# 6 Transmitter characteristics

## 6.1 General

Editor’s Note: Test configurations/environments that require new spherical scan shall be included in test procedure section and identifying such scenarios is currently FFS and owned by RAN5.

Unless otherwise stated, the transmitter characteristics are specified over the air (OTA) with a single or multiple transmit chains.

Unless otherwise stated, for power class 3 UEs, the beam correspondence side condition for SSB and CSI-RS specified in subclause 6.6 shall apply to the transmission tests.

Transmitter requirements for CA operation apply only when the DMRS initialization parameters (including the case when the UE applies cell ID as DMRS scrambling ID) are different across all CCs. The UE may use higher MPR values outside this limitation.

Transmitter requirements for UL MIMO operation apply when the UE transmits on 2 ports on the same CDM group. The UE may use higher MPR values outside this limitation.

For Tx test cases the identified beam peak direction can be stored and reused for a device under test in various configurations/environments for the full duration of device testing as long as beam peak direction is the same.

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 and Table 6.1-2 are used throughout this section, unless otherwise stated by the test case.

The UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

Table 6.1-1: Common Uplink Configuration for PC2, PC3, PC4 and PC7

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel Bandwidth | SCS(kHz) | OFDM | RB allocation | | | | | | | |  |  |
| Outer\_Full | Outer\_xRB\_Left (Note 6) | Outer\_xRB\_Right (Note 6) | Inner\_Full (Note 1) | Inner\_xRB\_Left (Note 6) | Inner\_xRB\_Right (Note 6) | Inner\_Partial\_Left | Inner\_Partial\_Right | Inner\_Partial2\_Left | Inner\_Partial2\_Right |
| 50MHz | 60 | DFT-s | 64@0 | x@0 | x@(66-x) | 20@223  20@204 | x@223  x@14 | x@(44-x)3  x@(65-x)4 | 4@223  8@84 | 4@403  8@504 | 6@64 | 6@544 |
| CP | 66@0 | x@0 | x@(66-x) | 22@22 | x@223  x@14 | x@(44-x)3  x@(65-x)4 | 4@223  7@74 | 4@403  7@524 | 6@64 | 6@544 |
| 120 | DFT-s | 32@0 | x@0 | x@(32-x) | 10@113  10@104 | x@113  x@14 | x@(22-x)3  @(31-x)4 | 4@113  4@44 | 4@183  4@244 | 3@34 | 3@264 |
| CP | 32@0 | x@0 | x@(32-x) | 11@113  10@104 | x@113  x@14 | x@(22-x)3  x@(31-x)4 | 4@113  4@44 | 4@183  4@244 | 3@34 | 3@264 |
| 100MHz | 60 | DFT-s | 128@0 | x@0 | x@(132-x) | 40@443  40@404 | x@443  x@14 | x@(88-x)3  x@(131-x)4 | 4@443  8@84 | 4@843  8@1164 | 6@64 | 6@1204 |
| CP | 132@0 | x@0 | x@(132-x) | 44@44 | x@443  x@14 | x@(88-x)3  x@(131-x)4 | 4@443  7@74 | 4@843  7@1184 | 6@64 | 6@1204 |
| 120 | DFT-s | 64@0 | x@0 | x@(66-x) | 20@223  20@204 | x@223  x@14 | x@(44-x)3  x@(65-x)4 | 4@223  4@44 | 4@403  4@584 | 3@34 | 3@604 |
| CP | 66@0 | x@0 | x@(66-x) | 22@22 | x@223  x@14 | x@(44-x)3  x@(65-x)4 | 4@223  4@44 | 4@403  4@584 | 3@34 | 3@604 |
| 200MHz5 | 60 | DFT-s | 256@0 | x@0 | x@(264-x) | 81@883  81@814 | x@883  x@14 | x@(176-x)3  x@(263-x)4 | 4@883  8@84 | 4@1723  8@2484 | 6@64 | 6@2524 |
| CP | 264@0 | x@0 | x@(264-x) | 88@88 | x@883  x@14 | x@(176-x)3  x@(263-x)4 | 4@883  7@74 | 4@1723  7@2504 | 6@64 | 6@2524 |
| 120 | DFT-s | 128@0 | x@0 | x@(132-x) | 40@443  40@404 | x@443  x@14 | x@(88-x)3  x@(131-x)4 | 4@443  4@44 | 4@843  4@1244 | 3@34 | 3@1264 |
| CP | 132@0 | x@0 | x@(132-x) | 44@44 | x@443  x@14 | x@(88-x)3  x@(131-x)4 | 4@443  4@44 | 4@843  4@1244 | 3@34 | 3@1264 |
| 400MHz5 | 60 | DFT-s | N/A | N/A | 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 | N/A | N/A |
| 120 | DFT-s | 256@0 | x@0 | x@(264-x) | 64@66 | x@66 | x@(198-x) | 4@66 | 4@194 | N/A | N/A |
| CP | 264@0 | x@0 | x@(264-x) | 66@66 | x@66 | x@(198-x) | 4@66 | 4@194 | N/A | N/A |
| Note 1: RB allocation is left aligned within inner region.  Note 2: Inner\_Full allocation is selected as the largest RB allocation within Region 1 inner allocation defined in 6.2.2.3.3; Inner\_Partial\_Left and Inner\_Partial\_Right are selected as partial allocation within Region 1 inner allocation which are not impacted by MPRnarrow defined in 6.2.2.3.3; Inner\_Partial2\_Left and Inner\_Partial2\_Right are selected as partial allocation within Region 1 inner allocation which are impacted by MPRnarrow defined in 6.2.2.3.3 when MPRnarrow=2 dB.  Note 3: Applicable to Rel-15 PC3 devices which do not support *modifiedMPR-Behaviour* bit 0 capability (according to Annex P.1) and to Rel-15 and forward PC2 and PC4 devices..  Note 4: Applicable to Rel-15 PC3 devices which supports *modifiedMPR-Behaviour* bit 0 capability (according to Annex P.1) and Rel-16 and forward PC3 devices.  Note 5: The 200MHz and 400MHz bandwidths are not applicable to PC7 RedCap UEs.  Note 6: In case of transform precoding, applicable only if , where  is a set of non- negative integers. | | | | | | | | | | | | |

Table 6.1-2: Common Uplink Configuration for PC1

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Channel Bandwidth | SCS(kHz) | OFDM | RB allocation | | | | | | | | |
| Outer\_Full | Outer\_xRB\_Left (Note 3) | Outer\_xRB\_Right (Note 3) | Inner\_Full\_Region1 | Innner\_partial\_Left\_Region1 | Inner\_Partial\_Right\_Region1 | Inner\_Full\_Region2 | Innner\_Partial\_Left\_Region2 | Inner\_Partial\_Right\_Region2 |
| 50MHz | 60 | DFT-s | 64@0 | x@0 | x@(66-x) | 20@22 | 16@22 | 16@28 | 32@16 | 16@8 | 16@42 |
| CP | 66@0 | x@0 | x@(66-x) | 22@22 | 16@22 | 16@28 | 33@16 | 16@8 | 16@42 |
| 120 | DFT-s | 32@0 | x@0 | x@(32-x) | 10@11 | 8@11 | 8@14 | 16@8 | 8@4 | 8@20 |
| CP | 32@0 | x@0 | x@(32-x) | 11@11 | 8@11 | 8@14 | 16@8 | 8@4 | 8@20 |
| 100MHz | 60 | DFT-s | 128@0 | x@0 | x@(132-x) | 40@44 | 16@44 | 16@72 | 64@32 | 16@8 | 16@108 |
| CP | 132@0 | x@0 | x@(132-x) | 44@44 | 16@44 | 16@72 | 66@33 | 16@8 | 16@108 |
| 120 | DFT-s | 64@0 | x@0 | x@(66-x) | 20@23 | 8@22 | 8@36 | 32@16 | 8@4 | 8@54 |
| CP | 66@0 | x@0 | x@(66-x) | 22@22 | 8@22 | 8@36 | 33@16 | 8@4 | 8@54 |
| 200MHz | 60 | DFT-s | 256@0 | x@0 | x@(264-x) | 81@88 | 16@88 | 16@160 | 128@64 | 16@8 | 16@240 |
| CP | 264@0 | x@0 | x@(264-x) | 88@88 | 16@88 | 16@160 | 132@66 | 16@8 | 16@240 |
| 120 | DFT-s | 128@0 | x@0 | x@(132-x) | 40@44 | 8@44 | 8@80 | 64@32 | 8@4 | 8@120 |
| CP | 132@0 | x@0 | x@(132-x) | 44@44 | 8@44 | 8@80 | 66@33 | 8@4 | 8@120 |
| 400MHz | 60 | DFT-s | N/A | 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 | N/A |
| 120 | DFT-s | 256@0 | x@0 | x@(264-x) | 64@66 | 8@66 | 8@190 | 128@64 | 8@4 | 8@252 |
| CP | 264@0 | x@0 | x@(264-x) | 66@66 | 8@66 | 8@190 | 132@66 | 8@4 | 8@252 |
| Note 1: RB allocation is left aligned within inner region 1 or inner region 2 as defined in clause 6.2.2.3.1.  Note 2: Inner\_Full allocation is selected as the largest RB allocation within Region 1 or Region 2 inner allocation defined in 6.2.2.3.1; Inner\_partial\_Left and Inner\_partial\_Right are selected as minimum allocation within Region 1 or Region 2 inner allocation which are not impacted by MPRnarrow defined in 6.2.2.3.1.  Note 3: In case of transform precoding, applicable only if , where  is a set of non- negative integers. | | | | | | | | | | | |

## 6.2 Transmit power

### 6.2.1 UE maximum output power

#### 6.2.1.0 General

Note: Power class 1, 2, 3, and 4 are specified based on the assumption of certain UE types with specific device architectures. The UE types can be found in Table 6.2.1.0-1.

Table 6.2.1.0-1: Assumption of UE Types

|  |  |
| --- | --- |
| UE Power class | UE type |
| 1 | Fixed wireless access (FWA) UE |
| 2 | Vehicular UE |
| 3 | Handheld UE |
| 4 | High power non-handheld UE |
| 7 | RedCap UE |
| Note: RedCap variants of non-RedCap UEs are not precluded. | |

#### 6.2.1.1 UE maximum output power - EIRP and TRP

Editor’s note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS for power class 2, 4 and 7.

- The test case is incomplete for band n259 for TRP in ETC.

6.2.1.1.1 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.

6.2.1.1.2 Test applicability

This test case applies to all types of release 15 NR UEs.

This test case also applies to all types of release 16 and forward NR Power Class 1, Power Class 2 and Power Class 4 UEs.

This test case also applies to all types of release 16 and forward NR Power Class 3 UEs not supporting CSI-RS based or SSB-based enhanced beam correspondence.

This test case also applies to all types of release 17 and forward NR Power Class 7 UEs not supporting CSI-RS based or SSB-based enhanced beam correspondence.

6.2.1.1.3 Minimum conformance requirements

###### 6.2.1.1.3.1 UE maximum output power for power class 1

The following requirements define the maximum output power radiated by the UE for any transmission bandwidth within the channel bandwidth for non-CA configuration, unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). The minimum output power values for EIRP are found in Table 6.2.1.1.3.1-1. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.1-1: UE minimum peak EIRP for power class 1

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 40.0 |
| n258 | 40.0 |
| n260 | 38.0 |
| n261 | 40.0 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance | |

The maximum output power values for TRP and EIRP are found in Table 6.2.1.1.3.1-2 below. The maximum allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.1-2: UE maximum output power limits for power class 1

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 35 | 55 |
| n258 | 35 | 55 |
| n260 | 35 | 55 |
| n261 | 35 | 55 |

The minimum EIRP at the 85th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2.1.1.3.1-3 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2.1.1.3.1-3: UE spherical coverage for power class 1

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85%-tile CDF (dBm) |
| n257 | 32.0 |
| n258 | 32.0 |
| n260 | 30.0 |
| n261 | 32.0 |
| NOTE 1: Minimum EIRP at 85%-tile CDF is defined as the lower limit without tolerance  NOTE 2: The requirements in this table are verified only under normal temperature conditions as defined in TS 38.508-1 [10] subclause 4.1.1. | |

###### 6.2.1.1.3.2 UE maximum output power for power class 2

The following requirements define the maximum output power radiated by the UE for any transmission bandwidth within the channel bandwidth for non-CA configuration, unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). The minimum output power values for EIRP are found in Table 6.2.1.1.3.2-1. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.2-1: UE minimum peak EIRP for power class 2

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 29 |
| n258 | 29 |
| n261 | 29 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance | |

The maximum output power values for TRP and EIRP are found in Table 6.2.1.1.3.2-2 below. The maximum allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.2-2: UE maximum output power limits for power class 2

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |
| n261 | 23 | 43 |

The minimum EIRP at the 60th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2.1.1.3.2-3 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2.1.1.3.2-3: UE spherical coverage for power class 2

|  |  |
| --- | --- |
| Operating band | Min EIRP at 60%-tile CDF (dBm) |
| n257 | 18.0 |
| n258 | 18.0 |
| n261 | 18.0 |
| NOTE 1: Minimum EIRP at 60%-tile CDF is defined as the lower limit without tolerance  NOTE 2: The requirements in this table are verified only under normal temperature conditions as defined in TS 38.508-1 [10] subclause 4.1.1. | |

###### 6.2.1.1.3.3 UE maximum output power for power class 3

The following requirements define the maximum output power radiated by the UE for any transmission bandwidth within the channel bandwidth for non-CA configuration, unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). The minimum output power values for EIRP are found in Table 6.2.1.1.3.3-1. The requirement is verified with the test metric of total component of EIRP (Link=TX beam peak direction, Meas=Link angle). The requirement for the UE which supports a single FR2 band is specified in Table 6.2.1.1.3.3-1. The requirement for the UE which supports multiple FR2 bands is specified in both Table 6.2.1.1.3.3-1 and Table 6.2.1.1.3.3-4 or Table 6.2.1.1.3.3-5.

Table 6.2.1.1.3.3-1: UE minimum peak EIRP for power class 3

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 22.4 |
| n258 | 22.4 |
| n259 | 18.7 |
| n260 | 20.6 |
| n261 | 22.4 |
| n262 | 16.0 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance  NOTE 2: Void | |

The maximum output power values for TRP and EIRP are found on the Table 6.2.1.1.3.3-2. The max allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and the total component of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.3-2: UE maximum output power limits for power class 3

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |
| n259 | 23 | 43 |
| n260 | 23 | 43 |
| n261 | 23 | 43 |
| n262 | 23 | 43 |

The minimum EIRP at the 50th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2.1.1.3.3-3 below. The requirement is verified with the test metric of the total component of EIRP, as defined in [5] (Link=Spherical coverage grid, Meas=Link angle). The requirement for the UE which supports a single FR2 band is specified in Table 6.2.1.1.3.3-3. The requirement for the UE which supports multiple FR2 bands is specified in both Table 6.2.1.1.3.3-3 and Table 6.2.1.1.3.3-4 or Table 6.2.1.1.3.3-5.

Table 6.2.1.1.3.3-3: UE spherical coverage for power class 3

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50t%-tile CDF (dBm) |
| n257 | 11.5 |
| n258 | 11.5 |
| n259 | 5.8 |
| n260 | 8 |
| n261 | 11.5 |
| n262 | 2.9 |
| NOTE 1: Minimum EIRP at 50 %-tile CDF is defined as the lower limit without tolerance  NOTE 2: Void  NOTE 3: The requirements in this table are verified only under normal temperature conditions as defined in TS 38.508-1 [10] subclause 4.1.1. | |

For the UEs that support multiple FR2 bands, minimum requirement for peak EIRP and EIRP spherical coverage in Tables 6.2.1.1.3.3-1 and 6.2.1.1.3.3-3 shall be decreased per band, respectively, by the peak EIRP relaxation parameter MBP,n and EIRP spherical coverage relaxation parameter MBS,n, as indicated in Table 6.2.1.1.3.3-4 to 6.2.1.1.3.3-5. For Rel-15 UE, each combination of supported bands ΔMBP,n and ΔMBS,n apply to each supported band *n*, such that the total relaxations, ∑MBP and ∑MBS, across all supported bands shall not exceed the total value indicated in Table 6.2.1.1.3.3-4.

Table 6.2.1.1.3.3-4: UE multi-band relaxation factors for power class 3 (Rel-15)

|  |  |  |
| --- | --- | --- |
| Supported bands | ∑MBP (dB) | ∑MBS (dB) |
| n257, n258 | ≤ 1.3 | ≤ 1.25 |
| n257, n260 | ≤ 1.03 | ≤ 0.753 |
| n258, n260 | ≤ 1.03 | ≤ 0.753 |
| n258, n261 | ≤ 1.0 | ≤ 1.25 |
| n260, n261 | 0.0 | ≤ 0.752 |
| n257, n261 | 0.0 | 0.0 |
| n257, n258, n260 | ≤ 1.73 | ≤ 1.753 |
| n257, n258, n261 | ≤ 1.7 | ≤ 1.75 |
| n257, n260, n261 | ≤ 0.53 | ≤ 1.253 |
| n258, n260, n261 | ≤ 1.53 | ≤ 1.253 |
| n257, n258, n260, n261 | ≤ 1.73 | ≤ 1.753 |
| NOTE 1: The requirements in this table are applicable to UEs which support only the indicated bands.  NOTE 2: For supported bands n260 + n261, ΔMBS,n is not applied for band n260.  NOTE 3: For band n260, maximum applicable MBS,n is 0.4 dB and MBP,n is 0.75 dB.  NOTE 4: For all bands except n260, the maximum applicable MBP,n and MBS,n is 0.75 dB. | | |

Table 6.2.1.1.3.3-5: UE multi-band relaxation factors for power class 3 (Rel-16 and forward)

|  |  |  |
| --- | --- | --- |
| **Band** | **MBP,n (dB)** | **MBS,n (dB)** |
| n257 | 0.73 | 0.73 |
| n258 | 0.6 | 0.7 |
| n259 | 0.5 | 0.4 |
| n260 | 0.51 | 0.41 |
| n261 | 0.52,4 | 0.74 |
| n262 | 0.7 | 0.7 |
| Note 1: n260 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n260  Note 2: n261 peak relaxation is 0 dB for UE that exclusively supports n261+n260  Note 3: n257 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257  Note 4: n261 peak and spherical relaxations are 0 dB for UE that exclusively supports n261+n257 | | |

###### 6.2.1.1.3.4 UE maximum output power for power class 4

The following requirements define the maximum output power radiated by the UE for any transmission bandwidth within the channel bandwidth for non-CA configuration, unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). The minimum output power values for EIRP are found in Table 6.2.1.1.3.4-1. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.4-1: UE minimum peak EIRP for power class 4

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 34 |
| n258 | 34 |
| n260 | 31 |
| n261 | 34 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance | |

The maximum output power values for TRP and EIRP are found in Table 6.2.1.1.3.4-2 below. The maximum allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.4-2: UE maximum output power limits for power class 4

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |
| n260 | 23 | 43 |
| n261 | 23 | 43 |

The minimum EIRP at the 20th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2.1.1.3.4-3 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2.1.1.3.4-3: UE spherical coverage for power class 4

|  |  |
| --- | --- |
| Operating band | Min EIRP at 20%-tile CDF (dBm) |
| n257 | 25 |
| n258 | 25 |
| n260 | 19 |
| n261 | 25 |
| NOTE 1: Minimum EIRP at 20%-tile CDF is defined as the lower limit without tolerance  NOTE 2: The requirements in this table are verified only under normal temperature conditions as defined in TS 38.508-1 [10] subclause 4.1.1. | |

###### 6.2.1.1.3.5 UE maximum output power for power class 5

The following requirements define the maximum output power radiated by the UE for any transmission bandwidth within the channel bandwidth for non-CA configuration, unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). The minimum output power values for EIRP are found in Table 6.2.1.1.3.5-1. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.5-1: UE minimum peak EIRP for power class 5

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 30 |
| n258 | 30.4 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance. | |

The maximum output power values for TRP and EIRP are found in Table 6.2.1.1.3.5-2 below. The maximum allowed EIRP is derived from regulatory requirements. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.5-2: UE maximum output power limits for power class 5

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |

The minimum EIRP at the 85th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2.1.1.3.5-3 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2.1.1.3.5-3: UE spherical coverage for power class 5

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85 %-tile CDF (dBm) |
| n257 | 22 |
| n258 | 22.4 |
| NOTE 1: Minimum EIRP at 85 %-tile CDF is defined as the lower limit without tolerance.  NOTE 2: The requirements in this table are verified only under normal temperature conditions as defined in Annex E.2.1. | |

For the UEs that support multiple FR2 bands, minimum requirement for peak EIRP and EIRP spherical coverage in Tables 6.2.1.5-1 and 6.2.1.5-3 shall be decreased per band, respectively, by the peak EIRP relaxation parameter MBP,n and EIRP spherical coverage relaxation parameter MBS,n, as defined in Table 6.2.1.1.3.5-4.

Table 6.2.1.1.3.5-4: UE multi-band relaxation factors for power class 5

|  |  |  |
| --- | --- | --- |
| **Band** | **MBP,n (dB)** | **MBS,n (dB)** |
| n257 | 0.7 | 0.7 |
| n258 | 0.7 | 0.7 |

###### 6.2.1.1.3.6

###### 6.2.1.1.3.7 UE maximum output power for power class 7

The following requirements define the maximum output power radiated by the UE for any transmission bandwidth within the channel bandwidth for non-CA configuration, unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). The minimum output power values for EIRP are found in Table 6.2.1.1.3.7-1. The requirement is verified with the test metric of total component of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1.3.7-1: UE minimum peak EIRP for power class 7

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 16.4 |
| n258 | 16.4 |
| n261 | 16.4 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance  NOTE 2: Void | |

The maximum output power values for TRP and EIRP are found on the Table 6.2.1.1.3.7-2. The max allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and the total component of EIRP (Link=TX beam peak direction, Meas=Link angle.

Table 6.2.1.1.3.7-2: UE maximum output power limits for power class 7

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |
| n261 | 23 | 43 |

The minimum EIRP at the 50th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2.1.1.3.7-3 below. The requirement is verified with the test metric of the total component of EIRP (Link=Beam peak search grids, Meas=Link angle).

Table 6.2.1.1.3.7-3: UE spherical coverage for power class 7

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50%-tile CDF (dBm) |
| n257 | 5.5 |
| n258 | 5.5 |
| n261 | 5.5 |
| NOTE 1: Minimum EIRP at 50 %-tile CDF is defined as the lower limit without tolerance  NOTE 2: The requirements in this table are verified only under normal temperature conditions as defined in TS 38.508-1 [10] subclause 4.1.1. | |

For power class 7 UEs that support multiple FR2 bands, minimum requirement for peak EIRP and EIRP spherical coverage in Table 6.2.1.1.3.7-1 and Table 6.2.1.1.3.7-3 shall be decreased per band, respectively, by the peak EIRP relaxation parameter MBP,n and EIRP spherical coverage relaxation parameter MBS,n, as defined for power class 3 in 6.2.1.1.3.3-5.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.1.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.1.

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, 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 subcarrier spacing, 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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid Range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest, 100 MHz, Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120 kHz | |
| Test Parameters | | | | | | |
| Test ID | ChBw  (NOTE 2) | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | - | Modulation | | RB allocation (NOTE 1) |
| 1 | 50 |  | DFT-s-OFDM QPSK | | Inner\_Full for PC2, PC3 |
| 2 | 100 |  |  |  | | PC4, PC5 and PC7 |
| 3 | 200 |  |  |  | | Inner\_Full\_Region1 for |
| 4 | 400 |  |  |  | | PC1 |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3, PC4, PC5 and PC7 or Table 6.1-2 for PC1.  NOTE 2: The 200MHz and 400MHz bandwidths are not applicable to PC7 RedCap UEs | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2.1.1.4.1-1.

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 [10] 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 UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.2.1.1.4.3.

1a. The side conditions for SSB-based and CSI-RS based L1-RSRP measurements are applied as per clause 6.6.1.3.3.1.1 for PC3 and 6.6.1.3.6.1.1 for PC7.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Tables 6.2.1.1.5-1 to 6.2.1.1.5-4. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6. Measure TRP of the transmitted signal for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.5.2.3.5-1. Total radiated power is measured according to TRP measurement procedure defined in Annex K.1.7 and measurement grid specified in Annex M.4. TRP is calculated considering both polarizations, theta and phi.

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.2.1.1.5 Test requirement

The EIRP derived in step 5 and TRP derived in step 6 shall not exceed the values specified in Table 6.2.1.1.5-1 to Table 6.2.1.1.5-4.

Table 6.2.1.1.5-1: UE maximum output test requirements for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 35+TT | 55 | 40.0-TT |
| n258 | 35+TT | 55 | 40.0-TT |
| n260 | 35+TT | 55 | 38.0-TT |
| n261 | 35+TT | 55 | 40.0-TT |

Table 6.2.1.1.5-1a: Test Tolerance (Max TRP for Power class 1)

|  |  |  |
| --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** |
| Max device size ≤ 30 cm | 2.78 dB, NTC  2.94 dB, ETC | 2.87 dB, NTC  3.03 dB, ETC |

Table 6.2.1.1.5-1b: Test Tolerance (Min peak EIRP for Power class 1)

|  |  |  |
| --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** |
| Max device size ≤ 30 cm | 3.12 dB, NTC  3.28 dB, ETC | 3.12 dB, NTC  3.28 dB, ETC |

Table 6.2.1.1.5-2: UE maximum output test requirements for power class 2

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 29-TT |
| n258 | 23+TT | 43 | 29-TT |
| n260 |  |  |  |
| n261 | 23+TT | 43 | 29-TT |

Table 6.2.1.1.5-3: UE maximum output test requirements for power class 3 for single band UE

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 22.4-TT |
| n258 | 23+TT | 43 | 22.4-TT |
| n259 | 23+TT | 43 | 18.7-TT |
| n260 | 23+TT | 43 | 20.6-TT |
| n261 | 23+TT | 43 | 22.4-TT |

Table 6.2.1.1.5-3a: UE maximum output test requirements for power class 3 for multi-band UE (Rel-15)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Supported FR2 bands set | Test requirement (dB)  (Note 1) | | | | Maximum sum of MBp, ∑MBP (dB)  (Note 3) | Comments |
|  |  | n257 | n258 | n260 | n261 |  |  |
| 1 | n257, n258 | 22.4-TT-MBp | 22.4-TT-MBp |  |  | 1.3 | Maximum 0.75 dB relaxation allowed for each band |
| 2 | n257, n260 | 22.4-TT-MBp |  | 20.6-TT-MBp |  | 1.0 | Maximum 0.75 dB relaxation allowed for each band |
| 3 | n258, n260 |  | 22.4-TT-MBp | 20.6-TT-MBp |  | 1.0 | Maximum 0.75 dB relaxation allowed for each band |
| 4 | n258, n261 |  | 22.4-TT-MBp |  | 22.4-TT-MBp | 1.0 | Maximum 0.75 dB relaxation allowed for each band |
| 5 | n260, n261 |  |  | 20.6-TT | 22.4-TT | 0.0 | No relaxation factor allowed |
| 6 | n257, n258, n260 | 22.4-TT-MBp | 22.4-TT-MBp | 20.6-TT-MBp |  | 1.7 | Maximum 0.75 dB relaxation allowed for each band |
| 7 | n257, n258, n261 | 22.4-TT-MBp | 22.4-TT-MBp |  | 22.4-TT-MBp | 1.7 | Maximum 0.75 dB relaxation allowed for each band |
| 8 | n257, n260, n261 | 22.4-TT-MBp |  | 20.6-TT-MBp | 22.4-TT-MBp | 0.5 | Maximum 0.75 dB relaxation allowed for each band |
| 9 | n258, n260, n261 |  | 22.4-TT-MBp | 20.6-TT-MBp | 22.4-TT-MBp | 1.5 | Maximum 0.75 dB relaxation allowed for each band |
| 10 | n257, n258, n260, n261 | 22.4-TT-MBp | 22.4-TT-MBp | 20.6-TT-MBp | 22.4-TT-MBp | 1.7 | Maximum 0.75 dB relaxation allowed for each band |
| 11 | n257, n261 | 22.4-TT |  |  | 22.4-TT | 0.0 | No relaxation factor allowed |
| Note 1: MBp is the Multi-band Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2 11]. This declaration shall fulfil the requirements in Table 6.2.1.1.3.3-4.  Note 2: All UE supported bands needs to be tested to ensure the multi-band relaxation declaration is compliant  Note 3: Max allowed sum of MBp over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: For a Rel-15 UE supporting FR2 bands set not defined in Table 6.2.1.1.3.3-4, Table 6.2.1.1.5-3d applies. | | | | | | | |

Table 6.2.1.1.5-3b: Test Tolerance (Max TRP for Power class 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Test Metric | FR2a | FR2b | FR2c |
| Max device size ≤ 30 cm | 2.77 dB, NTC  2.91 dB, ETC | 2.89 dB, NTC  3.04 dB, ETC | 3.70 dB, NTC  TBD dB, ETC |

Table 6.2.1.1.5-3c: Test Tolerance (Min peak EIRP for Power class 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Test Metric | FR2a | FR2b | FR2c |
| Max device size ≤ 30 cm | 2.99 dB, NTC  3.15 dB, ETC | 2.99 dB, NTC  3.15 dB, ETC | 3.80 dB, NTC  3.89 dB, ETC |

Table 6.2.1.1.5-3d: UE maximum output test requirements for power class 3 (Rel-16 and forward)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | FR2 bands/set | Test requirement (dB)  (Note 1) | | | | | Comments |
|  |  | n257 | n258 | n259 | n260 | n261 |  |
| 1 | n257 | 22.4-TT-MBP,n |  |  |  |  |  |
| 2 | n258 |  | 22.4-TT-MBP,n |  |  |  |  |
| 3 | n259 |  |  | 18.7-TT-MBP,n |  |  |  |
| 4 | n260 |  |  |  | 20.6-TT-MBP,n |  |  |
| 5 | n261 |  |  |  |  | 22.4-TT-MBP,n |  |
| 6 | n257, n261 | 22.4-TT |  |  |  | 22.4-TT | MBP,n relaxation is 0 dB |
| 7 | n260, n261 |  |  |  | 20.6-TT | 22.4-TT | MBP,n relaxation is 0 dB |
| Note 1: MBP,n is the Multi-band Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2.1.1.5-4: UE maximum output power test requirements for power class 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 34-TT |
| n258 | 23+TT | 43 | 34-TT |
| n260 | 23+TT | 43 | 31-TT |
| n261 | 23+TT | 43 | 34-TT |

Table 6.2.1.1.5-5: UE maximum output power test requirements for power class 5

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 30.0-TT-MBP,n |
| n258 | 23+TT | 43 | 30.4-TT-MBP,n |
| Note 1: MBP,n = 0 for single band UE. For multi-band UEs, MBP,n is defined in table 6.2.1.1.3.5-4. | | | |

Table 6.2.1.1.5-5a: Test Tolerance (Max TRP for Power class 5)

|  |  |
| --- | --- |
| **Test Metric** | **FR2a** |
| Max device size ≤ 30 cm | 2.78 dB, NTC  2.94 dB, ETC |

Table 6.2.1.1.5-5b: Test Tolerance (Min peak EIRP for Power class 5)

|  |  |
| --- | --- |
| **Test Metric** | **FR2a** |
| Max device size ≤ 30 cm | 3.12 dB, NTC  3.28 dB, ETC |

Table 6.2.1.1.5-7: UE maximum output power test requirements for power class 7

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 16.4-TT |
| n258 | 23+TT | 43 | 16.4-TT |
| n261 | 23+TT | 43 | 16.4-TT |

Table 6.2.1.1.5-7a: UE maximum output test requirements for power class 7 (Rel-16 and forward)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | FR2 bands/set | Test requirement (dB)  (Note 1) | | | | | Comments |
|  |  | n257 | n258 | n259 | n260 | n261 |  |
| 1 | n257 | 16.4-TT-MBP,n |  |  |  |  |  |
| 2 | n258 |  | 16.4-TT-MBP,n |  |  |  |  |
| 3 | n261 |  |  |  |  | 16.4-TT-MBP,n |  |
| 4 | n257, n261 | 16.4-TT |  |  |  | 16.4-TT | MBP,n relaxation is 0 dB |
| Note 1: MBP,n is the Multi-band Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2.1.1.5-7b: Test Tolerance (Max TRP for Power class 7)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | [2.65] dB, NTC  [2.82] dB, ETC | [2.77] dB, NTC  [2.94] dB, ETC |

Table 6.2.1.1.5-7c: Test Tolerance (Min peak EIRP for Power class 7)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | [2.87] dB, NTC  [3.04] dB, ETC | [2.87] dB, NTC  [3.04] dB, ETC |

#### 6.2.1.1\_1 UE maximum output power - EIRP and TRP (Rel16 and forward)

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

- Same as in 6.2.1.1

6.2.1.1\_1.1 Test purpose

Same as 6.2.1.1.1

6.2.1.1\_1.2 Test applicability

This test case applies to all types of NR Power Class 3 UEs release 16 and forward supporting SSB-based or CSI-RS based enhanced beam correspondence.

