.0      |
| 2026-03        | RAN#111 | R5-261468 | 0144 | 1    | F   | Addition of new test cases 6.2.2_1 and 6.2.2_2 MPR for TxD                                                        | 19.1.0      |
| 2026-03        | RAN#111 | R5-261469 | 0161 | 1    | F   | Addition of new test case 6.2.4_2 Configured transmitted power for 4Tx TxD                                        | 19.1.0      |
| 2026-03        | RAN#111 | R5-261472 | 0140 | 1    | F   | Addition of new test case 6.2.1_2 for UE maximum output power for UEs supporting 2Tx Tx Diversity                 | 19.1.0      |
| 2026-03        | RAN#111 | R5-261474 | 0134 | 1    | F   | Addition of less than 5MHz bandwidth configuration                                                                | 19.1.0      |
| 2026-03        | RAN#111 | R5-261478 | 0156 | 1    | F   | Updates to reference sensitivity (default tx-rx separation) test case to include NR NTN bands n250, n251 and n253 | 19.1.0      |
| 2026-03        | RAN#111 | R5-261479 | 0128 | 1    | F   | Addition of new test case 6.5.2.4.1_1 for NR-NTN Power Class 2 NR ACLR for UEs with 2Tx Tx Diversity              | 19.1.0      |
| 2026-03        | RAN#111 | R5-261480 | 0130 | 1    | F   | Addition of new test case 7.3.2_2 for NR-NTN Power Class 2 NR Reference sensitivity for UEs with 2Tx Tx Diversity | 19.1.0      |
| 2026-03        | RAN#111 | R5-261481 | 0129 | 1    | F   | Addition of Bandwidth less than 5MHz for Enhanced requirements in NR NTN RX test cases                            | 19.1.0      |
| 2026-03        | RAN#111 | R5-261482 | 0137 | 1    | F   | Correction to NR NTN TC 6.4.2.4                                                                                   | 19.1.0      |
| 2026-03        | RAN#111 | R5-261483 | 0138 | 1    | F   | Addition of Annex A.5 in NR NTN test specs                                                                        | 19.1.0      |
| 2026-03        | RAN#111 | R5-261484 | 0163 | 1    | F   | Update of Doppler and delay in NR NTN frequency error test cases                                                  | 19.1.0      |
| 2026-03        | RAN#111 | R5-261485 | 0164 | 1    | F   | Update of NR NTN additional spurious emission test case                                                           | 19.1.0      |
| 2026-03        | RAN#111 | R5-261612 | 0157 | 1    | F   | Update of Annex G to clarify pass fail limits                                                                     | 19.1.0      |
| 2026-03        | RAN#111 | R5-261638 | 0131 | 2    | F   | Update clauses 5.3.5 and 5.3.6 to align with the core specification TS 38.101-5                                   | 19.1.0      |
| 2026-03        | RAN#111 | R5-261639 | 0123 | 1    | F   | Update to A-MPR and Reference sensitivity level TCs for NR-NTN                                                    | 19.1.0      |
| 2026-03        | RAN#111 | R5-261642 | 0139 | 1    | F   | Addition of HPUE requirement for NR NTN UE maximum output power                                                   | 19.1.0      |
| 2026-03        | RAN#111 | R5-261647 | 0149 | 1    | F   | Addition of A-MPR test case for NTN NR band n254 at 3MHz channel bandwidth for NS_03N                             | 19.1.0      |
| 2026-03        | RAN#111 | R5-261648 | 0150 | 1    | F   | Corrections on A-MPR requirements for NS_24N for NTN NR band n256                                                 | 19.1.0      |
| 2026-03        | RAN#111 | R5-261651 | 0151 | 1    | F   | Corrections on A-MPR test requirements for NS_100 and NS_03N and NS_04N and NS_05N                                | 19.1.0      |
| 2026-03        | RAN#111 | R5-261652 | 0152 | 1    | F   | Corrections on test message contents for UE maximum output power reduction                                        | 19.1.0      |

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# History

| Version | Date          | Status      |
|---------|---------------|-------------|
| V19.0.0 | February 2026 | Publication |
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