This test case also applies to all types of release 17 and forward NR Power Class 7 UEs supporting SSB-based or CSI-RS based enhanced beam correspondence.

6.2.1.1\_1.3 Minimum conformance requirements

Same as 6.2.1.1.3 including UE multi-band relaxation factors defined for Rel-16 and forward UEs supporting power class 3, power class 5, power class 6 or power class 7.

6.2.1.1\_1.4 Test description

6.2.1.1\_1.4.1 Initial conditions

Same as 6.2.1.1.4.1 and 6.6.1.4.3

6.2.1.1\_1.4.2 Test procedure

The following cases are tested depending on UE capability:

1. Test procedure if *beamCorrespondenceWithoutUL-BeamSweeping* is NOT supported and *beamCorrespondenceSSB-based-r16* is supported:

1.1 Same as 6.2.1.1.4.2 with the exception that step 6 is skipped and measurements shall be carried out using only side conditions defined in clause 6.6.2.3.1.3.1 for PC3.

1.2 Skip to Step 7.

2. Test procedure if *beamCorrespondenceWithoutUL-BeamSweeping* is NOT supported, and *beamCorrespondenceCSI-RS-based-r16* is supported

2.1 Same as 6.2.1.1.4.2 with the exception that step 6 is skipped and measurements shall be carried out using only side conditions defined in clause 6.6.2.3.1.3.2 for PC3.

2.2 Skip to Step 7.

3. Test procedure if *beamCorrespondenceWithoutUL-BeamSweeping* is NOT supported, *beamCorrespondenceCSI-RS-based-r16* and *beamCorrespondenceSSB-based-r16* are supported

3.1 Same as 6.2.1.1.4.2 with the exception that step 6 is skipped and measurements shall be carried out using only side conditions defined in clause 6.3.2.3.1.3.2 for PC3.

3.2 Repeat 6.2.1.1.4.2 with step 6 skipped with Tx Beam Peak direction determined using the side conditions in clause 6.3.2.3.1.3.2 for PC3. Record the verdict (as this result will not be compared to test requirements in this test case but in a different one).

3.3 Skip to Step 7.

4. Test procedure if beamCorrespondenceWithoutUL-BeamSweeping is supported and beamCorrespondenceSSB- based-r16 is supported:

4.1 Same as 6.2.1.1.4.2 with the exception that step 6 is skipped and measurements shall be carried out using only side conditions defined in clause 6.6.2.3.1.3.1 for PC3 and clause 6.6.2.3.4.3.1 for PC7.

4.2 Skip to Step 7.

5. Test procedure if beamCorrespondenceWithoutUL-BeamSweeping is supported and beamCorrespondenceCSI-RS-based-r16 is supported:

5.1 Same as 6.2.1.1.4.2 with the exception that step 6 is skipped and measurements shall be carried out using only side conditions defined in clause 6.6.2.3.1.3.2 for PC3 and clause 6.6.2.3.4.3.2 for PC7.

5.2 Skip to Step 7

6. Test procedure if beamCorrespondenceWithoutUL-BeamSweeping is supported, beamCorrespondenceCSI-RS-based-r16 and beamCorrespondenceSSB-based-r16 is supported

6.1 Same as 6.2.1.1.4.2 with the exception that step 6 is skipped and measurements shall be carried out using only side conditions defined in clause 6.6.2.3.1.3.1 for PC3 and clause 6.6.2.3.4.3.1 for PC7.

6.2 Repeat 6.2.1.1.4.2 with step 6 skipped with Tx Beam Peak direction determined using the side conditions in clause 6.6.2.3.1.3.2 for PC3 and clause 6.6.2.3.4.3.2 for PC7. Record the verdict (as this result will not be compared to test requirements in this test case but in a different one).

7. Set side conditions for SSB-based and CSI-RS based L1-RSRP measurements as per clause 6.6.1.3.3.1.1 for PC3 and clause 6.6.1.3.6.1.1 for PC7.

8. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

9. SS activates the UE BeamlockFunction (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

10. Measure TRP of the transmitted signal for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.5.2.3.5-1. Total radiated power is measured according to TRP measurement procedure defined in Annex K.1.7 and measurement grid specified in Annex M.4. TRP is calculated considering both polarizations, theta and phi.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2.1.1\_1.4.3 Message contents

Same as 6.2.1.1.4.3 and 6.6.1.4.3

6.2.1.1\_1.5 Test requirement

Same as 6.2.1.1.5 including UE multi-band relaxation factors defined for Rel-16 and forward UEs supporting power class 3, power class 5, power class 6 or power class 7.

#### 6.2.1.2 UE maximum output power - Spherical coverage

Editor’s note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS for power class 2, 4 and 7.

6.2.1.2.1 Test purpose

To verify that the spatial coverage of the UE in expected directions is acceptable.

6.2.1.2.2 Test applicability

This test case applies to all types of release 15 NR UEs.

This test case also applies to all types of release 16 and forward NR Power Class 1, Power Class 2 and Power Class 4 UEs.

This test case also applies to all types of release 16 and forward NR Power Class 3 UEs not supporting CSI-RS based or SSB-based enhanced beam correspondence.This test case also applies to all types of release 17 and forward NR Power Class 7 UEs not supporting CSI-RS based or SSB-based enhanced beam correspondence.

6.2.1.2.3 Minimum conformance requirements

Minimum conformance requirements are defined in clause 6.2.1.1.3.

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, 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 subcarrier spacing, 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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid Range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest, Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120 kHz | |
| Test Parameters | | | | | | |
| Test ID | ChBw | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | - | Modulation | | RB allocation (NOTE 1) |
| 1 | 50 |  | DFT-s-OFDM QPSK | | Inner\_Full for PC2, PC3, |
| 2 | 100 |  |  |  | | PC4, PC5 and PC7 |
| 3 | 200 |  |  |  | | Inner\_Full\_Region1 for |
| 4 | 400 |  |  |  | | PC1 |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 , PC4, PC5 and PC7 or Table 6.1-2 for PC1. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2.1.2.4.1-1.

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 [10] 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 UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.2.1.2.4.3.

1a. The side conditions for SSB-based and CSI-RS based L1-RSRP measurements are applied as per clause 6.6.1.3.3.1.1 for PC3 and 6.6.1.3.6.1.1 for PC7.

2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Through its beam correspondence procedure, DUT refines its TX beam toward that direction depending on DUT’s beam correspondence capability which shall match OEM declaration:

3a If the DUT’s beam correspondence capability beamCorrespondenceWithoutUL-BeamSweeping is supported, then DUT autonomously chooses the corresponding TX beam for PUSCH transmission using downlink reference signals to transmit in the direction of the incoming DL signal, which is based on beam correspondence without relying on UL beam sweeping;

3b If the DUT’s beam correspondence capability beamCorrespondenceWithoutUL-BeamSweeping is not present, then DUT chooses the TX beam for PUSCH transmission which is based on beam correspondence with relying on both DL measurements on downlink reference signals and network-assisted uplink beam sweeping:

3b.1) DUT uses downlink reference signals to select proper RX beam and uses autonomous beam correspondence to select the TX beam.

3b.2) SS configures M=8 SRS resources to DUT, with the field *spatialRelationInfo* omitted and the field usage set as ‘beamManagement’. In case DUT supports less than 8 SRS resources, SS configures the number of SRS resources according to the maximum number of SRS resources indicated by UE capability signalling. Additionally, for codebook based PUSCH transmission, SS configures a semi-persistent SRS resource set with the field *usage* as 'codebook'.

3b.3) Based on the TX beam autonomously selected by DUT, DUT chooses TX beams to transmit SRS-resources configured by SS.

3b.4) Based on measurement of the received *beamManagement* SRS, SS chooses the best SRS beam and, if needed, updates the spatial relation information between the semi-persistent *codebook* SRS resources and the SS selected *beamManagement* SRS resource in the activation MAC CE of the semi-persistent SRS resource. The SS indicates in the SRS Resource Indicator (SRI) field in the scheduling grant for PUSCH, if present, the SRS resource within the semi-persistent SRS resource set whose spatial relation is linked to the best detected SRS beam.

3b.5) DUT transmits PUSCH corresponding to the SRS resource indicated by the SRI.

4. Measure UE EIRP value for each grid point according to the EIRP spherical coverage procedure defined in Annex K.1.5, and obtain a cumulative distribution function (CDF) of all EIRP dBm values. Alternatively, UE EIRP measurement for each grid point could be done according to Tx Fast spherical coverage procedure defined in Annex K.1.5.1. After a rotation, allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for UE to find the best beam to use. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

5. Identify the EIRP dBm value corresponding to %-tile (UE power class dependent) value in the applicable test requirement table in section 6.2.1.2.5.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.2.1.2.5 Test requirement

The defined %-tile EIRP in measurement distribution derived in step 5 shall exceed the values specified in Table 6.2.1.2.5-1 to Table 6.2.1.2.5-4.

Table 6.2.1.2.5-1: UE spherical coverage for power class 1

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85%-tile CDF (dBm) |
| n257 | 32.0-TT |
| n258 | 32.0-TT |
| n260 | 30.0-TT |
| n261 | 32.0-TT |

Table 6.2.1.2.5-1a: Test Tolerance (UE spherical coverage for Power class 1)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 2.69 dB | 2.69 dB |

Table 6.2.1.2.5-2: UE spherical coverage for power class 2

|  |  |
| --- | --- |
| Operating band | Min EIRP at 60%-tile CDF (dBm) |
| n257 | 18.0-TT |
| n258 | 18.0-TT |
| n260 |  |
| n261 | 18.0-TT |

Table 6.2.1.2.5-3: UE spherical coverage for power class 3 for single band UE or multiband UE declaring MBs = 0 in all FR2 bands

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50t%-tile CDF (dBm) |
| n257 | 11.5-TT |
| n258 | 11.5-TT |
| n259 | 5.8-TT |
| n260 | 8-TT |
| n261 | 11.5-TT |

Table 6.2.1.2.5-3a: UE spherical coverage for power class 3 for multi band UE declaring MBs>0 in any FR2 band (Rel-15)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Supported FR2 bands set | Test requirement (dB)  (Note 1) | | | | Maximum sum of MBs, ∑MBs (dB)  (Note 3) | Comments |
|  |  | n257 | n258 | n260 | n261 |  |  |
| 1 | n257, n258 | 11.5-TT-MBs | 11.5-TT-MBs |  |  | 1.25 | Maximum 0.75 dB relaxation allowed for each band |
| 2 | n257, n260 | 11.5-TT-MBs |  | 8-TT-MBs |  | 0.75 | Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands |
| 3 | n258, n260 |  | 11.5-TT-MBs | 8-TT-MBs |  | 0.75 | Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands |
| 4 | n258, n261 |  | 11.5-TT-MBs |  | 11.5-TT-MBs | 1.25 | Maximum 0.75 dB relaxation allowed for each band |
| 5 | n260, n261 |  |  | 8-TT-MBs | 11.5-TT-MBs | 0.75 | No relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands |
| 6 | n257, n258, n260 | 11.5-TT-MBs | 11.5-TT-MBs | 8-TT-MBs |  | 1.75 | Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands |
| 7 | n257, n258, n261 | 11.5-TT-MBs | 11.5-TT-MBs |  | 11.5-TT-MBs | 1.75 | Maximum 0.75 dB relaxation allowed for each band |
| 8 | n257, n260, n261 | 11.5-TT-MBs |  | 8-TT-MBs | 11.5-TT-MBs | 1.25 | Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands |
| 9 | n258, n260, n261 |  | 11.5-TT-MBs | 8-TT-MBs | 11.5-TT-MBs | 1.25 | Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands |
| 10 | n257, n258, n260, n261 | 11.5-TT-MBs | 11.5-TT-MBs | 8-TT-MBs | 11.5-TT-MBs | 1.75 | Maximum 0.4 dB relaxation allowed for n260 and 0.75 dB relaxation allowed for all other bands |
| Note 1: MBs is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-3 of TS38.508-2 [11]. This declaration shall fulfil the requirements in Table 6.2.1.1.3.3-4.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant  Note 3: Max allowed sum of MBs over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: For a Rel-15 UE supporting FR2 bands set not defined in Table 6.2.1.1.3.3-4, Table 6.2.1.2.5-3c applies. | | | | | | | |

Table 6.2.1.2.5-3b: Test Tolerance (UE spherical coverage for Power class 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Test Metric | FR2a | FR2b | FR2c |
| Max device size ≤ 30 cm | 2.69 dB | 2.69 dB | 3.50 dB |

Table 6.2.1.2.5-3c: UE spherical coverage for power class 3 (Rel-16 and forward)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | FR2 bands/set | Test requirement (dB)  (Note 1) | | | | | Comments |
|  |  | n257 | n258 | n259 | n260 | n261 |  |
| 1 | n257 | 11.5-TT-MBs,n |  |  |  |  |  |
| 2 | n258 |  | 11.5-TT-MBs,n |  |  |  |  |
| 3 | n259 |  |  | 5.8-TT-MBs,n |  |  |  |
| 4 | n260 |  |  |  | 8-TT-MBs,n |  |  |
| 5 | n261 |  |  |  |  | 11.5-TT-MBs,n |  |
| 6 | n257, n261 | 11.5-TT-MBs,n |  |  |  | 11.5-TT-MBs,n | MBs,n relaxation is 0 dB |
| 7 | n260, n261 |  |  |  | 8-TT-MBs,n | 11.5-TT-MBs,n | MBs,n relaxation is 0 dB for n260 |
| Note 1: MBs,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2.1.2.5-4: UE spherical coverage for power class 4

|  |  |
| --- | --- |
| Operating band | Min EIRP at 20%-tile CDF (dBm) |
| n257 | 25 |
| n258 | 25 |
| n260 | 19 |
| n261 | 25 |

Table 6.2.1.2.5-5: UE spherical coverage for power class 5

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85%-tile CDF (dBm) |
| n257 | 22.0-TT-MBs,n |
| n258 | 22.4-TT-MBs,n |
| Note 1: MBs,n = 0 for single band UE. For multi-band UEs, MBs,n is defined in table 6.2.1.1.3.5-5. | |

Table 6.2.1.2.5-5a: Test Tolerance (UE spherical coverage for Power class 5)

|  |  |
| --- | --- |
| Test Metric | FR2a |
| Max device size ≤ 30 cm | 2.69 dB |

Table 6.2.1.2.5-7: UE spherical coverage for power class 7

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50%-tile CDF (dBm) |
| n257 | 5.5 |
| n258 | 5.5 |
| n261 | 5.5 |
| NOTE 1: Minimum EIRP at 50 %-tile CDF is defined as the lower limit without tolerance  NOTE 2: The requirements in this table are verified only under normal temperature conditions as defined in Annex E.2.1. | |

Table 6.2.1.2.5-7a: Test Tolerance (UE spherical coverage for Power class 7)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | [2.58] dB | [2.58] dB |

Table 6.2.1.2.5-7b: UE spherical coverage for power class 7 (Rel-16 and forward)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | FR2 bands/set | Test requirement (dB)  (Note 1) | | | | | Comments |
|  |  | n257 | n258 | n259 | n260 | n261 |  |
| 1 | n257 | 5.5-TT-MBs,n |  |  |  |  |  |
| 2 | n258 |  | 5.5-TT-MBs,n |  |  |  |  |
| 3 | n261 |  |  |  |  | 5.5-TT-MBs,n |  |
| 4 | n257, n261 | 5.5-TT-MBs,n |  |  |  | 5.5-TT-MBs,n | MBs,n relaxation is 0 dB |
| Note 1: MBs,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

#### 6.2.1.2\_1 UE maximum output power - Spherical coverage (Rel16 and forward)

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

- Same as in 6.2.1.2

6.2.1.2\_1.1 Test purpose

Same as 6.2.1.2.1.

6.2.1.2\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward supporting either SSB-based or CSI-RS based enhanced beam correspondence without UL beam sweeping.

6.2.1.2\_1.3 Minimum conformance requirements

Same as 6.2.1.2.3 including UE multi-band relaxation factors defined for Rel-16 and forward UEs supporting power class 3, power class 5, power class 6 or power class 7.

6.2.1.2\_1.4 Test description

6.2.1.2\_1.4.1 Initial conditions

Same as 6.2.1.2.4.1

6.2.1.2\_1.4.2 Test procedure

The following cases are tested depending on UE capability:

1. Test procedure if *beamCorrespondenceWithoutUL-BeamSweeping* is NOT supported and *beamCorrespondenceSSB-based-r16* is supported:

1.1 Same as 6.2.1.2.4.2 with the exception that measurements shall be carried out using only side conditions defined in clause 6.6.2.3.1.3.1 for PC3 and clause 6.6.2.3.4.3.1 for PC7.

1.2 End test procedure

2. Test procedure if *beamCorrespondenceWithoutUL-BeamSweeping* is NOT supported, and *beamCorrespondenceCSI-RS-based-r16* is supported

2.1 Same as 6.2.1.2.4.2 with the exception that measurements shall be carried out using only side conditions defined in clause 6.6.2.3.1.3.2 for PC3 and clause 6.6.2.3.4.3.2 for PC7.

2.2 End test procedure.

3. Test procedure if beamCorrespondenceWithoutUL-BeamSweeping is supported and beamCorrespondenceSSB- based-r16 is supported:

3.1 Same as 6.2.1.2.4.2 with the exception that measurements shall be carried out using only side conditions defined in clause 6.6.2.3.1.3.1 for PC3 and clause 6.6.2.3.4.3.1 for PC7.

3.2 End test procedure

4. Test procedure if beamCorrespondenceWithoutUL-BeamSweeping is supported and beamCorrespondenceCSI-RS-based-r16 is supported:

4.1 Same as 6.2.1.2.4.2 with the exception that step 7 is skipped and measurements shall be carried out using only side conditions defined in clause 6.6.2.3.1.3.2 for PC3 and clause 6.6.2.3.4.3.2 for PC7.

4.2 End test procedure

6.2.1.2\_1.4.3 Message contents

Same as 6.2.1.2.4.3 and 6.6.1.4.3.

6.2.1.2\_1.5 Test requirement

Same as 6.2.1.2.5 including UE multi-band relaxation factors defined for Rel-16 and forward UEs supporting power class 3, power class 5, power class 6 or power class 7

### 6.2.2 UE maximum output power reduction

Editor’s note: The following aspects are either missing or not yet determined:

* Measurement Uncertainties and Test Tolerances are FFS for PC2, PC4 and PC7.
* Measurement grid for PC2/4 in Annex M.4 is FFS.
* How to deal with power classes reusing PC3 MPR requirements, especially those defined from Release 17 and forward, and then the relationship with 6.2.2\_1 test is FFS.
* Declaration of the Multiband Relaxation factor for n259 is not defined in TS 38.508-2 [11].

#### 6.2.2.0 General

The requirements in section 6.2.2 only apply when both UL and DL of a UE are configured for single CC operation, and they are of the same bandwidth. A UE may reduce its maximum output power due to modulation orders, transmit bandwidth configurations, waveform types and narrow allocations. This Maximum Power Reduction (MPR) is defined in subclauses below. 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. When the maximum output power of a UE is modified by MPR, the power limits specified in subclause 6.2.4 apply.

For a UE that is configured for single CC operation with different channel bandwidths in UL and DL, the requirements in section 6.2A.2 apply.

For all power classes, the waveform defined by BW = 100 MHz, SCS = 120 kHz, DFT-S-OFDM QPSK, 20RB23 is the reference waveform with 0 dB MPR and is used for the power class definition.

6.2.2.1 Test purpose

The number of RB identified in 6.2.2.3 is based on meeting the requirements for 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 2 and Powe Class 4 UE release 15 and forward.

The requirements of this test apply to all types of NR Power Class 5 UE release 17 and forward.

The requirements of this test apply to all types of NR Power Class 3 UE release 15 and release 16 which doesn’t support modifiedMPRbehaviour bit 0 capability (according to Annex P.1).

The requirements of this test apply to all types of NR Power Class 7 UE release 17 and forward.

NOTE: For a transition period until RAN5#100 (August 2023), the requirements of this test also apply to all types of NR Power Class 3 UE release 15 and release 16 which support modifiedMPRbehaviour bit 0 capability.

6.2.2.3 Minimum conformance requirements

##### 6.2.2.3.1 UE maximum output power reduction for power class 1

For power class 1, MPR for contiguous allocations is defined as:

MPR = max(MPRWT, MPRnarrow)

Where,

MPRnarrow = 14.4 dB, when BWalloc,RB ≤ 1.44 MHz, MPRnarrow = 10 dB, when 1.44 MHz < BWalloc,RB ≤ 10.8 MHz, where BWalloc,RB is the bandwidth of the RB allocation size.

MPRWT is the maximum power reduction due to modulation orders, transmission bandwidth configurations listed in Table 5.3.2-1, and waveform types. MPRWT is defined in Tables 6.2.2.3.1-1 and 6.2.2.3.1-2.

Table 6.2.2.3.1-1: MPRWT for power class 1, BWchannel ≤ 200 MHz

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPRWT (dB), BWchannel ≤ 200 MHz | | |
| Outer RB allocations | Inner RB allocations | |
| Region 1 | Region 2 |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.5 | 0.0 | ≤ 3.0 |
| QPSK | ≤ 6.5 | 0.0 | ≤ 3.0 |
| 16 QAM | ≤ 6.5 | ≤ 4.0 | ≤ 4.0 |
| 64 QAM | ≤ 6.5 | ≤ 5.0 | ≤ 5.0 |
| CP-OFDM | QPSK | ≤ 7.0 | ≤ 4.5 | ≤ 4.5 |
| 16 QAM | ≤ 7.0 | ≤ 5.5 | ≤ 5.5 |
| 64 QAM | ≤ 7.5 | ≤ 7.5 | ≤ 7.5 |

Table 6.2.2.3.1-2: MPRWT for power class 1, BWchannel = 400 MHz

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPRWT (dB), BWchannel = 400 MHz | | |
| Outer RB allocations | Inner RB allocations | |
| Region 1 | Region 2 |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.5 | 0.0 | ≤ 3.0 |
| QPSK | ≤ 6.5 | 0.0 | ≤ 3.5 |
| 16 QAM | ≤ 6.5 | ≤ 4.5 | ≤ 4.5 |
| 64 QAM | ≤ 6.5 | ≤ 6.5 | ≤ 6.5 |
| CP-OFDM | QPSK | ≤ 7.0 | ≤ 5.0 | ≤ 5.0 |
| 16 QAM | ≤ 7.0 | ≤ 6.5 | ≤ 6.5 |
| 64 QAM | ≤ 9.0 | ≤ 9.0 | ≤ 9.0 |

Where the following parameters are defined to specify valid RB allocation ranges for the RB allocations regions in Tables 6.2.2.3.1-1 and 6.2.2.3.1-2:

NRB is the maximum number of RBs for a given Channel bandwidth and sub-carrier spacing defined in Table 5.3.2-1.

RBend = RBStart + LCRB - 1

RBStart,Low = Max(1, Floor(LCRB/2))

RBStart,High = NRB – RBStart,Low – LCRB

An RB allocation is an Outer RB allocation if

RBStart < RBStart,Low OR RBStart > RBStart,High OR LCRB > Ceil(NRB/2)

An RB allocation belonging to Table 6.2.2.3.1-1 is a Region 1 inner RB allocation if

RBstart ≥ Ceil(1/3 NRB) AND RBend < Ceil(2/3 NRB)

An RB allocation belonging to Table 6.2.2.3.1-2 is a Region 1 inner RB allocation if

RBstart ≥ Ceil(1/4 NRB) AND RBend < Ceil(3/4 NRB) AND LCRB ≤ Ceil(1/4 NRB)

An RB allocation is a Region 2 inner allocation if it is NOT an Outer allocation AND NOT a Region 1 inner allocation.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.4 apply.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.2.1.

##### 6.2.2.3.2 UE maximum output power reduction for power class 2

For power class 2, MPR specified in subclause 6.2.2.3.3 applies.

Table 6.2.2.3.2-1: Void

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.2.2.

##### 6.2.2.3.3 UE maximum output power reduction for power class 3

For power class 3, MPR for contiguous allocations is defined as:

MPR = max(MPRWT, MPRnarrow)

Where,

MPRnarrow = 2.5 dB, BWalloc,RB ≤ 1.44 MHz, and 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil((2/3NRB) -LCRB) ≤ RBstart ≤ NRB-LCRB, where BWalloc,RB is the bandwidth of the RB allocation size.

MPRWT is the maximum power reduction due to modulation orders, transmission bandwidth configurations listed in Table 5.3.2-1, and waveform types. MPRWT is defined in Table 6.2.2.3.3-1 and Table 6.2.2.3.3-2.

Table 6.2.2.3.3-1: MPRWT for power class 3, BWchannel ≤ 200 MHz

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel ≤ 200 MHz | |
| Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 2.0 |
| QPSK | 0.0 | ≤ 2.0 |
| 16 QAM | ≤ 3.0 | ≤ 3.5 |
| 64 QAM | ≤ 5.0 | ≤ 5.5 |
| CP-OFDM | QPSK | ≤ 3.5 | ≤ 4.0 |
| 16 QAM | ≤ 5.0 | ≤ 5.0 |
| 64 QAM | ≤ 7.5 | ≤ 7.5 |

Table 6.2.2.3.3-2: MPRWT for power class 3, BWchannel = 400 MHz

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel = 400 MHz | |
| Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 3.0 |
| QPSK | 0.0 | ≤ 3.0 |
| 16 QAM | ≤ 4.5 | ≤ 4.5 |
| 64 QAM | ≤ 6.5 | ≤ 6.5 |
| CP-OFDM | QPSK | ≤ 5.0 | ≤ 5.0 |
| 16 QAM | ≤ 6.5 | ≤ 6.5 |
| 64 QAM | ≤ 9.0 | ≤ 9.0 |

Where the following parameters are defined to specify valid RB allocation ranges for RB allocations in Tables 6.2.2.3.3-1 and 6.2.2.3.3-2:

NRB is the maximum number of RBs for a given Channel bandwidth and sub-carrier spacing defined in Table 5.3.2-1.

RBend = RBStart + LCRB - 1

An RB allocation belonging to Table 6.2.2.3.3-1 is a Region 1 inner RB allocation if

RBstart ≥ Ceil(1/3 NRB) AND RBend < Ceil(2/3 NRB)

An RB allocation belonging to Table 6.2.2.3.3-2 is a Region 1 inner RB allocation if

RBstart ≥ Ceil(1/4 NRB) AND RBend < Ceil(3/4 NRB) AND LCRB ≤ Ceil(1/4 NRB)

An RB allocation is an Edge allocation if it is NOT a Region 1 inner allocation.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.2.3.

##### 6.2.2.3.4 UE maximum output power reduction for power class 4

For power class 4, MPR specified in sub-clause 6.2.2.3.3 applies.

Table 6.2.2.3.4-1: Void

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.2.4.

##### 6.2.2.3.5 UE maximum output power reduction for power class 5

For power class 5, MPR specified in sub-clause 6.2.2.3.3 applies.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.2.5.

##### 6.2.2.3.6 UE maximum output power reduction for power class 6

FFS

##### 6.2.2.3.7 UE maximum output power reduction for power class 7

For power class 7, MPR specified in sub-clause 6.2.2.3.3 for channel bandwidth less than or equal to 200MHz applies.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.2.7.

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, 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 subcarrier spacing, are shown in Table 6.2.2.4.1-1 to Table 6.2.2.4.1-9. 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 6.2.2.4.1-1: Test Configuration Table (Power Class 1, MPRnarrow)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | | |
| Test Parameters | | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) | |
| SCS 60 kHz | SCS 120 kHz |
| 1 | Low |  |  |  | CP-OFDM 64 QAM | Outer\_1RB\_Left | Outer\_1RB\_Left |
| 2 | High |  |  |  | CP-OFDM 64 QAM | Outer\_1RB\_Right | Outer\_1RB\_Right |
| 3 | Low |  |  |  | CP-OFDM 64 QAM | 3@0 | 2@0 |
| 4 | High |  |  |  | CP-OFDM 64 QAM | 3@NRB-3 | 2@NRB-2 |
| 5 | Low |  |  |  | CP-OFDM 64 QAM | 15@0 | 7@0 |
| 6 | High |  |  |  | CP-OFDM 64 QAM | 15@NRB-15 | 7@NRB-7 |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-2. | | | | | | | |

Table 6.2.2.4.1-2: Test Configuration Table (Power Class 1, MPRWT, BWchannel ≤ 200 MHz)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | | |
| Test Parameters | | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) | |
| SCS 60 kHz | SCS 120 kHz |
| 1 | Low |  |  |  | DFT-s-OFDM PI/2 BPSK | 16@0 | 8@0 |
| 2 | High |  |  |  | DFT-s-OFDM PI/2 BPSK | 16@NRB-16 | 8@NRB-8 |
| 3 | Mid |  |  |  | DFT-s-OFDM PI/2 BPSK | Outer\_Full | Outer\_Full |
| 4 | Mid |  |  |  | DFT-s-OFDM QPSK | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 5 | Low |  |  |  | DFT-s-OFDM QPSK | 16@0 | 8@0 |
| 6 | High |  |  |  | DFT-s-OFDM QPSK | 16@NRB-16 | 8@NRB-8 |
| 7 | Mid |  |  |  | DFT-s-OFDM QPSK | Outer\_Full | Outer\_Full |
| 8 | Mid |  |  |  | DFT-s-OFDM 16 QAM | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 9 | Low |  |  |  | DFT-s-OFDM 16 QAM | 16@0 | 8@0 |
| 10 | High |  |  |  | DFT-s-OFDM 16 QAM | 16@NRB-16 | 8@NRB-8 |
| 11 | Mid |  |  |  | DFT-s-OFDM 16 QAM | Outer\_Full | Outer\_Full |
| 12 | Low |  |  |  | DFT-s-OFDM 64 QAM | 16@0 | 8@0 |
| 13 | High |  |  |  | DFT-s-OFDM 64 QAM | 16@NRB-16 | 8@NRB-8 |
| 14 | Mid |  |  |  | DFT-s-OFDM 64 QAM | Outer\_Full | Outer\_Full |
| 15 | Mid |  |  |  | DFT-s-OFDM 64 QAM | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 16 | Mid |  |  |  | CP-OFDM QPSK | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 17 | Low |  |  |  | CP-OFDM QPSK | 16@0 | 8@0 |
| 18 | High |  |  |  | CP-OFDM QPSK | 16@NRB-16 | 8@NRB-8 |
| 19 | Mid |  |  |  | CP-OFDM QPSK | Outer\_Full | Outer\_Full |
| 20 | Low |  |  |  | CP-OFDM 16 QAM | 16@0 | 8@0 |
| 21 | High |  |  |  | CP-OFDM 16 QAM | 16@NRB-16 | 8@NRB-8 |
| 22 | Mid |  |  |  | CP-OFDM 16 QAM | Outer\_Full | Outer\_Full |
| 23 | Mid |  |  |  | CP-OFDM 16 QAM | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 24 | Low |  |  |  | CP-OFDM 64 QAM | 16@0 | 8@0 |
| 25 | High |  |  |  | CP-OFDM 64 QAM | 16@NRB-16 | 8@NRB-8 |
| 26 | Mid |  |  |  | CP-OFDM 64 QAM | Outer\_Full | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in clause 6.1-2. | | | | | | | |

Table 6.2.2.4.1-3: Test Configuration Table (Power Class 1, MPRWT, BWchannel = 400 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | 400 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120kHz | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | 8@0 |
| 2 | High | DFT-s-OFDM PI/2 BPSK | 8@NRB-8 |
| 3 | Mid | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| 4 | Mid | DFT-s-OFDM PI/2 BPSK | Inner\_Full\_Region2 |
| 5 | Mid | DFT-s-OFDM QPSK | Inner\_Full\_Region2 |
| 6 | Low | DFT-s-OFDM QPSK | 8@0 |
| 7 | High | DFT-s-OFDM QPSK | 8@NRB-8 |
| 8 | Mid | DFT-s-OFDM QPSK | Outer\_Full |
| 9 | Mid | DFT-s-OFDM 16 QAM | Inner\_Full\_Region2 |
| 10 | Low | DFT-s-OFDM 16 QAM | 8@0 |
| 11 | High | DFT-s-OFDM 16 QAM | 8@NRB-8 |
| 12 | Mid | DFT-s-OFDM 16 QAM | Outer\_Full |
| 13 | Low | DFT-s-OFDM 64 QAM | 8@0 |
| 14 | High | DFT-s-OFDM 64 QAM | 8@NRB-8 |
| 15 | Mid | DFT-s-OFDM 64 QAM | Outer\_Full |
| 16 | Mid | CP-OFDM QPSK | Inner\_Full\_Region2 |
| 17 | Low | CP-OFDM QPSK | 8@0 |
| 18 | High | CP-OFDM QPSK | 8@NRB-8 |
| 19 | Mid | CP-OFDM QPSK | Outer\_Full |
| 20 | Low | CP-OFDM 16 QAM | 8@0 |
| 21 | High | CP-OFDM 16 QAM | 8@NRB-8 |
| 22 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 23 | Mid | CP-OFDM 16 QAM | Inner\_Full\_Region2 |
| 24 | Low | CP-OFDM 64 QAM | 8@0 |
| 25 | High | CP-OFDM 64 QAM | 8@NRB-8 |
| 26 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in clause 6.1-2. | | | | | | |

Table 6.2.2.4.1-4: Void

Table 6.2.2.4.1-5: Void

Table 6.2.2.4.1-6: Void

Table 6.2.2.4.1-7: Test Configuration Table (Power Class 2, 3, 4, 5 and 7, MPRnarrow, BWchannel ≤ 200 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Left |
| 2 | High | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Right |
| 3 | Low | DFT-s-OFDM QPSK | Outer\_1RB\_Left |
| 4 | High | DFT-s-OFDM QPSK | Outer\_1RB\_Right |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

Table 6.2.2.4.1-8: Test Configuration Table (Power Class 2, 3, 4, 5 and 7, MPRWT, BWchannel ≤ 200 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) |
| 1 | Mid | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| 2 | Mid | DFT-s-OFDM QPSK | Outer\_Full |
| 3 | Mid | DFT-s-OFDM 16 QAM | Inner\_Full |
| 4 | Low | DFT-s-OFDM 16 QAM | Outer\_1RB\_Left |
| 5 | High | DFT-s-OFDM 16 QAM | Outer\_1RB\_Right |
| 6 | Mid | DFT-s-OFDM 16 QAM | Outer\_Full |
| 7 | Mid | DFT-s-OFDM 64 QAM | Inner\_Full |
| 8 | Low | DFT-s-OFDM 64 QAM | Outer\_1RB\_Left |
| 9 | High | DFT-s-OFDM 64 QAM | Outer\_1RB\_Right |
| 10 | Mid | DFT-s-OFDM 64 QAM | Outer\_Full |
| 11 | Mid | CP-OFDM QPSK | Inner\_Full |
| 12 | Low | CP-OFDM QPSK | Outer\_1RB\_Left |
| 13 | High | CP-OFDM QPSK | Outer\_1RB\_Right |
| 14 | Mid | CP-OFDM QPSK | Outer\_Full |
| 15 | Low | CP-OFDM 16 QAM | Outer\_1RB\_Left |
| 16 | High | CP-OFDM 16 QAM | Outer\_1RB\_Right |
| 17 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 18 | Low | CP-OFDM 64 QAM | Outer\_1RB\_Left |
| 19 | High | CP-OFDM 64 QAM | Outer\_1RB\_Right |
| 20 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

Table 6.2.2.4.1-8a: Test Configuration Table (Power Class 2, 3, 4, 5 MPRnarrow, BWchannel = 400 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | 400 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120 kHz | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | N/A for Maximum Power Reduction (MPR) test case | Modulation | RB allocation (NOTE 1) |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | Inner\_1RB\_Left |
| 2 | High | DFT-s-OFDM PI/2 BPSK | Inner\_1RB\_Right |
| 3 | Low | DFT-s-OFDM QPSK | Inner\_1RB\_Left |
| 4 | High | DFT-s-OFDM QPSK | Inner\_1RB\_Right |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

Table 6.2.2.4.1-9: Test Configuration Table (Power Class 2, 3, 4 and 5, MPRWT, BWchannel = 400 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | 400 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120kHz | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Left |
| 2 | High | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Right |
| 3 | Mid | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| 4 | Low | DFT-s-OFDM QPSK | Outer\_1RB\_Left |
| 5 | High | DFT-s-OFDM QPSK | Outer\_1RB\_Right |
| 6 | Mid | DFT-s-OFDM QPSK | Outer\_Full |
| 7 | Low | DFT-s-OFDM 16 QAM | Outer\_1RB\_Left |
| 8 | High | DFT-s-OFDM 16 QAM | Outer\_1RB\_Right |
| 9 | Mid | DFT-s-OFDM 16 QAM | Outer\_Full |
| 10 | Low | DFT-s-OFDM 64 QAM | Outer\_1RB\_Left |
| 11 | High | DFT-s-OFDM 64 QAM | Outer\_1RB\_Right |
| 12 | Mid | DFT-s-OFDM 64 QAM | Outer\_Full |
| 13 | Low | CP-OFDM QPSK | Outer\_1RB\_Left |
| 14 | High | CP-OFDM QPSK | Outer\_1RB\_Right |
| 15 | Mid | CP-OFDM QPSK | Outer\_Full |
| 16 | Low | CP-OFDM 16 QAM | Outer\_1RB\_Left |
| 17 | High | CP-OFDM 16 QAM | Outer\_1RB\_Right |
| 18 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 19 | Low | CP-OFDM 64 QAM | Outer\_1RB\_Left |
| 20 | High | CP-OFDM 64 QAM | Outer\_1RB\_Right |
| 21 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2.2.4.1-1 to Table 6.2.2.4.1-9.

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 [10] 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 to Table 6.2.2.4.1-9. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in 6.2.2.5. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.2.2.4.1-1 to Table 6.2.2.4.1-9, send an NR RRCReconfiguration message according to TS 38.508-1 [10] 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 [10] subclause 4.6.

6.2.2.5 Test requirement

The maximum output power, derived in step 5 shall be within the range prescribed by the nominal maximum output power and tolerance in following tables.

Table 6.2.2.5-1: UE Power Class test requirements for Power Class 1 (for Bands n257, n258, n261)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2.2.4.1-1 | 1 | 40 | 14.4 | 7 | 18.6-TT | 55 |
| 2 | 40 | 14.4 | 7 | 18.6-TT | 55 |
| 3 | 40 | 10 | 5 | 25-TT | 55 |
| 4 | 40 | 10 | 5 | 25-TT | 55 |
| 5 | 40 | 10 | 5 | 25-TT | 55 |
| 6 | 40 | 10 | 5 | 25-TT | 55 |
| Table 6.2.2.4.1-2 | 1 | 40 | 5.5 | 5 | 29.5-TT | 55 |
| 2 | 40 | 5.5 | 5 | 29.5-TT | 55 |
| 3 | 40 | 5.5 | 5 | 29.5-TT | 55 |
| 4 | 40 | 3 | 2 | 35-TT | 55 |
| 5 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 6 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 7 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 8 | 40 | 4 | 3 | 33-TT | 55 |
| 9 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 10 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 11 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 12 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 13 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 14 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 15 | 40 | 5 | 4 | 31-TT | 55 |
| 16 | 40 | 4.5 | 4 | 31.5-TT | 55 |
| 17 | 40 | 7 | 5 | 28-TT | 55 |
| 18 | 40 | 7 | 5 | 28-TT | 55 |
| 19 | 40 | 7 | 5 | 28-TT | 55 |
| 20 | 40 | 7 | 5 | 28-TT | 55 |
| 21 | 40 | 7 | 5 | 28-TT | 55 |
| 22 | 40 | 7 | 5 | 28-TT | 55 |
| 23 | 40 | 5.5 | 5 | 29.5-TT | 55 |
| 24 | 40 | 7.5 | 5 | 27.5-TT | 55 |
| 25 | 40 | 7.5 | 5 | 27.5-TT | 55 |
| 26 | 40 | 7.5 | 5 | 27.5-TT | 55 |
| Table 6.2.2.4.1-3 | 1 | 40 | 5.5 | 5 | 29.5-TT | 55 |
| 2 | 40 | 5.5 | 5 | 29.5-TT | 55 |
| 3 | 40 | 5.5 | 5 | 29.5-TT | 55 |
| 4 | 40 | 3 | 2 | 35-TT | 55 |
| 5 | 40 | 3.5 | 3 | 33.5-TT | 55 |
| 6 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 7 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 8 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 9 | 40 | 4.5 | 4 | 31.5-TT | 55 |
| 10 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 11 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 12 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 13 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 14 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 15 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 16 | 40 | 5 | 4 | 31-TT | 55 |
| 17 | 40 | 7 | 5 | 28-TT | 55 |
| 18 | 40 | 7 | 5 | 28-TT | 55 |
| 19 | 40 | 7 | 5 | 28-TT | 55 |
| 20 | 40 | 7 | 5 | 28-TT | 55 |
| 21 | 40 | 7 | 5 | 28-TT | 55 |
| 22 | 40 | 7 | 5 | 28-TT | 55 |
| 23 | 40 | 6.5 | 5 | 28.5-TT | 55 |
| 24 | 40 | 9 | 5 | 26-TT | 55 |
| 25 | 40 | 9 | 5 | 26-TT | 55 |
| 26 | 40 | 9 | 5 | 26-TT | 55 |

Table 6.2.2.5-1a: UE Power Class test requirements for Power Class 1 (for Bands n260)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2.2.4.1-1 | 1 | 38 | 14.4 | 7 | 16.6-TT | 55 |
| 2 | 38 | 14.4 | 7 | 16.6-TT | 55 |
| 3 | 38 | 10 | 5 | 23-TT | 55 |
| 4 | 38 | 10 | 5 | 23-TT | 55 |
| 5 | 38 | 10 | 5 | 23-TT | 55 |
| 6 | 38 | 10 | 5 | 23-TT | 55 |
| Table 6.2.2.4.1-2 | 1 | 38 | 5.5 | 5 | 27.5-TT | 55 |
| 2 | 38 | 5.5 | 5 | 27.5-TT | 55 |
| 3 | 38 | 5.5 | 5 | 27.5-TT | 55 |
| 4 | 38 | 3 | 2 | 33-TT | 55 |
| 5 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 6 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 7 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 8 | 38 | 4 | 3 | 31-TT | 55 |
| 9 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 10 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 11 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 12 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 13 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 14 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 15 | 38 | 5 | 4 | 29-TT | 55 |
| 16 | 38 | 4.5 | 4 | 29.5-TT | 55 |
| 17 | 38 | 7 | 5 | 26-TT | 55 |
| 18 | 38 | 7 | 5 | 26-TT | 55 |
| 19 | 38 | 7 | 5 | 26-TT | 55 |
| 20 | 38 | 7 | 5 | 26-TT | 55 |
| 21 | 38 | 7 | 5 | 26-TT | 55 |
| 22 | 38 | 7 | 5 | 26-TT | 55 |
| 23 | 38 | 5.5 | 5 | 27.5-TT | 55 |
| 24 | 38 | 7.5 | 5 | 25.5-TT | 55 |
| 25 | 38 | 7.5 | 5 | 25.5-TT | 55 |
| 26 | 38 | 7.5 | 5 | 25.5-TT | 55 |
| Table 6.2.2.4.1-3 | 1 | 38 | 5.5 | 5 | 27.5-TT | 55 |
| 2 | 38 | 5.5 | 5 | 27.5-TT | 55 |
| 3 | 38 | 5.5 | 5 | 27.5-TT | 55 |
| 4 | 38 | 3 | 2 | 33-TT | 55 |
| 5 | 38 | 3.5 | 3 | 31.5-TT | 55 |
| 6 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 7 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 8 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 9 | 38 | 4.5 | 4 | 29.5-TT | 55 |
| 10 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 11 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 12 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 13 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 14 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 15 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 16 | 38 | 5 | 4 | 29-TT | 55 |
| 17 | 38 | 7 | 5 | 26-TT | 55 |
| 18 | 38 | 7 | 5 | 26-TT | 55 |
| 19 | 38 | 7 | 5 | 26-TT | 55 |
| 20 | 38 | 7 | 5 | 26-TT | 55 |
| 21 | 38 | 7 | 5 | 26-TT | 55 |
| 22 | 38 | 7 | 5 | 26-TT | 55 |
| 23 | 38 | 6.5 | 5 | 26.5-TT | 55 |
| 24 | 38 | 9 | 5 | 24-TT | 55 |
| 25 | 38 | 9 | 5 | 24-TT | 55 |
| 26 | 38 | 9 | 5 | 24-TT | 55 |

Table 6.2.2.5-1b: Test Tolerance (Power class 1)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 3.38 dB, NTC  3.56 dB, ETC | 3.38 dB, NTC  3.56 dB, ETC |

Table 6.2.2.5-2: UE Power Class test requirements for Power Class 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2.2.4.1-7 | 1 | 29 | 2.5 | 2 | 24.5-TT | 43 |
| 2 | 29 | 2.5 | 2 | 24.5-TT | 43 |
| 3 | 29 | 2.5 | 2 | 24.5-TT | 43 |
| 4 | 29 | 2.5 | 2 | 24.5-TT | 43 |
| Table 6.2.2.4.1-8 | 1 | 29 | 2 | 1.5 | 25.5-TT | 43 |
| 2 | 29 | 2 | 1.5 | 25.5-TT | 43 |
| 3 | 29 | 3 | 2 | 24-TT | 43 |
| 4 | 29 | 3.5 | 3 | 22.5-TT | 43 |
| 5 | 29 | 3.5 | 3 | 22.5-TT | 43 |
| 6 | 29 | 3.5 | 3 | 22.5-TT | 43 |
| 7 | 29 | 5 | 4 | 20-TT | 43 |
| 8 | 29 | 5.5 | 5 | 18.5-TT | 43 |
| 9 | 29 | 5.5 | 5 | 18.5-TT | 43 |
| 10 | 29 | 5.5 | 5 | 18.5-TT | 43 |
| 11 | 29 | 3.5 | 3 | 22.5-TT | 43 |
| 12 | 29 | 4 | 3 | 22-TT | 43 |
| 13 | 29 | 4 | 3 | 22-TT | 43 |
| 14 | 29 | 4 | 3 | 22-TT | 43 |
| 15 | 29 | 5 | 4 | 20-TT | 43 |
| 16 | 29 | 5 | 4 | 20-TT | 43 |
| 17 | 29 | 5 | 4 | 20-TT | 43 |
| 18 | 29 | 7.5 | 5 | 16.5-TT | 43 |
| 19 | 29 | 7.5 | 5 | 16.5-TT | 43 |
| 20 | 29 | 7.5 | 5 | 16.5-TT | 43 |
| Table 6.2.2.4.1-8a | 1 | 29 | 2.5 | 2 | 24.5-TT | 43 |
| 2 | 29 | 2.5 | 2 | 24.5-TT | 43 |
| 3 | 29 | 2.5 | 2 | 24.5-TT | 43 |
| 4 | 29 | 2.5 | 2 | 24.5-TT | 43 |
| Table 6.2.2.4.1-9 | 1 | 29 | 3 | 2 | 24-TT | 43 |
| 2 | 29 | 3 | 2 | 24-TT | 43 |
| 3 | 29 | 3 | 2 | 24-TT | 43 |
| 4 | 29 | 3 | 2 | 24-TT | 43 |
| 5 | 29 | 3 | 2 | 24-TT | 43 |
| 6 | 29 | 3 | 2 | 24-TT | 43 |
| 7 | 29 | 4.5 | 4 | 20.5-TT | 43 |
| 8 | 29 | 4.5 | 4 | 20.5-TT | 43 |
| 9 | 29 | 4.5 | 4 | 20.5-TT | 43 |
| 10 | 29 | 6.5 | 5 | 17.5-TT | 43 |
| 11 | 29 | 6.5 | 5 | 17.5-TT | 43 |
| 12 | 29 | 6.5 | 5 | 17.5-TT | 43 |
| 13 | 29 | 5 | 4 | 20-TT | 43 |
| 14 | 29 | 5 | 4 | 20-TT | 43 |
| 15 | 29 | 5 | 4 | 20-TT | 43 |
| 16 | 29 | 6.5 | 5 | 17.5-TT | 43 |
| 17 | 29 | 6.5 | 5 | 17.5-TT | 43 |
| 18 | 29 | 6.5 | 5 | 17.5-TT | 43 |
| 19 | 29 | 9 | 5 | 15-TT | 43 |
| 20 | 29 | 9 | 5 | 15-TT | 43 |
| 21 | 29 | 9 | 5 | 15-TT | 43 |

Table 6.2.2.5-3: UE Power Class test requirements for Power Class 3 (n257, 258, 261)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2.2.4.1-7 | 1 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| 2 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| 3 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
|  | 4 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8 | 1 | 22.4 | 2 | 1.5 | 18.9-TT-ΔMBP,n | 43 |
| 2 | 22.4 | 2 | 1.5 | 18.9-TT-ΔMBP,n | 43 |
| 3 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 4 | 22.4 | 3.5 | 3 | 15.9-TT-ΔMBP,n | 43 |
| 5 | 22.4 | 3.5 | 3 | 15.9-TT-ΔMBP,n | 43 |
| 6 | 22.4 | 3.5 | 3 | 15.9-TT-ΔMBP,n | 43 |
| 7 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 8 | 22.4 | 5.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| 9 | 22.4 | 5.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| 10 | 22.4 | 5.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| 11 | 22.4 | 3.5 | 3 | 15.9-TT-ΔMBP,n | 43 |
| 12 | 22.4 | 4 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 13 | 22.4 | 4 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 14 | 22.4 | 4 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 15 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 16 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 17 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 18 | 22.4 | 7.5 | 5 | 9.9-TT-ΔMBP,n | 43 |
| 19 | 22.4 | 7.5 | 5 | 9.9-TT-ΔMBP,n | 43 |
| 20 | 22.4 | 7.5 | 5 | 9.9-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8a | 1 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| 2 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| 3 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| 4 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-9 | 1 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 2 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 3 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 4 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 5 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 6 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 7 | 22.4 | 4.5 | 4 | 13.9-TT-ΔMBP,n | 43 |
| 8 | 22.4 | 4.5 | 4 | 13.9-TT-ΔMBP,n | 43 |
| 9 | 22.4 | 4.5 | 4 | 13.9-TT-ΔMBP,n | 43 |
| 10 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 11 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 12 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 13 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 14 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 15 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 16 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 17 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 18 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 19 | 22.4 | 9 | 5 | 8.4-TT-ΔMBP,n | 43 |
| 20 | 22.4 | 9 | 5 | 8.4-TT-ΔMBP,n | 43 |
| 21 | 22.4 | 9 | 5 | 8.4-TT-ΔMBP,n | 43 |
| Note 1: ΔMBP,n is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant.  Note 3: Max allowed sum of ΔMBP,n over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: ΔMBP,n is 0 for single band UE. | | | | | | |

Table 6.2.2.5-3a: UE Power Class test requirements for Power Class 3 (n260)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2.2.4.1-7 | 1 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 2 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 3 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 4 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8 | 1 | 20.6 | 2 | 1.5 | 17.1-TT-ΔMBP,n | 43 |
| 2 | 20.6 | 2 | 1.5 | 17.1-TT-ΔMBP,n | 43 |
| 3 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 4 | 20.6 | 3.5 | 3 | 14.1-TT-ΔMBP,n | 43 |
| 5 | 20.6 | 3.5 | 3 | 14.1-TT-ΔMBP,n | 43 |
| 6 | 20.6 | 3.5 | 3 | 14.1-TT-ΔMBP,n | 43 |
| 7 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 8 | 20.6 | 5.5 | 5 | 10.1-TT-ΔMBP,n | 43 |
| 9 | 20.6 | 5.5 | 5 | 10.1-TT-ΔMBP,n | 43 |
| 10 | 20.6 | 5.5 | 5 | 10.1-TT-ΔMBP,n | 43 |
| 11 | 20.6 | 3.5 | 3 | 14.1-TT-ΔMBP,n | 43 |
| 12 | 20.6 | 4 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 13 | 20.6 | 4 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 14 | 20.6 | 4 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 15 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 16 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 17 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 18 | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| 19 | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| 20 | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8a | 1 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 2 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 3 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 4 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-9 | 1 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 2 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 3 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 4 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 5 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 6 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 7 | 20.6 | 4.5 | 4 | 12.1-TT-ΔMBP,n | 43 |
| 8 | 20.6 | 4.5 | 4 | 12.1-TT-ΔMBP,n | 43 |
| 9 | 20.6 | 4.5 | 4 | 12.1-TT-ΔMBP,n | 43 |
| 10 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 11 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 12 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 13 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 14 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 15 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 16 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 17 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 18 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 19 | 20.6 | 9 | 5 | 6.6-TT-ΔMBP,n | 43 |
| 20 | 20.6 | 9 | 5 | 6.6-TT-ΔMBP,n | 43 |
| 21 | 20.6 | 9 | 5 | 6.6-TT-ΔMBP,n | 43 |
| Note 1: ΔMBP,n is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant.  Note 3: Max allowed sum of ΔMBP,n over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: ΔMBP,n is 0 for single band UE. | | | | | | |

Table 6.2.2.5-3b: UE Power Class test requirements for Power Class 3 (n259)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2.2.4.1-7 | 1 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
| 2 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
| 3 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
| 4 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8 | 1 | 18.7 | 2 | 1.5 | 15.2-TT-ΔMBP,n | 43 |
| 2 | 18.7 | 2 | 1.5 | 15.2-TT-ΔMBP,n | 43 |
| 3 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
| 4 | 18.7 | 3.5 | 3 | 12.2-TT-ΔMBP,n | 43 |
| 5 | 18.7 | 3.5 | 3 | 12.2-TT-ΔMBP,n | 43 |
| 6 | 18.7 | 3.5 | 3 | 12.2-TT-ΔMBP,n | 43 |
| 7 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
| 8 | 18.7 | 5.5 | 5 | 8.2-TT-ΔMBP,n | 43 |
| 9 | 18.7 | 5.5 | 5 | 8.2-TT-ΔMBP,n | 43 |
| 10 | 18.7 | 5.5 | 5 | 8.2-TT-ΔMBP,n | 43 |
| 11 | 18.7 | 3.5 | 3 | 12.2-TT-ΔMBP,n | 43 |
| 12 | 18.7 | 4 | 3 | 11.7-TT-ΔMBP,n | 43 |
| 13 | 18.7 | 4 | 3 | 11.7-TT-ΔMBP,n | 43 |
| 14 | 18.7 | 4 | 3 | 11.7-TT-ΔMBP,n | 43 |
| 15 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
| 16 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
| 17 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
| 18 | 18.7 | 7.5 | 5 | 6.2-TT-ΔMBP,n | 43 |
| 19 | 18.7 | 7.5 | 5 | 6.2-TT-ΔMBP,n | 43 |
| 20 | 18.7 | 7.5 | 5 | 6.2-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8a | 1 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
| 2 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
| 3 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
| 4 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-9 | 1 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
| 2 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
| 3 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
| 4 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
| 5 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
| 6 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
| 7 | 18.7 | 4.5 | 4 | 10.2-TT-ΔMBP,n | 43 |
| 8 | 18.7 | 4.5 | 4 | 10.2-TT-ΔMBP,n | 43 |
| 9 | 18.7 | 4.5 | 4 | 10.2-TT-ΔMBP,n | 43 |
| 10 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
| 11 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
| 12 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
| 13 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
| 14 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
| 15 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
| 16 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
| 17 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
| 18 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
| 19 | 18.7 | 9 | 5 | 4.7-TT-ΔMBP,n | 43 |
| 20 | 18.7 | 9 | 5 | 4.7-TT-ΔMBP,n | 43 |
| 21 | 18.7 | 9 | 5 | 4.7-TT-ΔMBP,n | 43 |
| Note 1: ΔMBP,n is the Multiband Relaxation factor declared by the UE for the tested band in table FFS of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant.  Note 3: Max allowed sum of ΔMBP,n over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: ΔMBP,n is 0 for single band UE. | | | | | | |

Table 6.2.2.5-3c: Test Tolerance (Power class 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Test Metric | FR2a | FR2b | FR2c |
| Max device size ≤ 30 cm | 3.24 dB, NTC  3.41 dB, ETC | 3.24 dB, NTC  3.41 dB, ETC | [4.12] dB, NTC  TBD, ETC |

Table 6.2.2.5-4: UE Power Class test requirements for Power Class 4 (n257, 258, 261)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2.2.4.1-7 | 1 | 34 | 2.5 | 2 | 29.5-TT | 43 |
| 2 | 34 | 2.5 | 2 | 29.5-TT | 43 |
| 3 | 34 | 2.5 | 2 | 29.5-TT | 43 |
| 4 | 34 | 2.5 | 2 | 29.5-TT | 43 |
| Table 6.2.2.4.1-8 | 1 | 34 | 2 | 1.5 | 30.5-TT | 43 |
| 2 | 34 | 2 | 1.5 | 30.5-TT | 43 |
| 3 | 34 | 3 | 2 | 29-TT | 43 |
| 4 | 34 | 3.5 | 3 | 27.5-TT | 43 |
| 5 | 34 | 3.5 | 3 | 27.5-TT | 43 |
| 6 | 34 | 3.5 | 3 | 27.5-TT | 43 |
| 7 | 34 | 5 | 4 | 25-TT | 43 |
| 8 | 34 | 5.5 | 5 | 23.5-TT | 43 |
| 9 | 34 | 5.5 | 5 | 23.5-TT | 43 |
| 10 | 34 | 5.5 | 5 | 23.5-TT | 43 |
| 11 | 34 | 3.5 | 3 | 27.5-TT | 43 |
| 12 | 34 | 4 | 3 | 27-TT | 43 |
| 13 | 34 | 4 | 3 | 27-TT | 43 |
| 14 | 34 | 4 | 3 | 27-TT | 43 |
| 15 | 34 | 5 | 4 | 25-TT | 43 |
| 16 | 34 | 5 | 4 | 25-TT | 43 |
| 17 | 34 | 5 | 4 | 25-TT | 43 |
| 18 | 34 | 7.5 | 5 | 1.5-TT | 43 |
| 19 | 34 | 7.5 | 5 | 1.5-TT | 43 |
| 20 | 34 | 7.5 | 5 | 1.5-TT | 43 |
| Table 6.2.2.4.1-8a | 1 | 34 | 2.5 | 2 | 29.5-TT | 43 |
| 2 | 34 | 2.5 | 2 | 29.5-TT | 43 |
| 3 | 34 | 2.5 | 2 | 29.5-TT | 43 |
| 4 | 34 | 2.5 | 2 | 29.5-TT | 43 |
| Table 6.2.2.4.1-9 | 1 | 34 | 3 | 2 | 29-TT | 43 |
| 2 | 34 | 3 | 2 | 29-TT | 43 |
| 3 | 34 | 3 | 2 | 29-TT | 43 |
| 4 | 34 | 3 | 2 | 29-TT | 43 |
| 5 | 34 | 3 | 2 | 29-TT | 43 |
| 6 | 34 | 3 | 2 | 29-TT | 43 |
| 7 | 34 | 4.5 | 4 | 25.5-TT | 43 |
| 8 | 34 | 4.5 | 4 | 25.5-TT | 43 |
| 9 | 34 | 4.5 | 4 | 25.5-TT | 43 |
| 10 | 34 | 6.5 | 5 | 22.5-TT | 43 |
| 11 | 34 | 6.5 | 5 | 22.5-TT | 43 |
| 12 | 34 | 6.5 | 5 | 22.5-TT | 43 |
| 13 | 34 | 5 | 4 | 25-TT | 43 |
| 14 | 34 | 5 | 4 | 25-TT | 43 |
| 15 | 34 | 5 | 4 | 25-TT | 43 |
| 16 | 34 | 6.5 | 5 | 22.5-TT | 43 |
| 17 | 34 | 6.5 | 5 | 22.5-TT | 43 |
| 18 | 34 | 6.5 | 5 | 22.5-TT | 43 |
| 19 | 34 | 9 | 5 | 20-TT | 43 |
| 20 | 34 | 9 | 5 | 20-TT | 43 |
| 21 | 34 | 9 | 5 | 20-TT | 43 |

Table 6.2.2.5-4a: UE Power Class test requirements for Power Class 4 (n260)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2.2.4.1-7 | 1 | 31 | 2.5 | 2 | 26.5-TT | 43 |
| 2 | 31 | 2.5 | 2 | 26.5-TT | 43 |
| 3 | 31 | 2.5 | 2 | 26.5-TT | 43 |
| 4 | 31 | 2.5 | 2 | 26.5-TT | 43 |
| Table 6.2.2.4.1-8 | 1 | 31 | 2 | 1.5 | 27.5-TT | 43 |
| 2 | 31 | 2 | 1.5 | 27.5-TT | 43 |
| 3 | 31 | 3 | 2 | 26-TT | 43 |
| 4 | 31 | 3.5 | 3 | 24.5-TT | 43 |
| 5 | 31 | 3.5 | 3 | 24.5-TT | 43 |
| 6 | 31 | 3.5 | 3 | 24.5-TT | 43 |
| 7 | 31 | 5 | 4 | 22-TT | 43 |
| 8 | 31 | 5.5 | 5 | 20.5-TT | 43 |
| 9 | 31 | 5.5 | 5 | 20.5-TT | 43 |
| 10 | 31 | 5.5 | 5 | 20.5-TT | 43 |
| 11 | 31 | 3.5 | 3 | 24.5-TT | 43 |
| 12 | 31 | 4 | 3 | 24-TT | 43 |
| 13 | 31 | 4 | 3 | 24-TT | 43 |
| 14 | 31 | 4 | 3 | 24-TT | 43 |
| 15 | 31 | 5 | 4 | 22-TT | 43 |
| 16 | 31 | 5 | 4 | 22-TT | 43 |
| 17 | 31 | 5 | 4 | 22-TT | 43 |
| 18 | 31 | 7.5 | 5 | 18.5-TT | 43 |
| 19 | 31 | 7.5 | 5 | 18.5-TT | 43 |
| 20 | 31 | 7.5 | 5 | 18.5-TT | 43 |
| Table 6.2.2.4.1-8a | 1 | 31 | 2.5 | 2 | 26.5-TT | 43 |
| 2 | 31 | 2.5 | 2 | 26.5-TT | 43 |
| 3 | 31 | 2.5 | 2 | 26.5-TT | 43 |
| 4 | 31 | 2.5 | 2 | 26.5-TT | 43 |
| Table 6.2.2.4.1-9 | 1 | 31 | 3 | 2 | 26-TT | 43 |
| 2 | 31 | 3 | 2 | 26-TT | 43 |
| 3 | 31 | 3 | 2 | 26-TT | 43 |
| 4 | 31 | 3 | 2 | 26-TT | 43 |
| 5 | 31 | 3 | 2 | 26-TT | 43 |
| 6 | 31 | 3 | 2 | 26-TT | 43 |
| 7 | 31 | 4.5 | 4 | 22.5-TT | 43 |
| 8 | 31 | 4.5 | 4 | 22.5-TT | 43 |
| 9 | 31 | 4.5 | 4 | 22.5-TT | 43 |
| 10 | 31 | 6.5 | 5 | 19.5-TT | 43 |
| 11 | 31 | 6.5 | 5 | 19.5-TT | 43 |
| 12 | 31 | 6.5 | 5 | 19.5-TT | 43 |
| 13 | 31 | 5 | 4 | 22-TT | 43 |
| 14 | 31 | 5 | 4 | 22-TT | 43 |
| 15 | 31 | 5 | 4 | 22-TT | 43 |
| 16 | 31 | 6.5 | 5 | 19.5-TT | 43 |
| 17 | 31 | 6.5 | 5 | 19.5-TT | 43 |
| 18 | 31 | 6.5 | 5 | 19.5-TT | 43 |
| 19 | 31 | 9 | 5 | 17-TT | 43 |
| 20 | 31 | 9 | 5 | 17-TT | 43 |
| 21 | 31 | 9 | 5 | 17-TT | 43 |

Table 6.2.2.5-5: UE Power Class test requirements for Power Class 5 (n257)

| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| --- | --- | --- | --- | --- | --- | --- |
| Table 6.2.2.4.1-7 | 1 | 30 | 2.5 | 2 | 25.5-TT-ΔMBP,n | 43 |
| 2 | 30 | 2.5 | 2 | 25.5-TT-ΔMBP,n | 43 |
| 3 | 30 | 2.5 | 2 | 25.5-TT-ΔMBP,n | 43 |
| 4 | 30 | 2.5 | 2 | 25.5-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8 | 1 | 30 | 2 | 1.5 | 26.5-TT-ΔMBP,n | 43 |
| 2 | 30 | 2 | 1.5 | 26.5-TT-ΔMBP,n | 43 |
| 3 | 30 | 3 | 2 | 25-TT-ΔMBP,n | 43 |
| 4 | 30 | 3.5 | 3 | 23.5-TT-ΔMBP,n | 43 |
| 5 | 30 | 3.5 | 3 | 23.5-TT-ΔMBP,n | 43 |
| 6 | 30 | 3.5 | 3 | 23.5-TT-ΔMBP,n | 43 |
| 7 | 30 | 5 | 4 | 21-TT-ΔMBP,n | 43 |
| 8 | 30 | 5.5 | 5 | 19.5-TT-ΔMBP,n | 43 |
| 9 | 30 | 5.5 | 5 | 19.5-TT-ΔMBP,n | 43 |
| 10 | 30 | 5.5 | 5 | 19.5-TT-ΔMBP,n | 43 |
| 11 | 30 | 3.5 | 3 | 23.5-TT-ΔMBP,n | 43 |
| 12 | 30 | 4 | 3 | 23-TT-ΔMBP,n | 43 |
| 13 | 30 | 4 | 3 | 23-TT-ΔMBP,n | 43 |
| 14 | 30 | 4 | 3 | 23-TT-ΔMBP,n | 43 |
| 15 | 30 | 5 | 4 | 21-TT-ΔMBP,n | 43 |
| 16 | 30 | 5 | 4 | 21-TT-ΔMBP,n | 43 |
| 17 | 30 | 5 | 4 | 21-TT-ΔMBP,n | 43 |
| 18 | 30 | 7.5 | 5 | 17.5-TT-ΔMBP,n | 43 |
| 19 | 30 | 7.5 | 5 | 17.5-TT-ΔMBP,n | 43 |
| 20 | 30 | 7.5 | 5 | 17.5-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8a | 1 | 30 | 2.5 | 2 | 25.5-TT-ΔMBP,n | 43 |
| 2 | 30 | 2.5 | 2 | 25.5-TT-ΔMBP,n | 43 |
| 3 | 30 | 2.5 | 2 | 25.5-TT-ΔMBP,n | 43 |
| 4 | 30 | 2.5 | 2 | 25.5-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-9 | 1 | 30 | 3 | 2 | 25-TT-ΔMBP,n | 43 |
| 2 | 30 | 3 | 2 | 25-TT-ΔMBP,n | 43 |
| 3 | 30 | 3 | 2 | 25-TT-ΔMBP,n | 43 |
| 4 | 30 | 3 | 2 | 25-TT-ΔMBP,n | 43 |
| 5 | 30 | 3 | 2 | 25-TT-ΔMBP,n | 43 |
| 6 | 30 | 3 | 2 | 25-TT-ΔMBP,n | 43 |
| 7 | 30 | 4.5 | 4 | 21.5-TT-ΔMBP,n | 43 |
| 8 | 30 | 4.5 | 4 | 21.5-TT-ΔMBP,n | 43 |
| 9 | 30 | 4.5 | 4 | 21.5-TT-ΔMBP,n | 43 |
| 10 | 30 | 6.5 | 5 | 18.5-TT-ΔMBP,n | 43 |
| 11 | 30 | 6.5 | 5 | 18.5-TT-ΔMBP,n | 43 |
| 12 | 30 | 6.5 | 5 | 18.5-TT-ΔMBP,n | 43 |
| 13 | 30 | 5 | 4 | 21-TT-ΔMBP,n | 43 |
| 14 | 30 | 5 | 4 | 21-TT-ΔMBP,n | 43 |
| 15 | 30 | 5 | 4 | 21-TT-ΔMBP,n | 43 |
| 16 | 30 | 6.5 | 5 | 18.5-TT-ΔMBP,n | 43 |
| 17 | 30 | 6.5 | 5 | 18.5-TT-ΔMBP,n | 43 |
| 18 | 30 | 6.5 | 5 | 18.5-TT-ΔMBP,n | 43 |
| 19 | 30 | 9 | 5 | 16-TT-ΔMBP,n | 43 |
| 20 | 30 | 9 | 5 | 16-TT-ΔMBP,n | 43 |
| 21 | 30 | 9 | 5 | 16-TT-ΔMBP,n | 43 |

Table 6.2.2.5-5a: UE Power Class test requirements for Power Class 5 (n258)

| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| --- | --- | --- | --- | --- | --- | --- |
| Table 6.2.2.4.1-7 | 1 | 30.4 | 2.5 | 2 | 25.9-TT-ΔMBP,n | 43 |
| 2 | 30.4 | 2.5 | 2 | 25.9-TT-ΔMBP,n | 43 |
| 3 | 30.4 | 2.5 | 2 | 25.9-TT-ΔMBP,n | 43 |
| 4 | 30.4 | 2.5 | 2 | 25.9-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8 | 1 | 30.4 | 2 | 1.5 | 26.9-TT-ΔMBP,n | 43 |
| 2 | 30.4 | 2 | 1.5 | 26.9-TT-ΔMBP,n | 43 |
| 3 | 30.4 | 3 | 2 | 25.4-TT-ΔMBP,n | 43 |
| 4 | 30.4 | 3.5 | 3 | 23.9-TT-ΔMBP,n | 43 |
| 5 | 30.4 | 3.5 | 3 | 23.9-TT-ΔMBP,n | 43 |
| 6 | 30.4 | 3.5 | 3 | 23.9-TT-ΔMBP,n | 43 |
| 7 | 30.4 | 5 | 4 | 21.4-TT-ΔMBP,n | 43 |
| 8 | 30.4 | 5.5 | 5 | 19.9-TT-ΔMBP,n | 43 |
| 9 | 30.4 | 5.5 | 5 | 19.9-TT-ΔMBP,n | 43 |
| 10 | 30.4 | 5.5 | 5 | 19.9-TT-ΔMBP,n | 43 |
| 11 | 30.4 | 3.5 | 3 | 23.9-TT-ΔMBP,n | 43 |
| 12 | 30.4 | 4 | 3 | 23.4-TT-ΔMBP,n | 43 |
| 13 | 30.4 | 4 | 3 | 23.4-TT-ΔMBP,n | 43 |
| 14 | 30.4 | 4 | 3 | 23.4-TT-ΔMBP,n | 43 |
| 15 | 30.4 | 5 | 4 | 21.4-TT-ΔMBP,n | 43 |
| 16 | 30.4 | 5 | 4 | 21.4-TT-ΔMBP,n | 43 |
| 17 | 30.4 | 5 | 4 | 21.4-TT-ΔMBP,n | 43 |
| 18 | 30.4 | 7.5 | 5 | 17.9-TT-ΔMBP,n | 43 |
| 19 | 30.4 | 7.5 | 5 | 17.9-TT-ΔMBP,n | 43 |
| 20 | 30.4 | 7.5 | 5 | 17.9-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8a | 1 | 30.4 | 2.5 | 2 | 25.9-TT-ΔMBP,n | 43 |
| 2 | 30.4 | 2.5 | 2 | 25.9-TT-ΔMBP,n | 43 |
| 3 | 30.4 | 2.5 | 2 | 25.9-TT-ΔMBP,n | 43 |
| 4 | 30.4 | 2.5 | 2 | 25.9-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-9 | 1 | 30.4 | 3 | 2 | 25.4-TT-ΔMBP,n | 43 |
| 2 | 30.4 | 3 | 2 | 25.4-TT-ΔMBP,n | 43 |
| 3 | 30.4 | 3 | 2 | 25.4-TT-ΔMBP,n | 43 |
| 4 | 30.4 | 3 | 2 | 25.4-TT-ΔMBP,n | 43 |
| 5 | 30.4 | 3 | 2 | 25.4-TT-ΔMBP,n | 43 |
| 6 | 30.4 | 3 | 2 | 25.4-TT-ΔMBP,n | 43 |
| 7 | 30.4 | 4.5 | 4 | 21.9-TT-ΔMBP,n | 43 |
| 8 | 30.4 | 4.5 | 4 | 21.9-TT-ΔMBP,n | 43 |
| 9 | 30.4 | 4.5 | 4 | 21.9-TT-ΔMBP,n | 43 |
| 10 | 30.4 | 6.5 | 5 | 18.9-TT-ΔMBP,n | 43 |
| 11 | 30.4 | 6.5 | 5 | 18.9-TT-ΔMBP,n | 43 |
| 12 | 30.4 | 6.5 | 5 | 18.9-TT-ΔMBP,n | 43 |
| 13 | 30.4 | 5 | 4 | 21.4-TT-ΔMBP,n | 43 |
| 14 | 30.4 | 5 | 4 | 21.4-TT-ΔMBP,n | 43 |
| 15 | 30.4 | 5 | 4 | 21.4-TT-ΔMBP,n | 43 |
| 16 | 30.4 | 6.5 | 5 | 18.9-TT-ΔMBP,n | 43 |
| 17 | 30.4 | 6.5 | 5 | 18.9-TT-ΔMBP,n | 43 |
| 18 | 30.4 | 6.5 | 5 | 18.9-TT-ΔMBP,n | 43 |
| 19 | 30.4 | 9 | 5 | 16.4-TT-ΔMBP,n | 43 |
| 20 | 30.4 | 9 | 5 | 16.4-TT-ΔMBP,n | 43 |
| 21 | 30.4 | 9 | 5 | 16.4-TT-ΔMBP,n | 43 |

Table 6.2.2.5-5c: Test Tolerance (Power class 5)

|  |  |
| --- | --- |
| Test Metric | FR2a |
| Max device size ≤ 30 cm | 3.38 dB, NTC  3.56 dB, ETC |

Table 6.2.2.5-6: FFS

Table 6.2.2.5-7: UE Power Class test requirements for Power Class 7 (n257, n258, n261)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2.2.4.1-7 | 1 | 16.4 | 2.5 | 2 | 11.9-TT-ΔMBP,n | 43 |
| 2 | 16.4 | 2.5 | 2 | 11.9-TT-ΔMBP,n | 43 |
| 3 | 16.4 | 2.5 | 2 | 11.9-TT-ΔMBP,n | 43 |
| 4 | 16.4 | 2.5 | 2 | 11.9-TT-ΔMBP,n | 43 |
| Table 6.2.2.4.1-8 | 1 | 16.4 | 2 | 1.5 | 12.9-TT-ΔMBP,n | 43 |
| 2 | 16.4 | 2 | 1.5 | 12.9-TT-ΔMBP,n | 43 |
| 3 | 16.4 | 3 | 2 | 11.4-TT-ΔMBP,n | 43 |
| 4 | 16.4 | 3.5 | 3 | 9.9-TT-ΔMBP,n | 43 |
| 5 | 16.4 | 3.5 | 3 | 9.9-TT-ΔMBP,n | 43 |
| 6 | 16.4 | 3.5 | 3 | 9.9-TT-ΔMBP,n | 43 |
| 7 | 16.4 | 5 | 4 | 7.4-TT-ΔMBP,n | 43 |
| 8 | 16.4 | 5.5 | 5 | 5.9-TT-ΔMBP,n | 43 |
| 9 | 16.4 | 5.5 | 5 | 5.9-TT-ΔMBP,n | 43 |
| 10 | 16.4 | 5.5 | 5 | 5.9-TT-ΔMBP,n | 43 |
| 11 | 16.4 | 3.5 | 3 | 9.9-TT-ΔMBP,n | 43 |
| 12 | 16.4 | 4 | 3 | 9.4-TT-ΔMBP,n | 43 |
| 13 | 16.4 | 4 | 3 | 9.4-TT-ΔMBP,n | 43 |
| 14 | 16.4 | 4 | 3 | 9.4-TT-ΔMBP,n | 43 |
| 15 | 16.4 | 5 | 4 | 7.4-TT-ΔMBP,n | 43 |
| 16 | 16.4 | 5 | 4 | 7.4-TT-ΔMBP,n | 43 |
| 17 | 16.4 | 5 | 4 | 7.4-TT-ΔMBP,n | 43 |
| 18 | 16.4 | 7.5 | 5 | 3.9-TT-ΔMBP,n | 43 |
| 19 | 16.4 | 7.5 | 5 | 3.9-TT-ΔMBP,n | 43 |
| 20 | 16.4 | 7.5 | 5 | 3.9-TT-ΔMBP,n | 43 |
| Note 1: ΔMBP,n is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.7.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant.  Note 3: Max allowed sum of ΔMBP,n over all supported FR2 bands as defined in clause 6.2.1.1.3.7.  Note 4: ΔMBP,n is 0 for single band UE. | | | | | | |

Table 6.2.2.5-7a: Test Tolerance (Power class 7)

FFS

### 6.2.2\_1 UE maximum output power reduction enhancements

#### 6.2.2\_1.0 General

The requirements in section 6.2.2\_1 only apply when both UL and DL of a UE are configured for single CC operation, and they are of the same bandwidth. A UE may reduce its maximum output power due to modulation orders, transmit bandwidth configurations, waveform types and narrow allocations. This Maximum Power Reduction (MPR) is defined in subclauses below. 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. When the maximum output power of a UE is modified by MPR, the power limits specified in subclause 6.2.4 apply.

For a UE that is configured for single CC operation with different channel bandwidths in UL and DL, the requirements in section 6.2A.2 apply.

For all power classes, the waveform defined by BW = 100 MHz, SCS = 120 kHz, DFT-S-OFDM QPSK, 20RB23 is the reference waveform with 0 dB MPR and is used for the power class definition.

6.2.2\_1.1 Test purpose

The number of RB identified in 6.2.2\_1.3 is based on meeting the requirements for the maximum power reduction (MPR) due to Cubic Metric (CM).

6.2.2\_1.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 15 and release 16 which supports *modifiedMPRbehaviour* bit 0 capability (according to Annex P.1)

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward.

6.2.2\_1.3 Minimum conformance requirements

6.2.2\_1.3.1 Void

6.2.2\_1.3.2 Void

6.2.2\_1.3.3 UE maximum output power reduction for power class 3

For transmission bandwidth configuration less than or equal to 200MHz, and 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil((2/3NRB) – LCRB) < RBstart ≤ NRB-LCRB:

- MPRnarrow = 2.5 dB, when BWalloc,RB is less than or equal to 1.44 MHz,

- MPRnarrow = 2.0 dB, when 1.44 MHz < BWalloc,RB <= 4.32 MHz,

- otherwise MPRnarrow = 0 dB.

MPRWT is the maximum power reduction due to modulation orders, transmission bandwidth configurations listed in Table 5.3.2-1, and waveform types. MPRWT is defined in Table 6.2.2\_1.3.3-1.

**Table 6.2.2\_1.3.3-1 MPRWT for power class 3, BWchannel ≤ 200 MHz**

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation** | | **MPRWT, BWchannel ≤ 200 MHz** | |
|  | | **Inner RB allocations,**  **Region 1** | **Edge RB allocations** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 2.0 |
|  | QPSK | 0.0 | ≤ 2.0 |
|  | 16 QAM | ≤ 3.0 | ≤ 3.5 |
|  | 64 QAM | ≤ 5.0 | ≤ 5.5 |
| CP-OFDM | QPSK | ≤ 3.5 | ≤ 4.0 |
|  | 16 QAM | ≤ 5.0 | ≤ 5.0 |
|  | 64 QAM | ≤ 7.5 | ≤ 7.5 |

Where the following parameters are defined to specify valid RB allocation ranges for RB allocations in Table 6.2.2\_1.3.3-1:

- RBStart,Low = max(1, LCRB), where max() indicates the largest value of all arguments.

- RBStart,High = NRB – RBStart,Low – LCRB,

An RB allocation belonging to table 6.2.2\_1.3.3-1 is a Region 1 inner RB allocation if:

- RBStart,Low ≤ RBStart ≤ RBStart,High, and LCRB ≤ ceil(NRB/3), where ceil(x) is the smallest integer greater than or equal to x.

For transmission bandwidth configuration equal to 400MHz,

MPRnarrow = 2.5 dB, when BWalloc,RB is less than or equal to 1.44 MHz, and 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil(2/3NRB) ≤ RBstart ≤ NRB-LCRB, where BWalloc,RB is the bandwidth of the RB allocation size.

MPRWT is the maximum power reduction due to modulation orders, transmission bandwidth configurations listed in Table 5.3.2-1, and waveform types. MPRWT is defined in Table 6.2.2\_1.3.3-2.

**Table 6.2.2\_1.3.3-2 MPRWT for power class 3, BWchannel = 400 MHz**

|  |  |  |  |
| --- | --- | --- | --- |
| **Modulation** | | **MPRWT, BWchannel = 400 MHz** | |
|  | | **Inner RB allocations,**  **Region 1** | **Edge RB allocations** |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ 3.0 |
|  | QPSK | 0.0 | ≤ 3.0 |
|  | 16 QAM | ≤ 4.5 | ≤ 4.5 |
|  | 64 QAM | ≤ 6.5 | ≤ 6.5 |
| CP-OFDM | QPSK | ≤ 5.0 | ≤ 5.0 |
|  | 16 QAM | ≤ 6.5 | ≤ 6.5 |
|  | 64 QAM | ≤ 9.0 | ≤ 9.0 |

Where the following parameters are defined to specify valid RB allocation ranges for RB allocations in Table 6.2.2\_1.3.3-2:

NRB is the maximum number of RBs for a given Channel bandwidth and sub-carrier spacing defined in Table 5.3.2-1.

RBend = RBStart + LCRB - 1

An RB allocation belonging to table 6.2.2\_1.3.3-2 is a Region 1 inner RB allocation if

RBstart ≥ Ceil(1/4 NRB) AND RBend < Ceil(3/4 NRB) AND LCRB ≤ Ceil(1/4 NRB)

For all transmission bandwidth configurations, an RB allocation is an Edge allocation if it is NOT a Region 1 inner allocation.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.2.3

6.2.2\_1.3.4 Void

6.2.2\_1.4 Test description

Same as in clause 6.2.2.1.4.1 with following exceptions: Instead of Tables 6.2.2.1.4.1-1 to 6.2.2.1.4.1-9 🡪use Tables 6.2.2\_1.1.4.1-1 and 6.2.2\_1.1.4.1-4

Table 6.2.2\_1.4.1-1: Test Configuration Table (Power Class 3, MPRnarrow, BWchannel ≤ 200 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Default Conditions** | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | |
| **Test Parameters** | | | | | | |
| **Test ID** | **Freq** | **ChBw** | **SCS** | **Downlink Configuration** | **Uplink Configuration** | |
|  |  | Default | Default | - | **Modulation** | **RB allocation (NOTE 1)** |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Left |
| 2 | High | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Right |
| 3 | Low | DFT-s-OFDM QPSK | Outer\_1RB\_Left |
| 4 | High | DFT-s-OFDM QPSK | Outer\_1RB\_Right |
| 5 | Low | DFT-s-OFDM PI/2 BPSK | Inner\_Partial2\_Left |
| 6 | High | DFT-s-OFDM PI/2 BPSK | Inner\_Partial2\_Right |
| 7 | Low | DFT-s-OFDM QPSK | Inner\_Partial2\_Left |
| 8 | High | DFT-s-OFDM QPSK | Inner\_Partial2\_Right |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

Table 6.2.2\_1.4.1-2: Test Configuration Table (Power Class 3, MPRWT, BWchannel ≤ 200 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Default Conditions** | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | |
| **Test Parameters** | | | | | | |
| **Test ID** | **Freq** | **ChBw** | **SCS** | **Downlink Configuration** | **Uplink Configuration** | |
|  |  | Default | Default | - | **Modulation** | **RB allocation (NOTE 1)** |
| 1 | Mid | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| 2 | Mid | DFT-s-OFDM QPSK | Outer\_Full |
| 3 | Mid | DFT-s-OFDM 16 QAM | Inner\_Full |
| 4 | Low | DFT-s-OFDM 16 QAM | Outer\_1RB\_Left |
| 5 | High | DFT-s-OFDM 16 QAM | Outer\_1RB\_Right |
| 6 | Mid | DFT-s-OFDM 16 QAM | Outer\_Full |
| 7 | Mid | DFT-s-OFDM 64 QAM | Inner\_Full |
| 8 | Low | DFT-s-OFDM 64 QAM | Outer\_1RB\_Left |
| 9 | High | DFT-s-OFDM 64 QAM | Outer\_1RB\_Right |
| 10 | Mid | DFT-s-OFDM 64 QAM | Outer\_Full |
| 11 | Mid | CP-OFDM QPSK | Inner\_Full |
| 12 | Low | CP-OFDM QPSK | Outer\_1RB\_Left |
| 13 | High | CP-OFDM QPSK | Outer\_1RB\_Right |
| 14 | Mid | CP-OFDM QPSK | Outer\_Full |
| 15 | Low | CP-OFDM 16 QAM | Outer\_1RB\_Left |
| 16 | High | CP-OFDM 16 QAM | Outer\_1RB\_Right |
| 17 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 18 | Low | CP-OFDM 64 QAM | Outer\_1RB\_Left |
| 19 | High | CP-OFDM 64 QAM | Outer\_1RB\_Right |
| 20 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

Table 6.2.2\_1.4.1-3: Test Configuration Table (Power Class 3, MPRnarrow, BWchannel = 400 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Default Conditions** | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | 400 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120 kHz | |
| **Test Parameters** | | | | | | |
| **Test ID** | **Freq** | **ChBw** | **SCS** | **Downlink Configuration** | **Uplink Configuration** | |
|  |  | Default | Default | N/A for Maximum Power Reduction (MPR) test case | **Modulation** | **RB allocation (NOTE 1)** |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | Inner\_1RB\_Left |
| 2 | High | DFT-s-OFDM PI/2 BPSK | Inner\_1RB\_Right |
| 3 | Low | DFT-s-OFDM QPSK | Inner\_1RB\_Left |
| 4 | High | DFT-s-OFDM QPSK | Inner\_1RB\_Right |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

Table 6.2.2\_1.4.1-4: Test Configuration Table (Power Class 3, MPRWT, BWchannel = 400 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Default Conditions** | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | 400 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120kHz | |
| **Test Parameters** | | | | | | |
| **Test ID** | **Freq** | **ChBw** | **SCS** | **Downlink Configuration** | **Uplink Configuration** | |
|  |  | Default | Default | - | **Modulation** | **RB allocation (NOTE 1)** |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Left |
| 2 | High | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Right |
| 3 | Mid | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| 4 | Low | DFT-s-OFDM QPSK | Outer\_1RB\_Left |
| 5 | High | DFT-s-OFDM QPSK | Outer\_1RB\_Right |
| 6 | Mid | DFT-s-OFDM QPSK | Outer\_Full |
| 7 | Low | DFT-s-OFDM 16 QAM | Outer\_1RB\_Left |
| 8 | High | DFT-s-OFDM 16 QAM | Outer\_1RB\_Right |
| 9 | Mid | DFT-s-OFDM 16 QAM | Outer\_Full |
| 10 | Low | DFT-s-OFDM 64 QAM | Outer\_1RB\_Left |
| 11 | High | DFT-s-OFDM 64 QAM | Outer\_1RB\_Right |
| 12 | Mid | DFT-s-OFDM 64 QAM | Outer\_Full |
| 13 | Low | CP-OFDM QPSK | Outer\_1RB\_Left |
| 14 | High | CP-OFDM QPSK | Outer\_1RB\_Right |
| 15 | Mid | CP-OFDM QPSK | Outer\_Full |
| 16 | Low | CP-OFDM 16 QAM | Outer\_1RB\_Left |
| 17 | High | CP-OFDM 16 QAM | Outer\_1RB\_Right |
| 18 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 19 | Low | CP-OFDM 64 QAM | Outer\_1RB\_Left |
| 20 | High | CP-OFDM 64 QAM | Outer\_1RB\_Right |
| 21 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

6.2.2\_1.5 Test requirement

The maximum output power, derived in step 5 shall be within the range prescribed by the nominal maximum output power and tolerance in following tables.

Table 6.2.2\_1.5-1: UE Power Class test requirements for Power Class 3 (n257, 258, 261)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Configuration Table** | **Test ID** | **PPowerclass** | **MPRf,c** | **T(MPRf,c)** | **Lower limit**  **(dBm)** | **Upper limit**  **(dBm)** |
| 6.2.2\_1.4.1-1 | 1 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| 2 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| 3 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
|  | 4 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
|  | 5 | 22.4 | 2 | 1.5 | 18.9-TT-ΔMBP,n | 43 |
|  | 6 | 22.4 | 2 | 1.5 | 18.9-TT-ΔMBP,n | 43 |
|  | 7 | 22.4 | 2 | 1.5 | 18.9-TT-ΔMBP,n | 43 |
|  | 8 | 22.4 | 2 | 1.5 | 18.9-TT-ΔMBP,n | 43 |
| 6.2.2\_1.4.1-2 | 1 | 22.4 | 2 | 1.5 | 18.9-TT-ΔMBP,n | 43 |
| 2 | 22.4 | 2 | 1.5 | 18.9-TT-ΔMBP,n | 43 |
| 3 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 4 | 22.4 | 3.5 | 3 | 15.9-TT-ΔMBP,n | 43 |
| 5 | 22.4 | 3.5 | 3 | 15.9-TT-ΔMBP,n | 43 |
| 6 | 22.4 | 3.5 | 3 | 15.9-TT-ΔMBP,n | 43 |
| 7 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 8 | 22.4 | 5.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| 9 | 22.4 | 5.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| 10 | 22.4 | 5.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| 11 | 22.4 | 3.5 | 3 | 15.9-TT-ΔMBP,n | 43 |
| 12 | 22.4 | 4 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 13 | 22.4 | 4 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 14 | 22.4 | 4 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 15 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 16 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 17 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 18 | 22.4 | 7.5 | 5 | 9.9-TT-ΔMBP,n | 43 |
| 19 | 22.4 | 7.5 | 5 | 9.9-TT-ΔMBP,n | 43 |
| 20 | 22.4 | 7.5 | 5 | 9.9-TT-ΔMBP,n | 43 |
| 6.2.2\_1.4.1-3 | 1 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
|  | 2 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
|  | 3 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
|  | 4 | 22.4 | 2.5 | 2 | 17.9-TT-ΔMBP,n | 43 |
| 6.2.2\_1.4.1-4 | 1 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 2 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 3 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 4 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 5 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 6 | 22.4 | 3 | 2 | 17.4-TT-ΔMBP,n | 43 |
| 7 | 22.4 | 4.5 | 4 | 13.9-TT-ΔMBP,n | 43 |
| 8 | 22.4 | 4.5 | 4 | 13.9-TT-ΔMBP,n | 43 |
| 9 | 22.4 | 4.5 | 4 | 13.9-TT-ΔMBP,n | 43 |
| 10 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 11 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 12 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 13 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 14 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 15 | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 16 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 17 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 18 | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 19 | 22.4 | 9 | 5 | 8.4-TT-ΔMBP,n | 43 |
| 20 | 22.4 | 9 | 5 | 8.4-TT-ΔMBP,n | 43 |
| 21 | 22.4 | 9 | 5 | 8.4-TT-ΔMBP,n | 43 |
| Note 1: ΔMBP,n is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant.  Note 3: Max allowed sum of ΔMBP,n over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: ΔMBP,n is 0 for single band UE. | | | | | | |

Table 6.2.2\_1.5-2: UE Power Class test requirements for Power Class 3 (n260)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Configuration Table** | **Test ID** | **PPowerclass** | **MPRf,c** | **T(MPRf,c)** | **Lower limit**  **(dBm)** | **Upper limit**  **(dBm)** |
| 6.2.2\_1.4.1-1 | 1 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 2 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 3 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 4 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
|  | 5 | 20.6 | 2 | 1.5 | 17.1-TT-ΔMBP,n | 43 |
|  | 6 | 20.6 | 2 | 1.5 | 17.1-TT-ΔMBP,n | 43 |
|  | 7 | 20.6 | 2 | 1.5 | 17.1-TT-ΔMBP,n | 43 |
|  | 8 | 20.6 | 2 | 1.5 | 17.1-TT-ΔMBP,n | 43 |
| 6.2.2\_1.4.1-2 | 1 | 20.6 | 2 | 1.5 | 17.1-TT-ΔMBP,n | 43 |
| 2 | 20.6 | 2 | 1.5 | 17.1-TT-ΔMBP,n | 43 |
| 3 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 4 | 20.6 | 3.5 | 3 | 14.1-TT-ΔMBP,n | 43 |
| 5 | 20.6 | 3.5 | 3 | 14.1-TT-ΔMBP,n | 43 |
| 6 | 20.6 | 3.5 | 3 | 14.1-TT-ΔMBP,n | 43 |
| 7 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 8 | 20.6 | 5.5 | 5 | 10.1-TT-ΔMBP,n | 43 |
| 9 | 20.6 | 5.5 | 5 | 10.1-TT-ΔMBP,n | 43 |
| 10 | 20.6 | 5.5 | 5 | 10.1-TT-ΔMBP,n | 43 |
| 11 | 20.6 | 3.5 | 3 | 14.1-TT-ΔMBP,n | 43 |
| 12 | 20.6 | 4 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 13 | 20.6 | 4 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 14 | 20.6 | 4 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 15 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 16 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 17 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 18 | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| 19 | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| 20 | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| 6.2.2\_1.4.1-3 | 1 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
|  | 2 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
|  | 3 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
|  | 4 | 20.6 | 2.5 | 2 | 16.1-TT-ΔMBP,n | 43 |
| 6.2.2\_1.4.1-4 | 1 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 2 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 3 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 4 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 5 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 6 | 20.6 | 3 | 2 | 15.6-TT-ΔMBP,n | 43 |
| 7 | 20.6 | 4.5 | 4 | 12.1-TT-ΔMBP,n | 43 |
| 8 | 20.6 | 4.5 | 4 | 12.1-TT-ΔMBP,n | 43 |
| 9 | 20.6 | 4.5 | 4 | 12.1-TT-ΔMBP,n | 43 |
| 10 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 11 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 12 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 13 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 14 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 15 | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 16 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 17 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 18 | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 19 | 20.6 | 9 | 5 | 6.6-TT-ΔMBP,n | 43 |
| 20 | 20.6 | 9 | 5 | 6.6-TT-ΔMBP,n | 43 |
| 21 | 20.6 | 9 | 5 | 6.6-TT-ΔMBP,n | 43 |
| Note 1: ΔMBP,n is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant.  Note 3: Max allowed sum of ΔMBP,n over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: ΔMBP,n is 0 for single band UE. | | | | | | |

Table 6.2.2\_1.5-3: Test Tolerance (Power class 3)

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** | **FR2c** |
| Max device size ≤ 30 cm | 3.24 dB | 3.24 dB | [4.12] dB |

Table 6.2.2\_1.5-4: UE Power Class test requirements for Power Class 3 (n259)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test Configuration Table** | **Test ID** | **PPowerclass** | **MPRf,c** | **T(MPRf,c)** | **Lower limit**  **(dBm)** | **Upper limit**  **(dBm)** |
| 6.2.2\_1.4.1-1 | 1 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
|  | 2 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
|  | 3 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
|  | 4 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
|  | 5 | 18.7 | 2 | 1.5 | 15.2-TT-ΔMBP,n | 43 |
|  | 6 | 18.7 | 2 | 1.5 | 15.2-TT-ΔMBP,n | 43 |
|  | 7 | 18.7 | 2 | 1.5 | 15.2-TT-ΔMBP,n | 43 |
|  | 8 | 18.7 | 2 | 1.5 | 15.2-TT-ΔMBP,n | 43 |
| 6.2.2\_1.4.1-2 | 1 | 18.7 | 2 | 1.5 | 15.2-TT-ΔMBP,n | 43 |
|  | 2 | 18.7 | 2 | 1.5 | 15.2-TT-ΔMBP,n | 43 |
|  | 3 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
|  | 4 | 18.7 | 3.5 | 3 | 12.2-TT-ΔMBP,n | 43 |
|  | 5 | 18.7 | 3.5 | 3 | 12.2-TT-ΔMBP,n | 43 |
|  | 6 | 18.7 | 3.5 | 3 | 12.2-TT-ΔMBP,n | 43 |
|  | 7 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
|  | 8 | 18.7 | 5.5 | 5 | 8.2-TT-ΔMBP,n | 43 |
|  | 9 | 18.7 | 5.5 | 5 | 8.2-TT-ΔMBP,n | 43 |
|  | 10 | 18.7 | 5.5 | 5 | 8.2-TT-ΔMBP,n | 43 |
|  | 11 | 18.7 | 3.5 | 3 | 12.2-TT-ΔMBP,n | 43 |
|  | 12 | 18.7 | 4 | 3 | 11.7-TT-ΔMBP,n | 43 |
|  | 13 | 18.7 | 4 | 3 | 11.7-TT-ΔMBP,n | 43 |
|  | 14 | 18.7 | 4 | 3 | 11.7-TT-ΔMBP,n | 43 |
|  | 15 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
|  | 16 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
|  | 17 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
|  | 18 | 18.7 | 7.5 | 5 | 6.2-TT-ΔMBP,n | 43 |
|  | 19 | 18.7 | 7.5 | 5 | 6.2-TT-ΔMBP,n | 43 |
|  | 20 | 18.7 | 7.5 | 5 | 6.2-TT-ΔMBP,n | 43 |
| 6.2.2\_1.4.1-3 | 1 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
|  | 2 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
|  | 3 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
|  | 4 | 18.7 | 2.5 | 2 | 14.2-TT-ΔMBP,n | 43 |
| 6.2.2\_1.4.1-4 | 1 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
|  | 2 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
|  | 3 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
|  | 4 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
|  | 5 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
|  | 6 | 18.7 | 3 | 2 | 13.7-TT-ΔMBP,n | 43 |
|  | 7 | 18.7 | 4.5 | 4 | 10.2-TT-ΔMBP,n | 43 |
|  | 8 | 18.7 | 4.5 | 4 | 10.2-TT-ΔMBP,n | 43 |
|  | 9 | 18.7 | 4.5 | 4 | 10.2-TT-ΔMBP,n | 43 |
|  | 10 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
|  | 11 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
|  | 12 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
|  | 13 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
|  | 14 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
|  | 15 | 18.7 | 5 | 4 | 9.7-TT-ΔMBP,n | 43 |
|  | 16 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
|  | 17 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
|  | 18 | 18.7 | 6.5 | 5 | 7.2-TT-ΔMBP,n | 43 |
|  | 19 | 18.7 | 9 | 5 | 4.7-TT-ΔMBP,n | 43 |
|  | 20 | 18.7 | 9 | 5 | 4.7-TT-ΔMBP,n | 43 |
|  | 21 | 18.7 | 9 | 5 | 4.7-TT-ΔMBP,n | 43 |
| Note 1: ΔMBP,n is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant.  Note 3: Max allowed sum of ΔMBP,n over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: ΔMBP,n is 0 for single band UE. | | | | | | |

### 6.2.3 UE maximum output power with additional requirements

Editor’s note: The following aspects are either missing or not yet determined:

* Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, 4, 6 and 7.

6.2.3.1 Test purpose

Additional spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power.

6.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

6.2.3.3 Minimum conformance requirements

##### 6.2.3.3.1 General

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 frequency band number of the applicable operating band (the IE field *freqBandIndicatorNR*) and an associated value of additionalSpectrumEmission in the relevant RRC information elements.

To meet these additional requirements, additional maximum power reduction (A-MPR) is allowed for the maximum output power as specified in subclause 6.2.1.1.3. Unless stated otherwise, an A-MPR of 0 dB shall be used.

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 frequency band numbers and values of the *additionalSpectrumEmission* to network signalling labels is specified in Table 6.2.3.3.1-2. Unless otherwise stated, the allowed total back off is maximum of A-MPR and MPR specified in subclause 6.2.2.

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Network Signalling label | Requirements (subclause) | NR Band | Channel bandwidth (MHz) | Resources Blocks (*N*RB) | A-MPR (dB) |
| NS\_200 |  |  |  |  | N/A |
| NS\_201  (NOTE 1) | 6.5.3.3.3 | n258 |  |  | 6.2.3.3.2 |
| NS\_202 | 6.5.3.3.3 | n257, n258 | 50, 100, 200, 400 | Table 5.3.2-1 | 6.2.3.3.3 |
| NS\_203 | 6.5.3.3.3 | n258 | 50, 100, 200, 400 | Table 5.3.2-1 | 6.2.3.3.4 |
| NOTE 1: NS\_201 is obsolete, the associated additional spurious emission requirements are not applicable. | | | | | |

Table 6.2.3.3.1-2: Mapping of Network Signalling label

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Value of *additionalSpectrumEmission*  (NOTE 1) | | | | | | | |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| n257 | NS\_200 | NS\_202 |  |  |  |  |  |  |
| n258 | NS\_200 | NS\_2012 | NS\_202 | NS\_203 |  |  |  |  |
| n260 | NS\_200 |  |  |  |  |  |  |  |
| n261 | NS\_200 |  |  |  |  |  |  |  |
| NOTE 1: *additionalSpectrumEmission* corresponds to an information element of the same name defined in sub-clause 6.3.2 of TS 38.331 [19].  NOTE 2: NS\_201 is obsolete, the associated additional spurious emission requirements are not applicable. | | | | | | | | |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.3.1.

##### 6.2.3.3.2 Void

6.2.3.3.2.1 Void

6.2.3.3.2.2 Void

6.2.3.3.2.3 Void

##### 6.2.3.3.3 A-MPR for NS\_202

6.2.3.3.3.1 A-MPR for NS\_202 for power class 1

For power class 1, A-MPR for NS\_202 shall be 11.0 dB.

6.2.3.3.3.2 A-MPR for NS\_202 for power class 2

For power class 2, A-MPR for NS\_202 specified in clause 6.2.3.3.3.3 applies.

6.2.3.3.3.3 A-MPR for NS\_202 for power class 3

For power class 3, A-MPR for NS\_202 shall be 1.0 dB.

6.2.3.3.3.4 A-MPR for NS\_202 for power class 4

For power class 4, A-MPR for NS\_202 specified in clause 6.2.3.3.3.3 applies.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.3.3.

6.2.3.3.3.5 Void

6.2.3.3.3.6 A-MPR for NS\_202 for power class 6

For power class 6, A-MPR for NS\_202 specified in clause 6.2.3.3.3.3 applies.

6.2.3.3.3.7 A-MPR for NS\_202 for power class 7

For power class 7, A-MPR for NS\_202 specified in clause 6.2.3.3.3.3 applies.

##### 6.2.3.3.4 A-MPR for NS\_203

6.2.3.3.4.1 A-MPR for NS\_203 for power class 1

For power class 1, A-MPR for NS\_203 shall be 3.0 dB if Offset frequency < BWchannel, 0.0 dB otherwise.   
The Offset frequency is defined as the frequency from 24.25 GHz to the lower edge of the channel bandwidth.

6.2.3.3.4.2 A-MPR for NS\_203 for power class 2

For power class 2, A-MPR for NS\_203 specified in clause 6.2.3.3.4.3 applies.

6.2.3.3.4.3 A-MPR for NS\_203 for power class 3

For power class 3, A-MPR for NS\_203 shall be 0 dB.

6.2.3.3.4.4 A-MPR for NS\_203 for power class 4

For power class 4, A-MPR for NS\_203 specified in clause 6.2.3.3.4.3 applies.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.3.4.

6.2.3.3.4.5 Void

6.2.3.3.4.6 A-MPR for NS\_203 for power class 6

For power class 6, AMPR for NS\_203 specified in subclause 6.2.3.3.4.3 applies.

6.2.3.3.4.7 A-MPR for NS\_203 for power class 7

For power class 7, A-MPR for NS\_203 specified in subclause 6.2.3.3.4.3 applies.

6.2.3.4 Test description

6.2.3.4.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, 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 subcarrier spacing, are shown in Table 6.2.3.4.1-2 to Table 6.2.3.4.1-3. 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 6.2.3.4.1-1: Void

Table 6.2.3.4.1-2: Test configuration table for NS\_202

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | Highest | |
| Test SCS as specified in Table 5.3.5-1 | | 120kHz | |
| Test Parameters | | | |
| Test ID | Downlink Configuration | Uplink Configuration | |
|  | - | Modulation | RB allocation  (NOTE 1) |
| 1 (NOTE 4) | DFT-s-OFDM QPSK | Inner\_Full |
| 2 | DFT-s-OFDM QPSK | Inner\_1RB\_Left for PC2, PC3, PC4, PC6 and PC7  Inner\_Partial for PC1 (NOTE 2) |
| 3 (NOTE 3) | DFT-s-OFDM 64QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3，PC4, PC6 and PC7 or Table 6.1-2 for PC1.  NOTE 2: When testing Low range configure uplink RB to Inner\_1RB\_Left for PC2, PC3, PC4, PC6 and PC7 or Inner\_Partial\_Left\_Region1 for PC1 and when testing High range configure uplink RB to Inner\_1RB\_Right for PC2, PC3, PC4, PC6 and PC7 or Inner\_Partial\_Right\_Region1 for PC1.  NOTE 3: Test ID only applicable to PC1.  NOTE 4: Test ID only applicable to PC2, PC3, PC4, PC6 and PC7. | | | |

Table 6.2.3.4.1-3: Test configuration table for NS\_203

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Initial Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | Low range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120kHz | |
| Test Parameters | | | | | |
| Test ID | Frequency | Channel Bandwidth | Downlink Configuration | Uplink Configuration | |
|  |  |  | - | Modulation | RB allocation  (NOTE 1) |
| 1 | Default | Default | DFT-s-OFDM QPSK | Inner\_Full |
| 2 | Default | Default | DFT-s-OFDM QPSK | Inner\_1RB\_Left for PC2, PC3, PC4, PC6 and PC7  Inner\_Partial\_Left\_Region1 for PC1 |
| 3 (NOTE 2) | Low range + Channel Bandwidth (NOTE 3) | Default | DFT-s-OFDM QPSK | Inner\_Partial\_Left\_Region1 |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3, PC4. PC6 and PC7 or Table 6.1-2 for PC1.  NOTE 2: Test ID only applicable to PC1  NOTE 3: Test frequencies for test ID 3 is specified in Table 6.2.3.4.1-4. | | | | | |

Table 6.2.3.4.1-4: NS\_203 test ID3 test frequencies for NR operating band n258, SCS 120kHz and ΔFRaster 120 kHz

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CBW [MHz] | *carrierBandwidth*  [PRBs] | Range | | Carrier centre  [MHz] | Carrier centre  [ARFCN] | point A [MHz] | *absoluteFrequencyPointA* [ARFCN] | *offsetToCarrier* [Carrier PRBs] | SS block SCS  [kHz] | GSCN | *absoluteFrequencySSB*  [ARFCN] | *k*SSB | **Offset Carrier CORESET#0**  **[RBs]**  **Note 2** | **CORESET#0 Index (Offset**  **[RBs])**  **Note 1** | offsetToPointA (SIB1)  [PRBs]  Note 1 |
| 50 | 32 | Downlink & Uplink | Low + CHBW | 24325.08 | 2017917 | 24302.04 | 2017533 | 0 | 120 | 22260 | 2017819 | 11 | 1 | 0 (0) | 2 |
| 100 | 66 | Downlink & Uplink | Low + CHBW | 24400.08 | 2019167 | 24352.56 | 2018375 | 0 | 120 | 22263 | 2018683 | 10 | 2 | 0 (0) | 4 |
| 200 | 132 | Downlink & Uplink | Low + CHBW | 24550.08 | 2021667 | 24455.04 | 2020083 | 0 | 120 | 22269 | 2020411 | 8 | 3 | 0 (0) | 6 |
| 400 | 264 | Downlink & Uplink | Low + CHBW | 24850.08 | 2026667 | 24660.00 | 2023499 | 0 | 120 | 22281 | 2023867 | 4 | 1 | 1 (4) | 10 |
| Note 1: The CORESET#0 Index and the associated CORESET#0 Offset refers to Table 13-8 in TS 38.213 [22]. The value of CORESET#0 Index is signalled in controlResourceSetZero (pdcch-ConfigSIB1) in the MIB. The offsetToPointA IE is expressed in units of resource blocks assuming 15 kHz subcarrier spacing for FR1 and 60 kHz subcarrier spacing for FR2.  Note 2: The parameter Offset Carrier CORESET#0 specifies the offset from the lowest subcarrier of the carrier and the lowest subcarrier of CORESET#0. It corresponds to the parameter ΔFOffsetCORESET-0-Carrier in Annex C expressed in number of common RBs. | | | | | | | | | | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The DL and UL Reference Measurement channels are set according to Table 6.2.3.4.1-2 to Table 6.2.3.4.1-3.

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 [10] 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 Table 6.2.3.4.1-2 to Table 6.2.3.4.1-3. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.2.3.5-4 to Table 6.2.3.5-12. EIRP test procedure is defined in Annex K. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6, with the following exceptions for each network signalling value.

1. Information element *AdditionalSpectrumEmission* for NR can be set in SIB1 according to TS 38.331[19]. 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: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10] clause 4.6.3, Table 4.6.3-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| *AdditionalSpectrumEmission* | 1 (NS\_202) | for band n257 |  |
| *AdditionalSpectrumEmission* | 2 (NS\_202) | for band n258 |  |
| *AdditionalSpectrumEmission* | 3 (NS\_203) | for band n258 |  |

6.2.3.5 Test requirement

The UE EIRP derived in step 5 shall not exceed the values specified in Table 6.2.3.5-5 to Table 6.2.3.5-14a.

Table 6.2.3.5-1: Void

Table 6.2.3.5-2: Void

Table 6.2.3.5-3: Void

Table 6.2.3.5-4: Void

Table 6.2.3.5-5: UE Power Class 1 test requirements (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 2 | 40 | 0 | 11 | 7 | 22-TT | 55 |
|  | 3 |  | 6.5 | 11 | 7 | 22-TT | 55 |

Table 6.2.3.5-6: UE Power Class 2 test requirements (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 29 | 0 | 1 | 1.5 | 26.5-TT | 43 |
|  | 2 |  | 0 | 1 | 1.5 | 26.5-TT | 43 |

Table 6.2.3.5-7: UE Power Class 3 test requirements (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 22.4 | 0 | 1 | 1.5 | 19.9-TT-MBP,n | 43 |
|  | 2 |  | 0 | 1 | 1.5 | 19.9-TT-MBP,n | 43 |
| Note 1: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2.3.5-8: UE Power Class 4 test requirements (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 34 | 0 | 1 | 1.5 | 31.5-TT | 43 |
|  | 2 |  | 0 | 1 | 1.5 | 31.5-TT | 43 |

Table 6.2.3.5-9: UE Power Class 6 test requirements (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257 | 1 | 30 | 0 | 1 | 1.5 | 27.5-TT-MBP,n | 43 |
| n258 | 2 | 30.4 | 0 | 1 | 1.5 | 27.9-TT-MBP,n | 43 |
| Note 1: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in FSS. | | | | | | | |

Table 6.2.3.5-9a: UE Power Class 7 test requirements (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 16.4 | 0 | 1 | 1.5 | 13.9-TT-MBP,n | 43 |
|  | 2 |  | 0 | 1 | 1.5 | 13.9-TT-MBP,n | 43 |
| Note 1: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2.3.5-10: UE Power Class 1 test requirements (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 40 | 0 | 3 | 2 | 35-TT | 55 |
|  | 2 |  | 0 | 3 | 2 | 35-TT | 55 |
|  | 3 |  | 0 | 0 | 0 | 40-TT | 55 |

Table 6.2.3.5-11: UE Power Class 2 test requirements (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 29 | 0 | 0 | 0 | 29-TT | 43 |
|  | 2 |  | 0 | 0 | 0 | 29-TT | 43 |

Table 6.2.3.5-12: UE Power Class 3 test requirements (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 22.4 | 0 | 0 | 0 | 22.4-TT-ΔMBP,n | 43 |
|  | 2 |  | 0 | 0 | 0 | 22.4-TT-ΔMBP,n | 43 |
| Note 1: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2.3.5-13: UE Power Class 4 test requirements (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 34 | 0 | 0 | 0 | 34-TT | 43 |
|  | 2 |  | 0 | 0 | 0 | 34-TT | 43 |

Table 6.2.3.5-14: UE Power Class 6 test requirements (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 30.4 | 0 | 0 | 0 | 30.4-TT-ΔMBP,n | 43 |
|  | 2 | 30.4 | 0 | 0 | 0 | 30.4-TT-ΔMBP,n | 43 |
| Note 1: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table FFS. | | | | | | | |

Table 6.2.3.5-14a: UE Power Class 7 test requirements (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 16.4 | 0 | 0 | 0 | 16.4-TT-ΔMBP,n | 43 |
|  | 2 |  | 0 | 0 | 0 | 16.4-TT-ΔMBP,n | 43 |
| Note 1: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2.3.5-15: Test Tolerance (Power class 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 3.11 dB | 3.11 dB |

### 6.2.4 Configured transmitted power

6.2.4.1 Test purpose

To verify the UE configured transmitted power PUMAX,f,c is within the range defined prescribed by the specified nominal maximum output power and tolerance.

6.2.4.2 Test applicability

The requirements of this test are covered in test cases 6.2.1 Maximum output power, 6.2.2 Maximum output power reduction and 6.2.3 UE maximum output power with additional requirements to all types of NR UE release 15 and forward.

6.2.4.3 Minimum conformance requirements

The UE can configure its maximum output power. The configured UE maximum output power PCMAX,f,c for carrier f of a serving cell c is defined as that available to the reference point of a given transmitter branch that corresponds to the reference point of the higher-layer filtered RSRP measurement as specified in TS 38.215 [24].

The configured UE maximum output power PCMAX,f,c for carrier *f* of a serving cell *c* shall be set such that the corresponding measured peak EIRP PUMAX,f,c is within the following bounds

PPowerclass + DPIBE – MAX(MAX(MPRf,c, A- MPRf,c,) + ΔMBP,n, P-MPRf,c) – MAX{T(MAX(MPRf,c, A- MPRf,c,)), T(P-MPRf,c)} ≤ PUMAX,f,c ≤ EIRPmax

while the corresponding measured total radiated power PTMAX,f,c is bounded by

PTMAX,f,c ≤ TRPmax

with PPowerclass the UE minimum peak EIRP as specified in sub-clause 6.2.1.1.3, EIRPmax the applicable maximum EIRP as specified in sub-clause 6.2.1.1.3, MPRf,c as specified in sub-clause 6.2.2.3, A-MPRf,c as specified in sub-clause 6.2.3.3, ΔMBP,n the peak EIRP relaxation as specified in section 6.2.1.1.3 and TRPmax the maximum TRP for the UE power class as specified in sub-clause 6.2.1.1.3. DPIBE is 1.0 dB if UE declares support for *mpr-PowerBoost-FR2-r16*, UL transmission is QPSK, MPRf,c = 0 and when NS\_200 applies and the network configures the UE to operate with *mpr-PowerBoost-FR2-r16,* otherwise DPIBE is 0.0 dB. The requirement is verified in beam peak direction.

*maxUplinkDutyCycle-FR2* as defined in TS 38.306 [26] is a UEcapability to facilitate electromagnetic power density exposure requirements. This UE capability is applicable to all FR2 power classes.

If the field of UE capability *maxUplinkDutyCycle-FR2* is present and the percentage of uplink symbols transmitted within any 1 s evaluation period is larger than *maxUplinkDutyCycle-FR2*, the UE follows the uplink scheduling and can apply P-MPRf,c.

If the field of UE capability *maxUplinkDutyCycle-FR2* is absent, the compliance to electromagnetic power density exposure requirements are ensured by means of scaling down the power density or by other means.

P-MPRf,c is the power management maximum output power reduction. The UE shall apply P-MPRf,c for carrier f of serving cell c only for the cases described below. For UE conformance testing P-MPRf,c shall be 0 dB, except for the testing of UL gap for Tx power management, where P-MPRf,c may be non-zero dB.

a) ensuring compliance with applicable electromagnetic power density exposure requirements and addressing unwanted emissions / self desense requirements in case of simultaneous transmissions on multiple RAT(s) for scenarios not in scope of 3GPP RAN specifications;

b) ensuring compliance with applicable electromagnetic power density exposure requirements in case of proximity detection is used to address such requirements that require a lower maximum output power.

NOTE 1: P-MPRf,c was introduced in the PCMAX,f,c equation such that the UE can report to the gNB the available maximum output transmit power. This information can be used by the gNB for scheduling decisions.

NOTE 2: P-MPRf,c and *maxUplinkDutyCycle-FR2* may impact the maximum uplink performance for the selected UL transmission path.

NOTE 3: MPE P-MPR Reporting, as defined in TS 38.306 [26], is an optional UE capability to report P-MPRf,c when the reporting conditions configured by gNB are met. This UE capability is applicable to all FR2 power classes.

The tolerance T(∆P) for applicable values of ∆P (values in dB) is specified in Table 6.2.4.3-1.

Table 6.2.4.3-1: PUMAX,f,c tolerance

|  |  |  |
| --- | --- | --- |
| Operating Band | ∆P (dB) | Tolerance T(∆P)  (dB) |
| n257, n258, n259, n260, n261, n262 | P = 0 | 0 |
|  | 0 < P ≤ 2 | 1.5 |
|  | 2 < P ≤ 3 | 2.0 |
|  | 3 < P ≤ 4 | 3.0 |
|  | 4 < P ≤ 5 | 4.0 |
|  | 5 < P ≤ 10 | 5.0 |
|  | 10 < P ≤ 15 | 7.0 |
|  | 15 < P ≤ X | 8.0 |
| NOTE: X is the value such that Pumax,f,c lower bound, PPowerclass - P – T(P) = minimum output power specified in clause 6.3.1. | | |

6.2.4.4 Test description

This test is covered by clause 6.2.1 Maximum output power, 6.2.2 Maximum output power reduction and 6.2.3 UE maximum output power with additional requirements.

6.2.4.5 Test requirements

This test is covered by clause 6.2.1 Maximum output power, 6.2.2 Maximum output power reduction and 6.2.3 UE maximum output power with additional requirements.

### 6.2.4\_1 Configured transmitted power with Power Boost

Editor’s note: The following aspects are either missing or not yet determined:

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- The test case is incomplete for band n259.

6.2.4\_1.1 Test purpose

To verify the UE configured transmitted power PUMAX,f,c is within the range defined prescribed by the specified nominal maximum output power and tolerance.

6.2.4\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward supporting *mpr-PowerBoost-FR2-r16* UE capability.

6.2.4\_1.3 Minimum conformance requirements

Same as clause 6.2.4.3.

6.2.4\_1.4 Test description

6.2.4\_1.4.1 Initial conditions

Same as clause 6.2.1.1.4.1

6.2.4\_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 Table 6.2.1.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.2.4\_1.4.3.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Tables 6.2.4\_1.5-1 to 6.2.4\_1.5-4. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2.4\_1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config with the following exceptions:

Table 6.2.4\_1.4.3-1: ServinCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [5], Table 4.6.3-167 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| ServingCellConfig ::= SEQUENCE { |  |  |  |
| uplinkConfig SEQUENCE { |  |  |  |
| mpr-PowerBoost-FR2-r16 | True |  |  |
| } |  |  |  |
| } |  |  |  |

6.2.4\_1.5 Test requirement

The EIRP derived in step 5 shall not exceed the values specified in Table 6.2.4\_1.5-1 to Table 6.2.4\_1.5-4.

Table 6.2.4\_1.5-1: UE maximum output test requirements for power class 1

|  |  |  |
| --- | --- | --- |
| **Operating band** | **Max EIRP (dBm)** | **Min peak EIRP (dBm)** |
| n257 | 55 | 41.0-TT |
| n258 | 55 | 41.0-TT |
| n260 | 55 | 39.0-TT |
| n261 | 55 | 41.0-TT |

Table 6.2.4\_1.5-2: UE maximum output test requirements for power class 2

|  |  |  |
| --- | --- | --- |
| **Operating band** | **Max EIRP (dBm)** | **Min peak EIRP (dBm)** |
| n257 | 43 | 30-TT |
| n258 | 43 | 30-TT |
| n260 |  |  |
| n261 | 43 | 30-TT |

Table 6.2.4\_1.5-3: UE maximum output test requirements for power class 3 for single band UE

|  |  |  |
| --- | --- | --- |
| **Operating band** | **Max EIRP (dBm)** | **Min peak EIRP (dBm)** |
| n257 | 43 | 23.4-TT |
| n258 | 43 | 23.4-TT |
| n260 | 43 | 21.6-TT |
| n261 | 43 | 23.4-TT |

Table 6.2.4\_1.5-3a: Test Tolerance (Min peak EIRP for Power class 3)

|  |  |  |
| --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** |
| Max device size ≤ 30 cm | 2.99 dB (NTC)  3.15 (ETC) | 2.99 dB (NTC)  3.15 (ETC) |

Table 6.2.4\_1.5-3b: UE maximum output test requirements for power class 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ID** | **FR2 bands/set** | **Test requirement (dB)**  **(Note 1)** | | | | | **Comments** |
|  |  | n257 | n258 | n259 | n260 | n261 |  |
| 1 | n257 | 23.4-TT-MBP,n |  |  |  |  |  |
| 2 | n258 |  | 23.4-TT-MBP,n |  |  |  |  |
| 3 | n259 |  |  | 19.7-TT-MBP,n |  |  |  |
| 4 | n260 |  |  |  | 21.6-TT-MBP,n |  |  |
| 5 | n261 |  |  |  |  | 23.4-TT-MBP,n |  |
| 6 | n257, n261 | 23.4-TT-MBP,n |  |  |  | 23.4-TT-MBP,n | MBP,n relaxation is 0 dB |
| 7 | n260, n261 |  |  |  | 21.6-TT-MBP,n | 23.4-TT-MBP,n | MBP,n relaxation is 0 dB |
| Note 1: MBP,n is the Multi-band Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2.4\_1.5-4: UE maximum output power test requirements for power class 4

|  |  |  |
| --- | --- | --- |
| **Operating band** | **Max EIRP (dBm)** | **Min peak EIRP (dBm)** |
| n257 | 43 | 35-TT |
| n258 | 43 | 35-TT |
| n260 | 43 | 35-TT |
| n261 | 43 | 35-TT |

### 6.2.5 UE Maximum Output Power – EIRP with UL Gaps

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

- The test case is incomplete for band n259.

- Initial conditions are pending analysis for PC1, PC5, PC6 and PC7.

- MU and TT are pending for PC1, PC5, PC6 and PC7.

- MU and TT is not finalized for PC3 extreme testing conditions-

6.2.5.1 Test purpose

The objective of this test is to determine the impact of UL-gaps on TX power management by measuring the EIRP with and without UL-Gaps configured.

6.2.5.2 Test applicability

This test case applies to all types of NR UEs release 17 and forward supporting  *ul-GapFR2-r17 and tdd-MPE-P-MPR-Reporting-r16*

6.2.5.3 Minimum conformance requirements

The difference of the measured peak EIRP PUMAX,f,c\_GAP\_ON when UL gap for TX power management is configured and activated, and the measured peak EIRP PUMAX,f,c\_GAP\_OFF when UL gap is not configured or de-activated, shall meet the following requirement:

PUMAX,f,c\_GAP\_ON - PUMAX,f,c\_GAP\_OFF max((EIRPmeas\_peak – 23) + 10 \* log10(Z/20), 3)dB

where EIRPmeas\_peak  is the measured UE peak EIRP with zero MPR/A-MPR/P-MPR as specified in clause 6.2.1 for the corresponding power class, and Z% is duty cycle of the reference measurement channel. PUMAX,f,c\_GAP\_ONshall be measured outside of the UL gap symbol(s)*.* The period of measurement shall be at least 4s. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle) and in the test Z is set to 20 when maxUplinkDutyCycle-FR2 is less than 20 or not reported, and should be larger than maxUplinkDutyCycle-FR2 when maxUplinkDutyCycle-FR2 is equal to or greater than 20. The reference measurement channel is specified in Annex A.2.3.

When UL gap for Tx power management is configured and activated, the reported P-MPRf,c shall be less than 3dB. When UL gap for Tx power management is not configured and activated, UE shall set the P bit in PHR to 1 in the test when PHR is configured.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.5.

NOTE 1: As mentioned in 6.2.4.3 - for UE conformance testing P-MPRf,c shall be 0 dB, except for the testing of UL gap for Tx power management, where P-MPRf,c may be non-zero dB – which is relevant to this test case

The UL gap patterns for TX power management are listed in Table 6.2.5.3-1 if UE supports the UL gap for Tx power management, and the UE shall support at least one of UL MGP#1 and UL MGP#3. All other UL MGPs are optional.

Table 6.2.5.3-1: UL Gap Pattern Configurations

|  |  |  |
| --- | --- | --- |
|  | UL Gap Length (UGL) [ms] | UL gap repetition periodicity (UGRP) [ms] |
| UL MGP #0 | 1.0 | 20 |
| UL MGP #1 | 1.0 | 40 |
| UL MGP #2 | 0.5 | 160 |
| UL MGP #3 | 0.125 when SCS of active UL BWP =120kHz  0.25 when SCS of active UL BWP =60kHz | 5 |

An uplink gap consists of consecutive static UL slot(s) in one or more *TDD-UL-DL-Pattern* duration, starting from the first static UL slot of an UL gap repetition period. UGL is the aggregated length of consecutive UL slots used as the UL gap within an UL gap repetition period. That means, there can be a DL slot and/or special slot but no static UL slot between the two consecutive static UL slots within the UL gap length.

When an UL gap overlaps with an uplink transmission in NR serving cells in FR2 single CC or FR2 intra-band CA or FR2 inter-band CA where UE does not support tx-Support-UL-GapFR2-r17, then the UE is not required to conduct any transmission during the UL gap on the NR serving cells other than those listed in Clause 5.30 in TS 38.321 [7].

The normative reference for the above configurations is TS 38.133 [25] clause 9.1.11.

6.2.5.4 Test description

6.2.5.4.1 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, 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 6.2.5.4.1-1: Test Configuration Table for power class 2,3 and 4

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid Range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest, 100 MHz, Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120 kHz | |
| Test Parameters | | | | | | |
| Test ID | ChBw  (NOTE 2) | SCS | Downlink Configuration | Uplink Configuration | | |
| 1 | 100 | Default | - | Modulation | | RB allocation (NOTE 1) |
| DFT-s-OFDM QPSK | | Inner\_Full for PC2, PC3 |
|  | | and PC4 |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3, PC4 and PC7 or Table 6.1-2 for PC1.  NOTE 2: The 200MHz and 400MHz bandwidths are not applicable to PC7 RedCap UEs | | | | | | |

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [10] Annex A, Figure A.3.1.2.1 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 [10] subclause 4.4.3.

3. Downlink signals are initially set up according to TS 38.521-1 [2] Annex C.0, C.1, C.2, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, G.3.0.

4. The UL Reference Measurement Channel is set according to Annex A.2.3-1 with the uplink duty cycle Z set to 20%.

5. Propagation conditions are set according to TS 38.521-1 [2] 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 [10] clause 4.5. Message contents are defined in clause 6.2.2.4.3.

6.2.5.4.2 Test procedure

1. to schedule the UL RMC according to Table 6.2.1.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.2.1.1.4.3.

1a. If the UE does not support beamCorrespondenceWithoutULBeamSweeping, the side conditions for SSB-based and CSI-RS based L1-RSRP measurements are applied as per Table 6.6.1.3.3.1.1-1 and Table 6.6.1.3.3.1.1-2 respectively.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

ACTIVATE Uplink Gaps

5. SS configures and activates UL-gaps via message contents defined in section 6.2.5.4.3-1. P-MPR reporting is also enabled via the message contents defined in 6.2.5.4.3-2.

6. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration. EIRP test procedure is defined in Annex K.1.3. The period of measurement shall be at least 4 seconds. EIRP is calculated considering both polarizations, theta and phi. Record this as peak EIRP PUMAX,f,c\_GAP\_ON

7. SS detects and record the value within the P-MPR reports. Call this value P-MPRULgapON

DE-ACTIVATE Uplink Gaps

8. SS de-activates UL-gaps via message contents defined in section 6.2.5.4.3-1.

9. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration. EIRP test procedure is defined in Annex K.1.3. The period of measurement shall be at least 4 seconds. EIRP is calculated considering both polarizations, theta and phi. Record this value as peak EIRP PUMAX,f,c\_GAP\_OFF

10. SS detects and record the value of the P bit within the PHR.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

12. Compute the difference between PUMAX,f,c\_GAP\_ON and PUMAX,f,c\_GAP\_OFF

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2.5.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config and with the following exception

Table 6.2.5.4.3-1: *UE* *UL-GapFR2-Config (FR2 UL-Gap Activation)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-200B | | | |
| Information Element | Value/remark | Comment | Condition |
| UL-GapFR2-Config-r17 ::= CHOICE { |  |  |  |
| Setup SEQUENCE { |  |  |  |
| gapOffset-r17 | 0 |  |  |
| ugl-r17 | ms1 |  |  |
| ugrp-r17 | ms40 |  |  |
| } |  |  |  |

Table 6.2.5.4.3-2: PHR Config (P-MPR Report Activation)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508 [10], clause 4.6.3-104 | | | |
| Information Element | Value/remark | Comment | Condition |
| PHR-Config ::= CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| mpe-Reporting-FR2-r16:: CHOICE { |  |  |  |
| Setup SEQUENCE { |  |  |  |
| Mpe-ProhibitTimer-r16 | [sf10] |  |  |
| Mpe-Threshold-r16 | dB3 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.5.4.3-3: *UE* *UL-GapFR2-Config (FR2 UL-Gap De-activation)*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508 [10], clause 4.6.3-200BB | | | |
| Information Element | Value/remark | Comment | Condition |
| UL-GapFR2-Config-r17 ::= CHOICE { |  |  |  |
| release |  |  |  |
| } |  |  |  |

6.2.5.5 Test requirement

The difference between PUMAX,f,c\_GAP\_ON and PUMAX,f,c\_GAP\_OFF computed in Step 12 and the UE reported P-MPRULgapON and P-bit within PHR value in Steps 7 and 10 respectively shall meet the requirements defined in Table 6.2.5.5-1

Table 6.2.5.5-1: Test Requirements for EIRP with UL Gaps (for Power class 3)

|  |  |
| --- | --- |
| **Test Metric** | **Requirement** |
| PUMAX,f,c\_GAP\_ON - PUMAX,f,c\_GAP\_OFF | max((EIRPmeas\_peak – 23– TT2) + 10 \* log10(Z/20), 3)dB – TT1 |
| P-MPRULgapON | < 3dB |
| P bit reported within PHR report (when UL-Gaps OFF) | 1 |
| NOTE 1: Z is the uplink duty cycle set within the test procedure | |

Table 6.2.5.5-2: TT for EIRP with UL Gaps (for Power class 3)

|  |  |  |  |
| --- | --- | --- | --- |
| TT term | Test Metric | FR2a | FR2b |
| TT1 | PUMAX,f,c\_GAP\_ON - PUMAX,f,c\_GAP\_OFF | 0.46 dB (NTC)  [0.46 dB] (ETC) | 0.46 dB (NTC)  [0.46 dB] (ETC) |
| TT2 | EIRPmeas\_peak | 2.99 dB (NTC)  3.15 dB (ETC) | 2.99 dB (NTC)  3.15 dB (ETC) |

## 6.2A Transmit power for CA

### 6.2A.1 UE maximum output power for CA

#### 6.2A.1.0 Minimum conformance requirements

For downlink intra-band contiguous and non-contiguous carrier aggregation with a single uplink component carrier configured in the NR band, the maximum output power is specified in subclause 6.2.1.1.3.

For uplink intra-band contiguous carrier aggregation for any CA bandwidth class, the maximum output power is specified in subclause 6.2.1.1.3.

Power class 3 is default power class.

#### 6.2A.1.1 UE maximum output power - EIRP and TRP for CA

##### 6.2A.1.1.1 UE maximum output power - EIRP and TRP for CA (2UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, 4, 5 and 7.

6.2A.1.1.1.1 Test purpose

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

6.2A.1.1.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

For bandwidth class B, this test case is not testable due to lack of appropriate test points since there is no configuration satisfying MPR=0dB requirements in TS 38.101-2.

6.2A.1.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause6.2A.1.0.

6.2A.1.1.1.4 Test description

6.2A.1.1.1.4.1 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, and channel bandwidths based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.2A.1.1.1.4.1-1. 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 6.2A.1.1.1.4.1-1: Intra-band Contiguous CA Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal, TL, TH (NOTE 2) | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated BW of the CA configuration  (≤ 400 MHz aggregated channel bandwidth) | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping  ( NOTE 4） | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 100 | - | | DFT-s-OFDM QPSK | Inner Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | 100 |  | | - | - |
| 2 | PCC/CC1 | 200 |  | | DFT-s-OFDM QPSK | Inner Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | 200 |  | | - | - |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Test environment for UE Max TRP is normal only.  NOTE 3: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 4: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: *“The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier”*. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2A.1.1.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.2A.1.1.1.4.3

6.2A.1.1.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [10] subclause 5.5.1. Message contents are defined in clause 6.2A.1.1.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 6.2A.1.1.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.2A.1.1.1.4.3.

5. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

6. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

8. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.2A.1.1.1.5-1. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

9. Measure TRP of the transmitted signal for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.2A.1.1.1.5-1. Total radiated power is measured according to TRP measurement procedure defined in Annex K.1.7 and measurement grid specified in Annex M.4. TRP is calculated considering both polarizations, theta and phi.

10. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2A.1.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.2A.1.1.1.5 Test Requirements

The EIRP derived in step 8 and TRP derived in step 9 shall not exceed the values specified in Table 6.2A.1.1.1.5-1 to Table 6.2A.1.1.1.5-4.

Table 6.2A.1.1.1.5-1: Intra-band Contiguous CA UE maximum output test requirements for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| UL CA configuration | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| CA\_n257D | 35+TT | 55 | 40-TT |
| CA\_n257G | 35+TT | 55 | 40-TT |
| CA\_n260D | 35+TT | 55 | 38-TT |
| CA\_n260G | 35+TT | 55 | 38-TT |
| CA\_n260O | 35+TT | 55 | 38-TT |
| CA\_n261D | 35+TT | 55 | 40-TT |
| CA\_n261G | 35+TT | 55 | 40-TT |
| CA\_n261O | 35+TT | 55 | 40-TT |

Table 6.2A.1.1.1.5-2: Intra-band Contiguous CA UE maximum output test requirements for power class 2

|  |  |  |  |
| --- | --- | --- | --- |
| UL CA configuration | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| CA\_n257D | 23+TT | 43 | 29-TT |
| CA\_n257G | 23+TT | 43 | 29-TT |
| CA\_n261D | 23+TT | 43 | 29-TT |
| CA\_n261G | 23+TT | 43 | 29-TT |
| CA\_n261O | 23+TT | 43 | 29-TT |

Table 6.2A.1.1.1.5-3: Intra-band Contiguous CA UE maximum output test requirements for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| UL CA configuration | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| CA\_n257D | 23+TT | 43 | 22.4-TT |
| CA\_n257G | 23+TT | 43 | 22.4-TT |
| CA\_n258D | 23+TT | 43 | 22.4-TT |
| CA\_n258G | 23+TT | 43 | 22.4-TT |
| CA\_n260D | 23+TT | 43 | 20.6-TT |
| CA\_n260G | 23+TT | 43 | 20.6-TT |
| CA\_n260O | 23+TT | 43 | 20.6-TT |
| CA\_n261D | 23+TT | 43 | 22.4-TT |
| CA\_n261G | 23+TT | 43 | 22.4-TT |
| CA\_n261O | 23+TT | 43 | 22.4-TT |

Table 6.2A.1.1.1.5-3a: UE maximum output test requirements for power class 3 for multi band UE declaring MBp>0 in any FR2 band

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Supported FR2 bands set | Test requirement (dB)  (Note 1) | | | | Maximum sum of MBp, ∑MBP (dB)  (Note 3) | Comments |
|  |  | CA\_n257D/G | CA\_n258 | CA\_n260D/G/O | CA\_n261D/G/O |  |  |
| 1 | n257, n258 | 22.4-TT-MBp |  |  |  | 1.3 |  |
| 2 | n257, n260 | 22.4-TT-MBp |  | 20.6-TT-MBp |  | 1.0 |  |
| 3 | n258, n260 |  |  | 20.6-TT-MBp |  | 1.0 |  |
| 4 | n258, n261 |  |  |  | 22.4-TT-MBp | 1.0 |  |
| 5 | n260, n261 |  |  |  |  | 0.0 | No relaxation factor allowed |
| 6 | n257, n258, n260 | 22.4-TT-MBp |  | 20.6-TT-MBp |  | 1.7 |  |
| 7 | n257, n258, n261 | 22.4-TT-MBp |  |  | 22.4-TT-MBp | 1.7 |  |
| 8 | n257, n260, n261 | 22.4-TT-MBp |  | 20.6-TT-MBp | 22.4-TT-MBp | 0.5 |  |
| 9 | n258, n260, n261 |  |  | 20.6-TT-MBp | 22.4-TT-MBp | 1.5 |  |
| 10 | n257, n258, n260, n261 | 22.4-TT-MBp |  | 20.6-TT-MBp | 22.4-TT-MBp | 1.7 |  |
| Note 1: MBp is the Multiband Relaxation factor declared by the UE for the tested band in Table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant  Note 3: Max allowed sum of MBp over all supported FR2 bands as defined in clause 6.2.1.1.3.3 | | | | | | | |

Table 6.2A.1.1.1.5-3b: Test Tolerance (Max TRP for Power class 3) (Aggregated BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 2.65 dB | 2.77 dB |

Table 6.2A.1.1.1.5-3c: Test Tolerance (Min peak EIRP for Power class 3) (Aggregated BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30cm | 2.87 dB | 2.87 dB |

Table 6.2A.1.1.1.5-4: Intra-band Contiguous CA UE maximum output test requirements for power class 4

|  |  |  |  |
| --- | --- | --- | --- |
| UL CA configuration | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| CA\_n257D | 23+TT | 43 | 34-TT |
| CA\_n257G | 23+TT | 43 | 34-TT |
| CA\_n260B | 23+TT | 43 | 31-TT |
| CA\_n260D | 23+TT | 43 | 31-TT |
| CA\_n260G | 23+TT | 43 | 31-TT |
| CA\_n260O | 23+TT | 43 | 31-TT |
| CA\_n261B | 23+TT | 43 | 34-TT |
| CA\_n261D | 23+TT | 43 | 34-TT |
| CA\_n261G | 23+TT | 43 | 34-TT |
| CA\_n261O | 23+TT | 43 | 34-TT |

##### 6.2A.1.1.2 UE maximum output power - EIRP and TRP for CA (3UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, 4, 5 and 7.

6.2A.1.1.2.1 Test purpose

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

6.2A.1.1.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

For bandwidth class C and E, this test case is not testable due to lack of appropriate test points since there is no configuration satisfying MPR=0dB requirements in TS 38.101-2.

6.2A.1.1.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2A.1.0.

6.2A.1.1.2.4 Test description

Same as in clause 6.2A.1.1.1.4 with following exceptions:

- Instead of Table 6.2A.1.1.1.4.1-1🡪 use Table 6.2A.1.1.2.4-1.

- Instead of Table 6.2A.1.1.1.5-1🡪 use Table 6.2A.1.1.2.5-1.

Table 6.2A.1.1.2.4-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal, TL, TH (NOTE 2) | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated BW (≤ 400 MHz aggregated channel bandwidth) | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 4) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 100 | - | | DFT-s-OFDM QPSK | Inner Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | 100 |  | | - | - |
| SCC/CC3 | 100 |  | | - | - |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Test environment for UE Max TRP is normal only.  NOTE 3: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 4: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 5: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 6: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: *“The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier”*. | | | | | | |

6.2A.1.1.2.5 Test Requirements

The EIRP derived in step 8 and TRP derived in step 9 shall not exceed the values specified in Table 6.2A.1.1.2.5-1.

Table 6.2A.1.1.2.5-1: UE maximum output test requirements for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| CA configuration | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| CA\_n257H | 23+TT | 43 | 22.4-TT |
| CA\_n258H | 23+TT | 43 | 22.4-TT |
| CA\_n260H | 23+TT | 43 | 20.6-TT |

Table 6.2A.1.1.2.5-1a: Test Tolerance (Max TRP for Power class 3) (Aggregated BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 2.65 dB | 2.77 dB |

Table 6.2A.1.1.2.5-1b: Test Tolerance (Min peak EIRP for Power class 3) (Aggregated BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 2.87 dB | 2.87 dB |

##### 6.2A.1.1.3 UE maximum output power - EIRP and TRP for CA (4UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, 4, 5 and 7.

6.2A.1.1.3.1 Test purpose

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

6.2A.1.1.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

For bandwidth class F, this test case is not testable due to lack of appropriate test points since there is no configuration satisfying MPR=0dB requirements in TS 38.101-2.

6.2A.1.1.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2A.1.0.

6.2A.1.1.3.4 Test description

Same as in clause 6.2A.1.1.1.4 with following exceptions:

- Instead of Table 6.2A.1.1.1.4.1-1🡪 use Table 6.2A.1.1.3.4-1.

- Instead of Table 6.2A.1.1.1.5-1🡪 use Table 6.2A.1.1.3.5-1.

Table 6.2A.1.1.3.4-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal, TL, TH (NOTE 2) | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes, and PCC and SCC are mapped onto physical frequencies according to Table 6.1-2 | | | | Low and High range | | |
| Test CC Combination setting (cumulative aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated BW (≤ 400 MHz aggregated channel bandwidth) | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 4) | ChBw | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 100 | - | | DFT-s-OFDM QPSK | Inner Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | 100 |  | | - | - |
| SCC/CC3 | 100 |  | | - | - |
| SCC/CC4 | 100 |  | | - | - |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Test environment for UE Max TRP is normal only.  NOTE 3: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 4: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 5: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 6: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: *“The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier”*. | | | | | | |

6.2A.1.1.3.5 Test Requirements

The EIRP derived in step 8 and TRP derived in step 9 shall not exceed the values specified in Table 6.2A.1.1.3.5-1.

Table 6.2A.1.1.3.5-1: UE maximum output test requirements for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| CA configuration | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| CA\_n257I | 23+TT | 43 | 22.4-TT |
| CA\_n258I | 23+TT | 43 | 22.4-TT |
| CA\_n260I | 23+TT | 43 | 20.6-TT |

Table 6.2A.1.1.3.5-1a: Test Tolerance (Max TRP for Power class 3) (Aggregated BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 2.65 dB | 2.77 dB |

Table 6.2A.1.1.3.5-1b: Test Tolerance (Min peak EIRP for Power class 3) (Aggregated BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 2.87 dB | 2.87 dB |

##### 6.2A.1.1.4 UE maximum output power - EIRP and TRP for CA (5UL CA)

6.2A.1.1.4.1 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.

6.2A.1.1.4.2 Test applicability

The requirements in this test are not testable due to lack of appropriate test points since there’s no configuration satisfying MPR=0dB requirements in RAN4.

No test case details are specified.

##### 6.2A.1.1.5 UE maximum output power - EIRP and TRP for CA (6UL CA)

6.2A.1.1.5.1 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.

6.2A.1.1.5.2 Test applicability

The requirements in this test are not testable due to lack of appropriate test points since there’s no configuration satisfying MPR=0dB requirements in TS 38.101-2.

No test case details are specified.

##### 6.2A.1.1.6 UE maximum output power - EIRP and TRP for CA (7UL CA)

6.2A.1.1.6.1 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.

6.2A.1.1.6.2 Test applicability

The requirements in this test are not testable due to lack of appropriate test points since there’s no configuration satisfying MPR=0dB requirements in TS 38.101-2.

No test case details are specified.

##### 6.2A.1.1.7 UE maximum output power - EIRP and TRP for CA (8UL CA)

6.2A.1.1.7.1 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.

6.2A.1.1.7.2 Test applicability

The requirements in this test are not testable due to lack of appropriate test points since there’s no configuration satisfying MPR=0dB requirements in TS 38.101-2.

No test case details are specified.

#### 6.2A.1.2 UE maximum output power - Spherical coverage

##### 6.2A.1.2.1 UE maximum output power - Spherical coverage for CA (2UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Measurement Uncertainties and Test Tolerances are FFS for power class 2, 4 and 7.

6.2A.1.2.1.1 Test purpose

To verify that the spatial coverage of the UE for CA in expected directions is acceptable.

6.2A.1.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

For bandwidth class B, this test case is not testable due to lack of appropriate test points since there is no configuration satisfying MPR=0dB requirements in TS 38.101-2.

6.2A.1.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2A.1.0.

6.2A.1.2.1.4 Test description

6.2A.1.2.1.4.1 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, and channel bandwidths based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.2A.1.2.1.4.1-1. 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 6.2A.1.2.1.4.1-1: Intra-band Contiguous CA Test Configuration Table (single CC requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated BW (≤ 400 MHz aggregated channel bandwidth) | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 4) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 100 | - | | DFT-s-OFDM QPSK | Inner Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | 100 |  | | - | - |
| 2 | PCC/CC1 | 200 |  | | DFT-s-OFDM QPSK | Inner Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | 200 |  | | - | - |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: *“The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier”*. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

3. Downlink signals for PCC are initially set up according to Annex C, and uplink signals according to Annex G.

4. The UL Reference Measurement channels are set according to Table 6.2A.1.2.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.2A.1.2.1.4.3

6.2A.1.2.1.4.2 Test procedure

1. Configure PCC and SCC according to Annex C.0, C.1, C.2 and Annex C.3.0 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1 Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in clause 6.2A.1.2.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321, clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 6.2A.1.2.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.2A.1.2.1.4.3.

5. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

6. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Through its beam correspondence procedure, DUT refines its TX beam toward that direction depending on DUT’s beam correspondence capability which shall match OEM declaration:

7a If the DUT’s beam correspondence capability beamCorrespondenceWithoutUL-BeamSweeping is supported, then DUT autonomously chooses the corresponding TX beam for PUSCH transmission using downlink reference signals to transmit in the direction of the incoming DL signal, which is based on beam correspondence without relying on UL beam sweeping;

7b If the DUT’s beam correspondence capability beamCorrespondenceWithoutUL-BeamSweeping is not present, then DUT chooses the TX beam for PUSCH transmission which is based on beam correspondence with relying on both DL measurements on downlink reference signals and network-assisted uplink beam sweeping:

7b.1) DUT uses downlink reference signals to select proper RX beam and uses autonomous beam correspondence to select the TX beam.

7b.2) SS configures M=8 SRS resources to DUT, with the field *spatialRelationInfo* omitted and the field usage set as ‘beamManagement’. In case DUT supports less than 8 SRS resources, SS configures the number of SRS resources according to the maximum number of SRS resources indicated by UE capability signalling. Additionally, for codebook based PUSCH transmission, SS configures a semi-persistent SRS resource set with the field *usage* as 'codebook'.

7b.3) Based on the TX beam autonomously selected by DUT, DUT chooses TX beams to transmit SRS-resources configured by SS.

7b.4) Based on measurement of the received *beamManagement* SRS, SS chooses the best SRS beam and, if needed, updates the spatial relation information between the semi-persistent *codebook* SRS resources and the SS selected *beamManagement* SRS resource in the activation MAC CE of the semi-persistent SRS resource. The SS indicates in the SRS Resource Indicator (SRI) field in the scheduling grant for PUSCH, if present, the SRS resource within the semi-persistent SRS resource set whose spatial relation is linked to the best detected SRS beam.

7b.5) DUT transmits PUSCH corresponding to the SRS resource indicated by the SRI.

8. Measure UE EIRP value for each grid point according to the EIRP spherical coverage procedure defined in Annex K.1.5.0, and obtain a cumulative distribution function (CDF) of all EIRP dBm values. Alternatively, UE EIRP measurement for each grid point could be done according to Tx Fast spherical coverage procedure defined in Annex K.1.5.1. After a rotation, allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for UE to find the best beam to use. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

9. Identify the EIRP dBm value corresponding to %-tile (UE power class dependent) value in the applicable test requirement table in section 6.2A.1.2.1.5..

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2A.1.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.2A.1.2.1.5 Test requirement

The defined %-tile EIRP in measurement distribution derived in step 8 shall exceed the values specified in Table 6.2A.1.2.1.5-1 to Table 6.2A.1.2.1.5-4.

Table 6.2A.1.2.1.5-1: Intra-band Contiguous CA UE spherical coverage for power class 1

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85%-tile CDF (dBm) |
| CA\_n257D | 32.0-TT |
| CA\_n257G | 32.0-TT |
| CA\_n260D | 30.0-TT |
| CA\_n260G | 30.0-TT |
| CA\_n260O | 30.0-TT |
| CA\_n261D | 32.0-TT |
| CA\_n261G | 32.0-TT |
| CA\_n261O | 32.0-TT |

Table 6.2A.1.2.1.5-2: Intra-band Contiguous CA UE spherical coverage for power class 2

|  |  |
| --- | --- |
| Operating band | Min EIRP at 60%-tile CDF (dBm) |
| CA\_n257D | 18.0-TT |
| CA\_n257G | 18.0-TT |
| CA\_n261D | 18.0-TT |
| CA\_n261G | 18.0-TT |
| CA\_n261O | 18.0-TT |

Table 6.2A.1.2.1.5-3: Intra-band Contiguous CA UE spherical coverage for power class 3 for single band UE or multiband UE declaring MBs = 0 in all FR2 bands

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50t%-tile CDF (dBm) |
| CA\_n257D | 11.5-TT |
| CA\_n257G | 11.5-TT |
| CA\_n258D | 11.5-TT |
| CA\_n258G | 11.5-TT |
| CA\_n260D | 8-TT |
| CA\_n260G | 8-TT |
| CA\_n260O | 8-TT |
| CA\_n261D | 11.5-TT |
| CA\_n261G | 11.5-TT |
| CA\_n261O | 11.5-TT |

Table 6.2A.1.2.1.5-3a: UE spherical coverage for power class 3 for multi band UE declaring MBs>0 in any FR2 band

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Supported FR2 bands set | Test requirement (dB)  (Note 1) | | | | Maximum sum of MBs, ∑MBs (dB)  (Note 3) | Comments |
|  |  | CA\_n257D/G | CA\_n258 | CA\_n260D/G/O | CA\_n261D/G/O |  |  |
| 1 | n257, n258 | 11.5-TT-MBs |  |  |  | 1.25 |  |
| 2 | n257, n260 | 11.5-TT-MBs |  | 8-TT-MBs |  | 0.75 | Maximum 0.4 dB relaxation allowed for n260 |
| 3 | n258, n260 |  |  | 8-TT-MBs |  | 0.75 | Maximum 0.4 dB relaxation allowed for n260 |
| 4 | n258, n261 |  |  |  | 11.5-TT-MBs | 1.25 |  |
| 5 | n260, n261 |  |  | 8-TT-MBs | 11.5-TT-MBs | 0.75 | No relaxation allowed for n260 |
| 6 | n257, n258, n260 | 11.5-TT-MBs |  | 8-TT-MBs |  | 1.75 | Maximum 0.4 dB relaxation allowed for n260 |
| 7 | n257, n258, n261 | 11.5-TT-MBs |  |  | 11.5-TT-MBs | 1.75 |  |
| 8 | n257, n260, n261 | 11.5-TT-MBs |  | 8-TT-MBs | 11.5-TT-MBs | 1.25 | Maximum 0.4 dB relaxation allowed for n260 |
| 9 | n258, n260, n261 |  |  | 8-TT-MBs | 11.5-TT-MBs | 1.25 | Maximum 0.4 dB relaxation allowed for n260 |
| 10 | n257, n258, n260, n261 | 11.5-TT-MBs |  | 8-TT-MBs | 11.5-TT-MBs | 1.75 | Maximum 0.4 dB relaxation allowed for n260 |
| Note 1: MBs is the Multiband Relaxation factor declared by the UE for the tested band in Table A.4.3.9-3 of TS38.508-2 [11]. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant  Note 3: Max allowed sum of MBs over all supported FR2 bands as defined in clause 6.2.1.1.3.3 | | | | | | | |

Table 6.2A.1.2.1.5-4: Intra-band Contiguous CA UE spherical coverage for power class 4

|  |  |
| --- | --- |
| Operating band | Min EIRP at 20%-tile CDF (dBm) |
| CA\_n257D | 25-TT |
| CA\_n257G | 25-TT |
| CA\_n260D | 19-TT |
| CA\_n260G | 19-TT |
| CA\_n260O | 19-TT |
| CA\_n261D | 25-TT |
| CA\_n261G | 25-TT |
| CA\_n261O | 25-TT |

Table 6.2A.1.2.1.5-5: Test Tolerance (Spherical coverage) (Aggregated BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | 2.58 dB | 2.58 dB |

##### 6.2A.1.2.2 UE maximum output power - Spherical coverage for CA (3UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Measurement Uncertainties and Test Tolerances are FFS for power class 2, 4 and 7.

6.2A.1.2.2.1 Test purpose

To verify that the spatial coverage of the UE for CA in expected directions is acceptable.

6.2A.1.2.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

For bandwidth class C and E, this test case is not testable due to lack of appropriate test points since there is no configuration satisfying MPR=0dB requirements in TS 38.101-2.

6.2A.1.2.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2A.1.0.

6.2A.1.2.2.4 Test description

Same as in clause 6.2A.1.2.1.4 with following exceptions:

- Instead of Table 6.2A.1.2.1.4.1-1🡪 use Table 6.2A.1.2.2.4-1.

- Instead of Table 6.2A.1.2.1.5-1 to 5🡪 use Table 6.2A.1.2.2.5-1 to 5.

Table 6.2A.1.2.2.4-1: Intra-band Contiguous CA Test Configuration Table (single CC requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated BW (≤ 400 MHz aggregated channel bandwidth) | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 4) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 100 | - | | DFT-s-OFDM QPSK | Inner Full |
| SCC/CC2 | 100 |  | | - | - |
| SCC/CC3 | 100 |  | | - | - |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: *“The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier”*. | | | | | | |

6.2A.1.2.2.5 Test requirement

The defined %-tile EIRP in measurement distribution derived in step 8 shall exceed the values specified in Table 6.2A.1.2.2.5-1 to Table 6.2A.1.2.2.5-4.

Table 6.2A.1.2.2.5-1: Intra-band Contiguous CA UE spherical coverage for power class 1

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85%-tile CDF (dBm) |
| CA\_n257H | 32.0-TT |
| CA\_n260H | 30.0-TT |
| CA\_n260P | 30.0-TT |
| CA\_n261H | 32.0-TT |
| CA\_n261P | 32.0-TT |

Table 6.2A.1.2.2.5-2: Intra-band Contiguous CA UE spherical coverage for power class 2

|  |  |
| --- | --- |
| Operating band | Min EIRP at 60%-tile CDF (dBm) |
| CA\_n257H | 18.0-TT |
| CA\_n261H | 18.0-TT |
| CA\_n261P | 18.0-TT |

Table 6.2A.1.2.2.5-3: Intra-band Contiguous CA UE spherical coverage for power class 3 for single band UE or multiband UE declaring MBs = 0 in all FR2 bands

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50t%-tile CDF (dBm) |
| CA\_n257H | 11.5-TT |
| CA\_n258H | 11.5-TT |
| CA\_n260H | 8-TT |
| CA\_n260P | 8-TT |
| CA\_n261H | 11.5-TT |
| CA\_n261P | 11.5-TT |

Table 6.2A.1.2.2.5-3a: UE spherical coverage for power class 3 for multi band UE declaring MBs>0 in any FR2 band

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Supported FR2 bands set | Test requirement (dB)  (Note 1) | | | | Maximum sum of MBs, ∑MBs (dB)  (Note 3) | Comments |
|  |  | CA\_n257H | CA\_n258 | CA\_n260H/P | CA\_n261H/P |  |  |
| 1 | n257, n258 | 11.5-TT-MBs |  |  |  | 1.25 |  |
| 2 | n257, n260 | 11.5-TT-MBs |  | 8-TT-MBs |  | 0.75 | Maximum 0.4 dB relaxation allowed for n260 |
| 3 | n258, n260 |  |  | 8-TT-MBs |  | 0.75 | Maximum 0.4 dB relaxation allowed for n260 |
| 4 | n258, n261 |  |  |  | 11.5-TT-MBs | 1.25 |  |
| 5 | n260, n261 |  |  | 8-TT-MBs | 11.5-TT-MBs | 0.75 | No relaxation allowed for n260 |
| 6 | n257, n258, n260 | 11.5-TT-MBs |  | 8-TT-MBs |  | 1.75 | Maximum 0.4 dB relaxation allowed for n260 |
| 7 | n257, n258, n261 | 11.5-TT-MBs |  |  | 11.5-TT-MBs | 1.75 |  |
| 8 | n257, n260, n261 | 11.5-TT-MBs |  | 8-TT-MBs | 11.5-TT-MBs | 1.25 | Maximum 0.4 dB relaxation allowed for n260 |
| 9 | n258, n260, n261 |  |  | 8-TT-MBs | 11.5-TT-MBs | 1.25 | Maximum 0.4 dB relaxation allowed for n260 |
| 10 | n257, n258, n260, n261 | 11.5-TT-MBs |  | 8-TT-MBs | 11.5-TT-MBs | 1.75 | Maximum 0.4 dB relaxation allowed for n260 |
| Note 1: MBs is the Multiband Relaxation factor declared by the UE for the tested band in Table A.4.3.9-3 of TS38.508-2 [11]. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant  Note 3: Max allowed sum of MBs over all supported FR2 bands as defined in clause 6.2.1.1.3.3 | | | | | | | |

Table 6.2A.1.2.2.5-4: Intra-band Contiguous CA UE spherical coverage for power class 4

|  |  |
| --- | --- |
| Operating band | Min EIRP at 20%-tile CDF (dBm) |
| CA\_n257H | 25-TT |
| CA\_n260H | 19-TT |
| CA\_n260P | 19-TT |
| CA\_n261H | 25-TT |
| CA\_n261P | 25-TT |

Table 6.2A.1.2.2.5-5: Test Tolerance (Spherical coverage) (Aggregated BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | 2.58 dB | 2.58 dB |

##### 6.2A.1.2.3 UE maximum output power - Spherical coverage for CA (4UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Measurement Uncertainties and Test Tolerances are FFS for power class 2, 4 and 7.

6.2A.1.2.3.1 Test purpose

To verify that the spatial coverage of the UE for CA in expected directions is acceptable.

6.2A.1.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

For bandwidth class F, this test case is not testable due to lack of appropriate test points since there is no configuration satisfying MPR=0dB requirements in TS 38.101-2.

6.2A.1.2.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2A.1.0.

6.2A.1.2.3.4 Test description

Same as in clause 6.2A.1.2.1.4 with following exceptions:

- Instead of Table 6.2A.1.2.1.4.1-1🡪 use Table 6.2A.1.2.3.4-1.

- Instead of Table 6.2A.1.2.1.5-1 to 5🡪 use Table 6.2A.1.2.3.5-1 to 5.

Table 6.2A.1.2.3.4-1: Intra-band Contiguous CA Test Configuration Table (single CC requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (cumulative aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated BW (≤ 400 MHz aggregated channel bandwidth) | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 4) | ChBw | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 100 | - | | DFT-s-OFDM QPSK | Inner Full |
| SCC/CC2 | 100 |  | | - | - |
| SCC/CC3 | 100 |  | | - | - |
| SCC/CC4 | 100 |  | | - | - |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: *“The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier”*. | | | | | | |

6.2A.1.2.3.5 Test requirement

The defined %-tile EIRP in measurement distribution derived in step 8 shall exceed the values specified in Table 6.2A.1.2.3.5-1 to Table 6.2A.1.2.3.5-4.

Table 6.2A.1.2.3.5-1: Intra-band Contiguous CA UE spherical coverage for power class 1

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85%-tile CDF (dBm) |
| CA\_n257I | 32.0-TT |
| CA\_n260I | 30.0-TT |
| CA\_n260Q | 30.0-TT |
| CA\_n261I | 32.0-TT |
| CA\_n261Q | 32.0-TT |

Table 6.2A.1.2.3.5-2: Intra-band Contiguous CA UE spherical coverage for power class 2

|  |  |
| --- | --- |
| Operating band | Min EIRP at 60%-tile CDF (dBm) |
| CA\_n257I | 32.0-TT |
| CA\_n261I | 32.0-TT |
| CA\_n261Q | 32.0-TT |

Table 6.2A.1.2.3.5-3: Intra-band Contiguous CA UE spherical coverage for power class 3 for single band UE or multiband UE declaring MBs = 0 in all FR2 bands

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50t%-tile CDF (dBm) |
| CA\_n257I | 11.5-TT |
| CA\_n258I | 11.5-TT |
| CA\_n260I | 8-TT |
| CA\_n260Q | 8-TT |
| CA\_n261I | 11.5-TT |
| CA\_n261Q | 11.5-TT |

Table 6.2A.1.2.3.5-3a: UE spherical coverage for power class 3 for multi band UE declaring MBs>0 in any FR2 band

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ID | Supported FR2 bands set | Test requirement (dB)  (Note 1) | | | | Maximum sum of MBs, ∑MBs (dB)  (Note 3) | Comments |
|  |  | CA\_n257I | CA\_n258 | CA\_n260I/Q | CA\_n261I/Q |  |  |
| 1 | n257, n258 | 11.5-TT-MBs |  |  |  | 1.25 |  |
| 2 | n257, n260 | 11.5-TT-MBs |  | 8-TT-MBs |  | 0.75 | Maximum 0.4 dB relaxation allowed for n260 |
| 3 | n258, n260 |  |  | 8-TT-MBs |  | 0.75 | Maximum 0.4 dB relaxation allowed for n260 |
| 4 | n258, n261 |  |  |  | 11.5-TT-MBs | 1.25 |  |
| 5 | n260, n261 |  |  | 8-TT-MBs | 11.5-TT-MBs | 0.75 | No relaxation allowed for n260 |
| 6 | n257, n258, n260 | 11.5-TT-MBs |  | 8-TT-MBs |  | 1.75 | Maximum 0.4 dB relaxation allowed for n260 |
| 7 | n257, n258, n261 | 11.5-TT-MBs |  |  | 11.5-TT-MBs | 1.75 |  |
| 8 | n257, n260, n261 | 11.5-TT-MBs |  | 8-TT-MBs | 11.5-TT-MBs | 1.25 | Maximum 0.4 dB relaxation allowed for n260 |
| 9 | n258, n260, n261 |  |  | 8-TT-MBs | 11.5-TT-MBs | 1.25 | Maximum 0.4 dB relaxation allowed for n260 |
| 10 | n257, n258, n260, n261 | 11.5-TT-MBs |  | 8-TT-MBs | 11.5-TT-MBs | 1.75 | Maximum 0.4 dB relaxation allowed for n260 |
| Note 1: MBs is the Multiband Relaxation factor declared by the UE for the tested band in Table A.4.3.9-3 of TS38.508-2 [11]. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant  Note 3: Max allowed sum of MBs over all supported FR2 bands as defined in clause 6.2.1.1.3.3 | | | | | | | |

Table 6.2A.1.2.3.5-4: Intra-band Contiguous CA UE spherical coverage for power class 4

|  |  |
| --- | --- |
| Operating band | Min EIRP at 20%-tile CDF (dBm) |
| CA\_n257I | 25-TT |
| CA\_n260I | 19-TT |
| CA\_n260Q | 19-TT |
| CA\_n261I | 25-TT |
| CA\_n261Q | 25-TT |

Table 6.2A.1.2.3.5-5: Test Tolerance (Spherical coverage) (Aggregated BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | 2.58 dB | 2.58 dB |

##### 6.2A.1.2.4 UE maximum output power - Spherical coverage for CA (5UL CA)

6.2A.1.2.4.1 Test purpose

To verify that the spatial coverage of the UE for CA in expected directions is acceptable.

6.2A.1.2.4.2 Test applicability

The requirements in this test are not testable due to lack of appropriate test points since there’s no configuration satisfying MPR=0dB requirements in TS 38.101-2.

No test case details are specified.

##### 6.2A.1.2.5 UE maximum output power - Spherical coverage for CA (6UL CA)

6.2A.1.2.5.1 Test purpose

To verify that the spatial coverage of the UE for CA in expected directions is acceptable.

6.2A.1.2.5.2 Test applicability

The requirements in this test are not testable due to lack of appropriate test points since there’s no configuration satisfying MPR=0dB requirements in TS 38.101-2.

No test case details are specified.

##### 6.2A.1.2.6 UE maximum output power - Spherical coverage for CA (7UL CA)

6.2A.1.2.6.1 Test purpose

To verify that the spatial coverage of the UE for CA in expected directions is acceptable.

6.2A.1.2.6.2 Test applicability

The requirements in this test are not testable due to lack of appropriate test points since there’s no configuration satisfying MPR=0dB requirements in TS 38.101-2.

No test case details are specified.

##### 6.2A.1.2.7 UE maximum output power - Spherical coverage for CA (8UL CA)

6.2A.1.2.7.1 Test purpose

To verify that the spatial coverage of the UE for CA in expected directions is acceptable.

6.2A.1.2.7.2 Test applicability

The requirements in this test are not testable due to lack of appropriate test points since there’s no configuration satisfying MPR=0dB requirements in TS 38.101-2.

No test case details are specified.

### 6.2A.2 UE maximum output power reduction for CA

#### 6.2A.2.0 Minimum conformance requirements

##### 6.2A.2.0.1 General

The UE is defined to be configured for CA operation when it has at least one of UL or DL configured for CA. In CA operation, the UE may reduce its maximum output power due to higher order modulations and transmit bandwidth configurations. This Maximum Power Reduction (MPR) is defined in subclauses below.

When the maximum output power of a UE is modified by MPR, the power limits specified in subclause 6.2A.4.0 apply.

The requirements in the following subclauses are only applicable to the following CA configurations:

- intra-band contiguous uplink CA, with the aggregated channel bandwidth up to 800 MHz.

- intra-band non-contiguous uplink CA with UL frequency separation no greater than 1400 MHz, and no more than 3 sub-blocks. A sub-block may consist of single CC or multiple contiguous CCs.

- In case the CA configuration consists of a single UL CC, MPR for contiguous UL CA applies and where necessary, BWchannel shall be used as BWchannel\_CA.

##### 6.2A.2.0.2 Maximum output power reduction for power class 1

For power class 1, MPR for intra-band contiguous UL CA with contiguous allocations within the cumulative aggregated bandwidth is defined as:

MPRC\_CA = max(MPRWT\_C\_CA, MPRnarrow)

Where,

MPRnarrow = 14.4 dB, when BWalloc,RB is less than or equal to 1.44 MHz, MPRnarrow = 10 dB, when 1.44 MHz < BWalloc,RB ≤ 10.8 MHz, where BWalloc,RB is the bandwidth of the RB allocation size.

MPRWT\_C\_CA is the maximum power reduction due to modulation orders, transmit bandwidth configurations, and waveform types. MPRWT\_C\_CA is defined in Table 6.2A.2.0.2-1.

Table 6.2A.2.0.2-1: Maximum power reduction (MPRWT\_C\_CA) for UE power class 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Waveform Type | | Cumulative aggregated channel bandwidth | | | |
| < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.5 | 7.7 | 8.2 | ≤ 8.7 |
| QPSK | ≤ 6.5 | 8.7 | 9.7 | ≤ 9.7 |
| 16 QAM | ≤ 6.5 | 8.7 | 9.2 | ≤ 9.7 |
| 64 QAM | ≤ 9.0 | 10.7 | 11.2 | ≤ 11.7 |
| CP-OFDM | QPSK | ≤ 6.5 | 8.7 | 8.7 | ≤ 9.7 |
| 16 QAM | ≤ 6.5 | 8.7 | 8.7 | ≤ 9.7 |
| 64 QAM | ≤ 9.0 | 10.7 | 11.2 | ≤ 11.7 |
| NOTE 1: Void. | | | | | |

In case of a contiguous RB, DFT-s-BPSK or DFT-s-QPSK UL allocation in a single CC of a CA configuration with contiguous CCs, and whose cumulative aggregated BW ≤ 400 MHz, MPRWT\_C\_CA shall be derived instead as MAX(MPR1, MPR2), where:

MPR1 shall be determined from Table 6.2.2.3.1-1 if CABW ≤ 200 MHz, from Table 6.2.2.3.1-2 if CABW > 200 MHz.

MPR2 shall be determined from Table 6.2.2.3.1-1 if UL BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.3.1-2 if UL BWchannel\_CA > 200 MHz.

and assume all UL CCs use the same SCS for the purpose of determination of inner and outer RB allocations in Table 6.2.2.3.1-1 and Table 6.2.2.3.1-2:

NRB shall be chosen as the sum of NRB of all constituent UL CCs in the CA configuration.

LCRB shall be chosen as BWalloc,RB

RBstart shall be derived as: RBstart\_allocatedCC+NRB\_unallocatedCC\_low

RBstart\_allocatedCC is the index of the first allocated RB in the CC with allocation

NRB\_unallocatedCC\_low is the sum of NRB in all UL CCs lower in frequency compared to the CC with allocation

When different waveform types exist across CCs, the requirement is set by the waveform type used in the configuration with the largest MPRC\_CA.

For intra-band contiguous UL CA with non-contiguous RB allocations, the following rule for MPR applies:

MPR = max(MPRC\_CA, -10\*A + 14.4)

Where:

A = NRB\_alloc / NRB\_agg\_C.

NRB\_alloc is the total number of allocated UL RBs

NRB\_agg\_C is the number of the aggregated RBs within the fully allocated cumulative aggregated channel bandwidth assuming lowest SCS among all configured CCs

For intra-band non-contiguous UL CA, the following rule for MPR applies:

MPR = max(MPRNC\_CA, -10\*A + 14.4)

Where:

MPRNC\_CA is derived from table 6.2A.2.0.2-2

A = NRB\_alloc / NRB\_agg\_C.

NRB\_alloc is the total number of allocated UL RBs

NRB\_agg\_C is the number of the aggregated RBs within the fully allocated cumulative aggregated channel bandwidth assuming lowest SCS among all configured CCs

Table 6.2A.2.0.2-2: MPRNC\_CA for UE power class 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Waveform Type | | Cumulative aggregated channel bandwidth (CABW) | | | |
|  | | < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 6 | ≤ 7.7 | ≤ 8.2 | ≤ 8.7 |
|  | QPSK | ≤ 7 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
|  | 16 QAM | ≤ 7 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
| CP-OFDM | QPSK | ≤ 7 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
|  | 16 QAM | ≤ 7 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |

When different waveform types exist across CCs, the requirement is set by the waveform type used in the configuration with the largest MPRC\_CA.

##### 6.2A.2.0.3 Maximum output power reduction for power class 2

For power class 2, MPR specified in sub-clause 6.2A.2.0.4 applies.

Table 6.2A.2.0.3-1: Void

##### 6.2A.2.0.4 Maximum output power reduction for power class 3

For power class 3, MPR for intra-band contiguous UL CA with contiguous allocations within the cumulative aggregated bandwidth is denoted as MPRC\_CA and is defined in Table 6.2A.2.0.4-1.

Table 6.2A.2.0.4-1: Maximum power reduction (MPRC\_CA) for UE power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | Cumulative aggregated bandwidth configuration (CABW) | | | |
| ≤ 400 MHz | > 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.0 | ≤ 7.7 | ≤ 8.2 | ≤ 8.7 |
| QPSK | ≤ 5.0 | ≤ 7.7 | ≤ 8.2 | ≤ 9.7 |
| 16 QAM | ≤ 6.5 | ≤ 8.7 | ≤ 9.3 | ≤ 9.7 |
| 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
| CP-OFDM | QPSK | ≤ 5.0 | ≤ 7.5 | ≤ 8.0 | ≤ 9.7 |
| 16 QAM | ≤ 6.5 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
| 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
| NOTE 1: void. | | | | | |

In case of a contiguous RB, DFT-s-BPSK or DFT-s-QPSK UL allocation in a single CC of a CA configuration with contiguous CCs, and whose cumulative aggregated BW ≤ 400 MHz, MPRC\_CA shall be derived instead as MAX(MPR1, MPR2), where:

MPR1 shall be determined from Table 6.2.2.3.3-1 if CABW ≤ 200 MHz, from Table 6.2.2.3.3-2 if CABW > 200 MHz.

MPR2 shall be determined from Table 6.2.2.3.3-1 if UL BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.3.3-2 if UL BWchannel\_CA > 200 MHz.

and assume all UL CCs use the same SCS for the purpose of determination of inner and outer RB allocations in Table 6.2.2.3.3-1 and Table 6.2.2.3.3-2:

NRB shall be chosen as the sum of NRB of all constituent UL CCs in the CA configuration.

LCRB shall be chosen as BWalloc,RB

RBstart shall be derived as: RBstart\_allocatedCC+NRB\_unallocatedCC\_low

RBstart\_allocatedCC is the index of the first allocated RB in the CC with allocation

NRB\_unallocatedCC\_low is the sum of NRB in all UL CCs lower in frequency compared to the CC with allocation

When different waveform types exist across CCs, the requirement is set by the waveform type used in the configuration with the highest contiguous MPR.

For intra-band contiguous UL CA with non-contiguous RB allocations, the following rule for MPR applies:

MPR = max(MPRC\_CA, -10\*A +7.0)

Where:

A = NRB\_alloc / NRB\_agg\_C.

NRB\_alloc is the total number of allocated UL RBs

NRB\_agg\_C is the number of the aggregated RBs within the fully allocated cumulative aggregated channel bandwidth assuming lowest SCS among all configured CCs

For intra-band non-contiguous UL CA, the following rule for MPR applies:

MPR = max(MPRNC\_CA, -8\*A +10.0)

Where:

MPRNC\_CA is derived from table 6.2A.2. 0.4-2

A = NRB\_alloc / NRB\_agg\_C.

NRB\_alloc is the total number of allocated UL RBs

NRB\_agg\_C is the number of the aggregated RBs within the fully allocated cumulative aggregated channel bandwidth assuming lowest SCS among all configured CCs

Table 6.2A.2.0.4-2: MPRNC\_CA for UE power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | Cumulative aggregated channel bandwidth (CABW) | | | |
|  | | ≤ 400 MHz | > 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.5 | ≤ 7.7 | ≤ 8.2 | ≤ 8.7 |
|  | QPSK | ≤ 6 | ≤ 7.7 | ≤ 8.2 | ≤ 8.7 |
|  | 16 QAM | ≤ 7 | ≤ 8.7 | ≤ 9.3 | ≤ 9.8 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
| CP-OFDM | QPSK | ≤ 6 | ≤ 7.5 | ≤ 8.0 | ≤ 8.5 |
|  | 16 QAM | ≤ 7 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |

When different waveform types exist across CCs, the requirement is set by the waveform type used in the configuration with the largest MPRNC\_CA.

##### 6.2A.2.0.5 Maximum output power reduction for power class 4

For power class 4, MPR specified in sub-clause 6.2A.2.0.4 applies.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2A.2.

#### 6.2A.2.1 UE maximum output power reduction for CA (2UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

- The UPLF test mode is applicable to UEs Release 16 and forward.

- This test case is incomplete for Power classes 1, 2, 4 Release 15.

* For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

- Whether additional check is needed in the test procedure to ensure UE continues transmissions on the SCell is FFS

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and intra-band non-contiguous CA are TBD.

- The test points for higher bandwidth classes with testability problem need an update to decrease the UL bandwidth until they become testable.

- Test points with more than 3 DL CCs for PC1, 2, 4 are pending removal as already done for PC3

6.2A.2.1.1 Test purpose

The number of RB identified in 6.2.2.3 is based on meeting the requirements for the maximum power reduction (MPR) due to Cubic Metric (CM).

6.2A.2.1.2 Test applicability

The requirements of this test apply to all types of NR UE release 15 and forward supporting 2UL CA.

6.2A.2.1.3 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2A.2.

6.2A.2.1.4 Test description

6.2A.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, and CC combinations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration and subcarrier spacing, are shown in Table 6.2A.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 6.2A.2.1.4.1-1: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, MPRnarrow)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Refer to “Test frequency” column | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (NOTE 1) |
| Default Test Settings for a CA\_nXB, CA\_nXD, CA\_nXG, CA\_nXO Configuration | | | | | | |
| 1 | PCC/CC1 | Default | Low | - | CP-OFDM 64QAM | Outer\_1RB\_Left |
| SCC/CC2 |  | Low |  | - | - |
| 2 | PCC/CC1 |  | High |  | CP-OFDM 64QAM | Outer\_1RB\_Right |
| SCC/CC2 |  | High |  | - | - |
| 3 | PCC/CC1 |  | Low |  | CP-OFDM 64QAM | 7@0 |
| SCC/CC2 |  | Low |  | - | - |
| 4 | PCC/CC1 |  | High |  | CP-OFDM 64QAM | 7@NRB-7 |
| SCC/CC2 |  | High |  | - | - |
| **Default Test Settings for a CA\_nX(D-G)\_UL\_nXD, CA\_nX(D-G)\_UL\_nXG, CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXO Configuration** | | | | | | |
| 1 | PCC/CC1 | Default | Low | - | CP-OFDM 64QAM | Outer\_1RB\_Left |
| SCC1/CC2 |  | Low |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | Low |  | N/A | N/A |
| SCC3/CC4 |  | Low |  | N/A | N/A |
| 2 | PCC/CC1 |  | High |  | CP-OFDM 64QAM | Outer\_1RB\_Right |
| SCC1/CC2 |  | High |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | High |  | N/A | N/A |
| SCC3/CC4 |  | High |  | N/A | N/A |
| 3 | PCC/CC1 |  | Low |  | CP-OFDM 64QAM | 7@0 |
| SCC1/CC2 |  | Low |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | Low |  | N/A | N/A |
| SCC3/CC4 |  | Low |  | N/A | N/A |
| 4 | PCC/CC1 |  | High |  | CP-OFDM 64QAM | 7@NRB-7 |
| SCC1/CC2 |  | High |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | High |  | N/A | N/A |
| SCC3/CC4 |  | High |  | N/A | N/A |
| **Default Test Settings for a CA\_nX(D-H)\_UL\_nXD, CA\_nX(D-P)\_UL\_nXD, CA\_nX(E-O)\_UL\_nXO Configuration** | | | | | | |
| 1 | PCC/CC1 | Default | Low | - | CP-OFDM 64QAM | Outer\_1RB\_Left |
| SCC1/CC2 |  | Low |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | Low |  | N/A | N/A |
| SCC3/CC4 |  | Low |  | N/A | N/A |
| SCC4/CC5 |  | Low |  | N/A | N/A |
| 2 | PCC/CC1 |  | High |  | CP-OFDM 64QAM | Outer\_1RB\_Right |
| SCC1/CC2 |  | High |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | High |  | N/A | N/A |
| SCC3/CC4 |  | High |  | N/A | N/A |
| SCC4/CC5 |  | High |  | N/A | N/A |
| 3 | PCC/CC1 |  | Low |  | CP-OFDM 64QAM | 7@0 |
| SCC1/CC2 |  | Low |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | Low |  | N/A | N/A |
| SCC3/CC4 |  | Low |  | N/A | N/A |
| SCC4/CC5 |  | Low |  | N/A | N/A |
| 4 | PCC/CC1 |  | High |  | CP-OFDM 64QAM | 7@NRB-7 |
| SCC1/CC2 |  | High |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | High |  | N/A | N/A |
| SCC3/CC4 |  | High |  | N/A | N/A |
| SCC4/CC5 |  | High |  | N/A | N/A |
| **Default Test Settings for a CA\_nX(D-I)\_UL\_nXD, CA\_nX(D-Q)\_UL\_nXD, CA\_nX(G-I)\_UL\_nXG Configuration** | | | | | | |
| 1 | PCC/CC1 | Default | Low | - | CP-OFDM 64QAM | Outer\_1RB\_Left |
| SCC1/CC2 |  | Low |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | Low |  | N/A | N/A |
| SCC3/CC4 |  | Low |  | N/A | N/A |
| SCC4/CC5 |  | Low |  | N/A | N/A |
| SCC5/CC6 |  | Low |  | N/A | N/A |
| 2 | PCC/CC1 |  | High |  | CP-OFDM 64QAM | Outer\_1RB\_Right |
| SCC1/CC2 |  | High |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | High |  | N/A | N/A |
| SCC3/CC4 |  | High |  | N/A | N/A |
| SCC4/CC5 |  | High |  | N/A | N/A |
| SCC5/CC6 |  | High |  | N/A | N/A |
| 3 | PCC/CC1 |  | Low |  | CP-OFDM 64QAM | 7@0 |
| SCC1/CC2 |  | Low |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | Low |  | N/A | N/A |
| SCC3/CC4 |  | Low |  | N/A | N/A |
| SCC4/CC5 |  | Low |  | N/A | N/A |
| SCC5/CC6 |  | Low |  | N/A | N/A |
| 4 | PCC/CC1 |  | High |  | CP-OFDM 64QAM | 7@NRB-7 |
| SCC1/CC2 |  | High |  | - | - |
| Wgap |  | Max Wgap |  | N/A | N/A |
| SCC2/CC3 |  | High |  | N/A | N/A |
| SCC3/CC4 |  | High |  | N/A | N/A |
| SCC4/CC5 |  | High |  | N/A | N/A |
| SCC5/CC6 |  | High |  | N/A | N/A |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-2.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10]. | | | | | | |

Table 6.2A.2.1.4.1-2: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low range, High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_nXG, CA\_nXO Configuration (Cumulative aggregated BWchannel <= 200MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC/CC2 |  |  |  | - | - |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Inner\_Full\_Region1 |
| SCC/CC2 |  |  |  | - | - |
| Default Test Settings for a CA\_nXD Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC/CC2 |  |  |  | - | - |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM Pi/2 BPSK | Inner\_Full\_Region1 |
| SCC/CC2 |  |  |  | - | - |
| 3 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Inner\_Full\_Region1 |
| SCC/CC2 |  |  |  | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-2.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 3: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. | | | | | | |

Table 6.2A.2.1.4.1-3: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, MPRC\_CA)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for different CA bandwidth classes | | | | For intra-band contiguous CA: Mid range.  For intra-band non-contiguous CA: FFS. | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC**& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_nXB, CA\_nXC\_UL\_nXB Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC/CC2 |  |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| 3 | PCC/CC1 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| 4 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| 5 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXD Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC/CC2 |  |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| 2 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXB Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | PCC/CC1 | 200MHz | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC/CC2 | 400MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| 2 | PCC/CC1 | 200MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 | 400MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 | 200MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 | 400MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXG, CA\_nXO Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC/CC2 |  |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| 2 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXD Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | |
| 1 | PCC/CC1 | 100MHz | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC/CC2 | 200MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| 2 | PCC/CC1 | 100MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 | 200MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 | 100MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 | 200MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nX(D-G)\_UL\_nXD, CA\_nX(D-G)\_UL\_nXG, CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXO Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| 3 | PCC/CC1 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| 4 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| 5 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(D-H)\_UL\_nXD, CA\_nX(D-P)\_UL\_nXD, CA\_nX(E-O)\_UL\_nXO Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| 3 | PCC/CC1 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| 4 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| 5 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(D-I)\_UL\_nXD, CA\_nX(D-Q)\_UL\_nXD, CA\_nX(G-I)\_UL\_nXG Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| SCC5/CC6 |  |  |  | N/A | N/A |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| SCC5/CC6 |  |  |  | N/A | N/A |
| 3 | PCC/CC1 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| SCC5/CC6 |  |  |  | N/A | N/A |
| 4 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| SCC5/CC6 |  |  |  | N/A | N/A |
| 5 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| SCC4/CC5 |  |  |  | N/A | N/A |
| SCC5/CC6 |  |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(D-G)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXD Configuration (400MHz <= Cumulative aggregated BWchannel <800MHz) | | | | | | |
| 1 | PCC/CC1 | 200MHz | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap | 190MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| 2 | PCC/CC1 | 200MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 190MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| 3 | PCC/CC1 | 200MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 190MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(D-G)\_UL\_nXG, CA\_nX(D-O)\_UL\_nXO Configuration (400MHz <= Cumulative aggregated BWchannel <800MHz) | | | | | | |
| 1 | PCC/CC1 | 100MHz | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 | 100MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap | 190MHz |  |  | N/A | N/A |
| SCC2/CC3 | 200MHz |  |  | N/A | N/A |
| SCC3/CC4 | 200MHz |  |  | N/A | N/A |
| 2 | PCC/CC1 | 100MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 100MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 190MHz |  |  | N/A | N/A |
| SCC2/CC3 | 200MHz |  |  | N/A | N/A |
| SCC3/CC4 | 200MHz |  |  | N/A | N/A |
| 3 | PCC/CC1 | 100MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 | 100MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 190MHz |  |  | N/A | N/A |
| SCC2/CC3 | 200MHz |  |  | N/A | N/A |
| SCC3/CC4 | 200MHz |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(D-H)\_UL\_nXD, CA\_nX(D-P)\_UL\_nXD, Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | PCC/CC1 | 200MHz | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap | 90MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| SCC4/CC5 | 100MHz |  |  | N/A | N/A |
| 2 | PCC/CC1 | 200MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 90MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| SCC4/CC5 | 100MHz |  |  | N/A | N/A |
| 3 | PCC/CC1 | 200MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 90MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| SCC4/CC5 | 100MHz |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(O-E)\_UL\_nXO Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | PCC/CC1 | 100MHz | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 | 100MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap | 90MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 200MHz |  |  | N/A | N/A |
| SCC4/CC5 | 200MHz |  |  | N/A | N/A |
| 2 | PCC/CC1 | 100MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 100MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 90MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 200MHz |  |  | N/A | N/A |
| SCC4/CC5 | 200MHz |  |  | N/A | N/A |
| 3 | PCC/CC1 | 100MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 | 100MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 90MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 200MHz |  |  | N/A | N/A |
| SCC4/CC5 | 200MHz |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(D-I)\_UL\_nXD, CA\_nX(D-Q)\_UL\_nXD Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | PCC/CC1 | 100MHz | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap | 90MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| SCC4/CC5 | 100MHz |  |  | N/A | N/A |
| SCC5/CC6 | 100MHz |  |  | N/A | N/A |
| 2 | PCC/CC1 | 100MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 90MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| SCC4/CC5 | 100MHz |  |  | N/A | N/A |
| SCC5/CC6 | 100MHz |  |  | N/A | N/A |
| 3 | PCC/CC1 | 100MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 90MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| SCC4/CC5 | 100MHz |  |  | N/A | N/A |
| SCC5/CC6 | 100MHz |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(G-I)\_UL\_nXG Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | PCC/CC1 | 100MHz | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 | 100MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap | 190MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| SCC4/CC5 | 100MHz |  |  | N/A | N/A |
| SCC5/CC6 | 100MHz |  |  | N/A | N/A |
| 2 | PCC/CC1 | 100MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 100MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 190MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| SCC4/CC5 | 100MHz |  |  | N/A | N/A |
| SCC5/CC6 | 100MHz |  |  | N/A | N/A |
| 3 | PCC/CC1 | 100MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 | 100MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 190MHz |  |  | N/A | N/A |
| SCC2/CC3 | 100MHz |  |  | N/A | N/A |
| SCC3/CC4 | 100MHz |  |  | N/A | N/A |
| SCC4/CC5 | 100MHz |  |  | N/A | N/A |
| SCC5/CC6 | 100MHz |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(D-O)\_UL\_nXD Configuration (Cumulative aggregated BWchannel <400MHz) | | | | | | |
| 1 | PCC/CC1 | 50MHz | Default | - | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| Wgap | 40MHz |  |  | N/A | N/A |
| SCC2/CC3 | 50MHz |  |  | N/A | N/A |
| SCC3/CC4 | 50MHz |  |  | N/A | N/A |
| 2 | PCC/CC1 | 50MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 40MHz |  |  | N/A | N/A |
| SCC2/CC3 | 50MHz |  |  | N/A | N/A |
| SCC3/CC4 | 50MHz |  |  | N/A | N/A |
| 3 | PCC/CC1 | 50MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 40MHz |  |  | N/A | N/A |
| SCC2/CC3 | 50MHz |  |  | N/A | N/A |
| SCC3/CC4 | 50MHz |  |  | N/A | N/A |
| Default Test Settings for a CA\_nX(D-O)\_UL\_nXO Configuration (Cumulative aggregated BWchannel <400MHz) | | | | | | |
| 1 | PCC/CC1 | 50MHz | Default | - | N/A | N/A |
| SCC1/CC2 | 200MHz |  |  | N/A | N/A |
| Wgap | 40MHz |  |  | N/A | N/A |
| SCC2/CC3 | 50MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| SCC3/CC4 | 50MHz |  |  | DFT-s-OFDM Pi/2 BPSK | Outer\_Full |
| 2 | PCC/CC1 | 50MHz |  |  | N/A | N/A |
| SCC1/CC2 | 200MHz |  |  | N/A | N/A |
| Wgap | 40MHz |  |  | N/A | N/A |
| SCC2/CC3 | 50MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC3/CC4 | 50MHz |  |  | CP-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 | 50MHz |  |  | N/A | N/A |
| SCC1/CC2 | 200MHz |  |  | N/A | N/A |
| Wgap | 40MHz |  |  | N/A | N/A |
| SCC2/CC3 | 50MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC3/CC4 | 50MHz |  |  | CP-OFDM 64QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-2.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10]. | | | | | | |

Table 6.2A.2.1.4.1-4: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, Non-contiguous allocation)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for different CA bandwidth classes | | | | For intra-band contiguous CA: Mid range.  For intra-band non-contiguous CA: FFS. | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_nXB, CA\_nXD, CA\_XG, CA\_nXO Configuration | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | CP-OFDM 64QAM | Outer\_1RB\_Left |
| SCC/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_1RB\_Right |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM Pi/2 BPSK | [Outer\_0.9\_Left] |
| SCC/CC2 |  |  |  | DFT-s-OFDM Pi/2 BPSK | [Outer\_0.9\_Right] |
| 3 | PCC/CC1 |  |  |  | DFT-s-OFDM Pi/2 QPSK | [Outer\_0.9\_Left] |
| SCC/CC2 |  |  |  | DFT-s-OFDM Pi/2 QPSK | [Outer\_0.9\_Right] |
| Default Test Settings for a CA\_nX(D-G), CA\_nX(D-O) Configuration | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM QPSK | Outer\_1RB\_Left (Note 3)  Outer\_2RB\_Left (Note 4) |
| SCC1/CC2 |  |  |  | DFT-s-OFDM QPSK | Outer\_1RB\_Right (Note 3)  Outer\_2RB\_Right (Note 4) |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM Pi/2 BPSK | [Outer\_0.9\_Left] |
| SCC1/CC2 |  |  |  | DFT-s-OFDM Pi/2 BPSK | [Outer\_0.9\_Right] |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| 3 | PCC/CC1 |  |  |  | DFT-s-OFDM Pi/2 QPSK | [Outer\_0.9\_Left] |
| SCC1/CC2 |  |  |  | DFT-s-OFDM Pi/2 QPSK | [Outer\_0.9\_Right] |
| Wgap |  |  |  | N/A | N/A |
| SCC2/CC3 |  |  |  | N/A | N/A |
| SCC3/CC4 |  |  |  | N/A | N/A |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-2.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 3: Applicable to Rel-16 and forward UEs.  NOTE 4: Applicable to Rel-15 UEs. | | | | | | |

Table 6.2A.2.1.4.1-5: Intra-band Contiguous UL CA Test Configuration Table (Power Class 2, 3 and 4, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low range, High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_nXG, CA\_nXO Configuration (Cumulative aggregated BWchannel <= 200MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC/CC2 |  |  |  | - | - |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  |  | - | - |
| Default Test Settings for a CA\_nXD Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC/CC2 |  |  |  | - | - |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  |  | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10]. | | | | | | |

Table 6.2A.2.1.4.1-6: Intra-band Contiguous UL CA Test Configuration Table (Power Class 2, 3 and 4, MPRC\_CA)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal | | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for different CA bandwidth classes | | | | | For intra-band contiguous CA: Mid range.  For intra-band non-contiguous CA: FFS | | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for the CA Configuration across bandwidth combination sets supported by the UE | | | | | Highest aggregated channel bandwidth of the CA configuration | | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120 kHz | | | |
| Test Parameters | | | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | | DL RB allocation | | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_nXB, nXC\_UL\_nXB Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | | | |
| 1 | PCC/CC1 | Default | Default | | - | | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  | |  | | DFT-s-OFDM QPSK | Outer\_Full |
| 2 | PCC/CC1 |  |  | |  | | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  | |  | | DFT-s-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 |  |  | |  | | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  | |  | | CP-OFDM QPSK | Outer\_Full |
| 4 | PCC/CC1 |  |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| 5 | PCC/CC1 |  |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 |  |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXD, CA\_nXE\_UL\_nXD, CA\_nXF\_UL\_nXD Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | | | |
| 1 | PCC/CC1 | Default | Default | | - | | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  | |  | | DFT-s-OFDM QPSK | Outer\_Full |
| 2 | PCC/CC1 |  |  | |  | | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  | |  | | CP-OFDM QPSK | Outer\_Full |
| 3 | PCC/CC1 |  |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| 4 | PCC/CC1 |  |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 |  |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXB Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | | | |
| 1 | PCC/CC1 | 200MHz | Default | | - | | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 | 400MHz |  | |  | | DFT-s-OFDM QPSK | Outer\_Full |
| 2 | PCC/CC1 | 200MHz |  | |  | | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 | 400MHz |  | |  | | CP-OFDM QPSK | Outer\_Full |
| 3 | PCC/CC1 | 200MHz |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 | 400MHz |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| 4 | PCC/CC1 | 200MHz |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 | 400MHz |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXG, CA\_nXO Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | | | |
| 1 | PCC/CC1 | Default | Default | | - | | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  | |  | | CP-OFDM QPSK | Outer\_Full |
| 2 | PCC/CC1 |  |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 |  |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 |  |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXD Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | | | |
| 1 | PCC/CC1 | 100MHz | Default | | - | | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 | 200MHz |  | |  | | CP-OFDM QPSK | Outer\_Full |
| 2 | PCC/CC1 | 100MHz |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 | 200MHz |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 | 100MHz |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 | 200MHz |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nX(D-A) )\_UL\_nXD, CA\_nX(A-G)\_UL\_nXG, CA\_nX(A-O)\_UL\_nXO Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | | | |
| 1 | PCC/CC1 | Default | Default | | - | | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1/CC2 |  |  | |  | | DFT-s-OFDM QPSK | Outer\_Full |
| Wgap |  |  | |  | | N/A | N/A |
| SCC2/CC3 |  |  | |  | | N/A | N/A |
|  |  |  | |  | |  |  |
| 2 | PCC/CC1 |  |  | |  | | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  | |  | | DFT-s-OFDM 16QAM | Outer\_Full |
| Wgap |  |  | |  | | N/A | N/A |
| SCC2/CC3 |  |  | |  | | N/A | N/A |
|  |  |  | |  | |  |  |
| 3 | PCC/CC1 |  |  | |  | | CP-OFDM QPSK | Outer\_Full |
| SCC1/CC2 |  |  | |  | | CP-OFDM QPSK | Outer\_Full |
| Wgap |  |  | |  | | N/A | N/A |
| SCC2/CC3 |  |  | |  | | N/A | N/A |
|  |  |  | |  | |  |  |
| 4 | PCC/CC1 |  |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| Wgap |  |  | |  | | N/A | N/A |
| SCC2/CC3 |  |  | |  | | N/A | N/A |
|  |  |  | |  | |  |  |
| 5 | PCC/CC1 |  |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 |  |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| Wgap |  |  | |  | | N/A | N/A |
| SCC2/CC3 |  |  | |  | | N/A | N/A |
|  |  |  | |  | |  |  |
| Default Test Settings for a CA\_nX(D-A)\_UL\_nXD Configuration (400MHz <= Cumulative aggregated BWchannel <800MHz) | | | | | | | | |
| 1 | PCC/CC1 | 200MHz | | Default | | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1/CC2 | 200MHz | |  | |  | DFT-s-OFDM QPSK | Outer\_Full |
| Wgap | 290MHz | |  | |  | N/A | N/A |
| SCC2/CC3 | 100MHz | |  | |  | N/A | N/A |
|  |  | |  | |  |  |  |
| 2 | PCC/CC1 | 200MHz | |  | |  | CP-OFDM QPSK | Outer\_Full |
| SCC1/CC2 | 200MHz | |  | |  | CP-OFDM QPSK | Outer\_Full |
| Wgap | 290MHz | |  | |  | N/A | N/A |
| SCC2/CC3 | 100MHz | |  | |  | N/A | N/A |
|  |  | |  | |  |  |  |
| 3 | PCC/CC1 | 200MHz | |  | |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 200MHz | |  | |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 290MHz | |  | |  | N/A | N/A |
| SCC2/CC3 | 100MHz | |  | |  | N/A | N/A |
|  |  | |  | |  |  |  |
| 4 | PCC/CC1 | 200MHz | |  | |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 | 200MHz | |  | |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 290MHz | |  | |  | N/A | N/A |
| SCC2/CC3 | 100MHz | |  | |  | N/A | N/A |
|  |  | |  | |  |  |  |
| Default Test Settings for a CA\_nX(A-G)\_UL\_nXG, CA\_nX(A-O)\_UL\_nXO Configuration (400MHz <= Cumulative aggregated BWchannel <800MHz) | | | | | | | | |
| 1 | PCC/CC1 | 100MHz | | Default | | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1/CC2 | 100MHz | |  | |  | DFT-s-OFDM QPSK | Outer\_Full |
| Wgap | 390MHz | |  | |  | N/A | N/A |
| SCC2/CC3 | 200MHz | |  | |  | N/A | N/A |
|  |  | |  | |  |  |  |
| 2 | PCC/CC1 | 100MHz | |  | |  | CP-OFDM QPSK | Outer\_Full |
| SCC1/CC2 | 100MHz | |  | |  | CP-OFDM QPSK | Outer\_Full |
| Wgap | 390MHz | |  | |  | N/A | N/A |
| SCC2/CC3 | 200MHz | |  | |  | N/A | N/A |
|  |  | |  | |  |  |  |
| 3 | PCC/CC1 | 100MHz | |  | |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 100MHz | |  | |  | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 390MHz | |  | |  | N/A | N/A |
| SCC2/CC3 | 200MHz | |  | |  | N/A | N/A |
|  |  | |  | |  |  |  |
| 4 | PCC/CC1 | 100MHz | |  | |  | c | Outer\_Full |
| SCC1/CC2 | 100MHz | |  | |  | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 390MHz | |  | |  | N/A | N/A |
| SCC2/CC3 | 200MHz | |  | |  | N/A | N/A |
|  |  | |  | |  |  |  |
| Default Test Settings for a CA\_nX(D-A)\_UL\_nXD Configuration (Cumulative aggregated BWchannel <400MHz) | | | | | | | | |
| 1 | PCC/CC1 | 50MHz | Default | | - | | CP-OFDM QPSK | Outer\_Full |
| SCC1/CC2 | 200MHz |  | |  | | CP-OFDM QPSK | Outer\_Full |
| Wgap | 90MHz |  | |  | | N/A | N/A |
| SCC2/CC3 | 50MHz |  | |  | | N/A | N/A |
|  |  |  | |  | |  |  |
| 2 | PCC/CC1 | 50MHz |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| Wgap | 90MHz |  | |  | | N/A | N/A |
| SCC2/CC3 | 50MHz |  | |  | | N/A | N/A |
|  |  |  | |  | |  |  |
| 3 | PCC/CC1 | 50MHz |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 | 200MHz |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| Wgap | 90MHz |  | |  | | N/A | N/A |
| SCC2/CC3 | 50MHz |  | |  | | N/A | N/A |
|  |  |  | |  | |  |  |
| Default Test Settings for a CA\_nX(A-O)\_UL\_nXO Configuration (Cumulative aggregated BWchannel <400MHz) | | | | | | | | |
| 1 |  |  |  | |  | |  |  |
| SCC1/CC2 | 200MHz |  | |  | | N/A | N/A |
| Wgap | 90MHz |  | |  | | N/A | N/A |
| PCC/CC3 | 50MHz |  | |  | | CP-OFDM QPSK | Outer\_Full |
| SCC3/CC4 | 50MHz |  | |  | | CP-OFDM QPSK | Outer\_Full |
| 2 |  |  |  | |  | |  |  |
| SCC1/CC2 | 200MHz |  | |  | | N/A | N/A |
| Wgap | 90MHz |  | |  | | N/A | N/A |
| PCC/CC3 | 50MHz |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| SCC3/CC4 | 50MHz |  | |  | | CP-OFDM 16QAM | Outer\_Full |
| 3 |  |  |  | |  | |  |  |
| SCC1/CC2 | 200MHz |  | |  | | N/A | N/A |
| Wgap | 90MHz |  | |  | | N/A | N/A |
| PCC/CC3 | 50MHz |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| SCC3/CC4 | 50MHz |  | |  | | CP-OFDM 64QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10]. | | | | | | | | |

Table 6.2A.2.1.4.1-7: Intra-band Contiguous UL CA Test Configuration Table (Power Class 2, 3 and 4, Non-contiguous allocation)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Mid range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_XG, CA\_nXO Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM QPSK | Outer\_1RB\_Left (Note 3)  Outer\_2RB\_Left (Note 4) |
| SCC/CC2 |  |  |  | DFT-s-OFDM QPSK | Outer\_1RB\_Right (Note 3)  Outer\_2RB\_Right (Note 4) |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM Pi/2 BPSK | [Outer\_0.9\_Left] |
| SCC/CC2 |  |  |  | DFT-s-OFDM Pi/2 BPSK | [Outer\_0.9\_Right] |
| 3 | PCC/CC1 |  |  |  | DFT-s-OFDM Pi/2 QPSK | [Outer\_0.9\_Left] |
| SCC/CC2 |  |  |  | DFT-s-OFDM Pi/2 QPSK | [Outer\_0.9\_Right] |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 3: Applicable to Rel-16 and forward UEs.  NOTE 4: Applicable to Rel-15 UEs. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2A.2.1.4.1-1 to Table 6.2A.2.1.4.1-7.

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 [10] clause 4.5. Message contents are defined in clause 6.2A.2.1.4.3.

6.2A.2.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 and Annex C.3.0 for all downlink physical channels

2. The SS shall configure SCC as per TS 38.508-1 [10] subclause 5.5.1 Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in subclause 6.2A.2.1.4.3.

3. Apply the test step based on the 5G NR UE Release:

3a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS applies a backoff on the PCell powerby activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using TOTAL NR AGGREGATED BANDWIDTH and PCELL NR bandwidth as per Test CC Combination setting. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

3b. For Release 15 5G NR UEs: No action.

3c. For testing single CC MPR requirement: No action.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321, clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 Table 6.2A.2.1.4.1-1 to Table 6.2A.2.1.4.1-7. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Apply the test step based on the 5G NR UE Release:

7a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.2.1.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

Table 6.2A.2.1.4.2-1: Power target values per UL CC for test procedure using PHR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BW ratio (Note 1) | Xmax [dB] (Note 2) | Target PHR | ΔPHR [dB] (Note 3) | BW combination examples |
| 1/2 | 3.0 | POWER\_HEADROOM\_36 (3  PH  4) | 1 | 2CC equal BW |
| 1/3 | 4.8 | POWER\_HEADROOM\_38 (5  PH  6) | 1.2 | 2CC 50+100 MHz CC1 |
| 2/3 | 1.8 | POWER\_HEADROOM\_35 (2  PH  3) | 1.2 | 2CC 50+100 MHz CC2 |
| 1/5 | 7.0 | POWER\_HEADROOM\_40 (7  PH  8) | 1.0 | 2CC 50+200 MHz CC1 |
| 4/5 | 1.0 | POWER\_HEADROOM\_34 (1  PH  2) | 1.0 | 2CC 50+200 MHz CC2 |
| 1/9 | 9.5 | POWER\_HEADROOM\_43 (10  PH  11) | 1.5 | 2CC 50+400 MHz CC1 |
| 8/9 | 0.5 | POWER\_HEADROOM\_34 (1  PH  2) | 1.5 | 2CC 50+400 MHz CC2 |
| Note 1: The BW ratio is the ratio of BW of the CC over the total Aggregated UL BW  Note 2: Xmax = 10log(BW ratio)  Note 3: ΔPHR is the worst case UE output power decrease due to Xmax and 1 dB reporting granularity of PHR according to TS38.133 [25]. | | | | |

7c. For testing single CC MPR requirement: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

9. Measure UE EIRP in the Tx beam peak direction in the accumulative aggregated channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in 6.2A.2.1.5. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

10. Apply the test step based on the 5G NR UE Release:

10a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

10b. For Release 15 5G NR UEs: No action.

10c. For testing single CC MPR requirement: No action.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.2A.2.1.4.1-1 to Table 6.2A.2.1.4.1-7, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.2A.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for Release 15 5G NR UE.

Table 6.2A.2.1.4.3-1: PUSCH-PowerControl

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-120 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-PowerControl ::= SEQUENCE { |  |  |  |
| p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE { | 1 entry |  |  |
| P0-PUSCH-AlphaSet[1] SEQUENCE { |  |  |  |
| alpha | alpha0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.2.1.4.3-2: *PUSCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -4 |  | 50 MHz |
| p0-NominalWithGrant | -8 |  | 100 MHz |
| p0-NominalWithGrant | -10 |  | 200 MHz |
| p0-NominalWithGrant | -14 |  | 400 MHz |
| } |  |  |  |

Table 6.2A.2.1.4.3-3: BSR-Config (Rel-15 UE only)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| BSR-Config ::= SEQUENCE { |  |  |  |
| periodicBSR-Timer | infinity |  |  |
| retxBSR-Timer | sf80 |  |  |
| logicalChannelSR-DelayTimer | Not present |  |  |
| } |  |  |  |

6.2A.2.1.5 Test requirement

The EIRP derived in step 8 shall be within the range prescribed by the nominal maximum output power and tolerance in the applicable table from Table 6.2A.2.1.5-1 to Table 6.2A.2.1.5-17.

Table 6.2A.2.1.5-1: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, MPRnarrow)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n257, n258, n261 | 40.0 | 14.4 | [7.0] | [18.6]-TT | 55 |
| 1 | n260 | 38.0 | 14.4 | [7.0] | [16.6]-TT | 55 |
| 2 | n257, n258, n261 | 40.0 | 14.4 | [7.0] | [18.6]-TT | 55 |
| 2 | n260 | 38.0 | 14.4 | [7.0] | [16.6]-TT | 55 |
| 3 | n257, n258, n261 | 40.0 | 10 | [5] | [25.0]-TT | 55 |
| 3 | n260 | 38.0 | 10 | [5] | [23.0]-TT | 55 |
| 4 | n257, n258, n261 | 40.0 | 10 | [5] | [25.0]-TT | 55 |
| 4 | n260 | 38.0 | 10 | [5] | [23.0]-TT | 55 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-5. | | | | | | |

Table 6.2A.2.1.5-2: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXG, CA\_nXO Configuration (Cumulative aggregated BWchannel <= 200MHz) | | | | | | |
| 1 | n257, n258, n261 | 40.0 | 5.5 | [5.0] | [29.5]-TT | 55 |
| 1 | n260 | 38.0 | 5.5 | [5.0] | [27.5]-TT | 55 |
| 2 | n257, n258, n261 | 40.0 | 3.0 | [2.0] | [35.0]-TT | 55 |
| 2 | n260 | 38.0 | 3.0 | [2.0] | [33.0]-TT | 55 |
| Test requirements for a CA\_nXD Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 40.0 | 5.5 | [5.0] | [29.5]-TT | 55 |
| 1 | n260 | 38.0 | 5.5 | [5.0] | [27.5]-TT | 55 |
| 2 | n257, n258, n261 | 40.0 | 3.0 | [2.0] | [35.0]-TT | 55 |
| 2 | n260 | 38.0 | 3.0 | [2.0] | [33.0]-TT | 55 |
| 3 | n257, n258, n261 | 40.0 | 3.5 | [3.0] | [33.5]-TT | 55 |
| 3 | n260 | 38.0 | 3.5 | [3.0] | [31.5]-TT | 55 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-5. | | | | | | |

Table 6.2A.2.1.5-3: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, MPRC\_CA)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXB, CA\_nXC\_UL\_nXB Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | n257, n258, n261 | 40.0 | 8.2 | [5.0] | [26.8]-TT | 55 |
| 1 | n260 | 38.0 | 8.2 | [5.0] | [24.8]-TT | 55 |
| 2 | n257, n258, n261 | 40.0 | 9.7 | [5.0] | [25.3]-TT | 55 |
| 2 | n260 | 38.0 | 9.7 | [5.0] | [23.3]-TT | 55 |
| 3 | n257, n258, n261 | 40.0 | 9.2 | [5.0] | [25.8]-TT | 55 |
| 3 | n260 | 38.0 | 9.2 | [5.0] | [23.8]-TT | 55 |
| 4 | n257, n258, n261 | 40.0 | 8.7 | [5.0] | [26.3]-TT | 55 |
| 4 | n260 | 38.0 | 8.7 | [5.0] | [24.3]-TT | 55 |
| 5 | n257, n258, n261 | 40.0 | 11.2 | [7.0] | [21.8]-TT | 55 |
| 5 | n260 | 38.0 | 11.2 | [7.0] | [19.8]-TT | 55 |
| Test requirements for a CA\_nXD, CA\_nXB Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | n257, n258, n261 | 40.0 | 7.7 | [5.0] | [27.3]-TT | 55 |
| 1 | n260 | 38.0 | 7.7 | [5.0] | [25.3]-TT | 55 |
| 2 | n257, n258, n261 | 40.0 | 8.7 | [5.0] | [26.3]-TT | 55 |
| 2 | n260 | 38.0 | 8.7 | [5.0] | [24.3]-TT | 55 |
| 3 | n257, n258, n261 | 40.0 | 10.7 | [7.0] | [22.3]-TT | 55 |
| 3 | n260 | 38.0 | 10.7 | [7.0] | [20.3]-TT | 55 |
| Test requirements for a CA\_nXG, CA\_nXO, CA\_nXD Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 40.0 | 5.5 | [5.0] | [29.5]-TT | 55 |
| 1 | n260 | 38.0 | 5.5 | [5.0] | [27.5]-TT | 55 |
| 2 | n257, n258, n261 | 40.0 | 6.5 | [5.0] | [28.5]-TT | 55 |
| 2 | n260 | 38.0 | 6.5 | [5.0] | [26.5]-TT | 55 |
| 3 | n257, n258, n261 | 40.0 | 9.0 | [5.0] | [26.0]-TT | 55 |
| 3 | n260 | 38.0 | 9.0 | [5.0] | [24.0]-TT | 55 |
| Test requirements for a CA\_nX(D-G)\_UL\_nXD, CA\_nX(D-G)\_UL\_nXG, CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXO, CA\_nX(D-H)\_UL\_nXD, CA\_nX(D-P)\_UL\_nXD, CA\_nX(E-O)\_UL\_nXO, CA\_nX(D-I)\_UL\_nXD, CA\_nX(D-Q)\_UL\_nXD, CA\_nX(G-I)\_UL\_nXG Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | n257, n258, n261 | 40.0 | 8.2 | [5.0] | [26.8] –TT | 55 |
| 1 | n260 | 38.0 | 8.2 | [5.0] | [24.8] –TT | 55 |
| 2 | n257, n258, n261 | 40.0 | 9.7 | [5.0] | [25.3] –TT | 55 |
| 2 | n260 | 38.0 | 9.7 | [5.0] | [23.3] –TT | 55 |
| 3 | n257, n258, n261 | 40.0 | 9.2 | [5.0] | [25.8] –TT | 55 |
| 3 | n260 | 38.0 | 9.2 | [5.0] | [23.8] –TT | 55 |
| 4 | n257, n258, n261 | 40.0 | 8.7 | [5.0] | [26.3] –TT | 55 |
| 4 | n260 | 38.0 | 8.7 | [5.0] | [24.3] –TT | 55 |
| 5 | n257, n258, n261 | 40.0 | 11.2 | [7.0] | [21.8] –TT | 55 |
| 5 | n260 | 38.0 | 11.2 | [7.0] | [19.8] –TT | 55 |
| Test requirements for a CA\_nX(D-G)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-G)\_UL\_nXG, CA\_nX(D-O)\_UL\_nXO, CA\_nX(D-H)\_UL\_nXD, CA\_nX(D-P)\_UL\_nXD, CA\_nX(O-E)\_UL\_nXO, CA\_nX(D-I)\_UL\_nXD, CA\_nX(D-Q)\_UL\_nXD, CA\_nX(G-I)\_UL\_nXG Configuration (400MHz <= Cumulative aggregated BWchannel <800MHz) | | | | | | |
| 1 | n257, n258, n261 | 40.0 | 7.7 | [5.0] | [27.3]-TT | 55 |
| 1 | n260 | 38.0 | 7.7 | [5.0] | [25.3]-TT | 55 |
| 2 | n257, n258, n261 | 40.0 | 8.7 | [5.0] | [26.3]-TT | 55 |
| 2 | n260 | 38.0 | 8.7 | [5.0] | [24.3]-TT | 55 |
| 3 | n257, n258, n261 | 40.0 | 10.7 | [7.0] | [22.3]-TT | 55 |
| 3 | n260 | 38.0 | 10.7 | [7.0] | [20.3]-TT | 55 |
| Test requirements for a CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXO Configuration (Cumulative aggregated BWchannel <400MHz) | | | | | | |
| 1 | n257, n258, n261 | 40.0 | 5.5 | [5.0] | [29.5]-TT | 55 |
| 1 | n260 | 38.0 | 5.5 | [5.0] | [27.5]-TT | 55 |
| 2 | n257, n258, n261 | 40.0 | 6.5 | [5.0] | [28.5]-TT | 55 |
| 2 | n260 | 38.0 | 6.5 | [5.0] | [26.5]-TT | 55 |
| 3 | n257, n258, n261 | 40.0 | 9.0 | [5.0] | [26.0]-TT | 55 |
| 3 | n260 | 38.0 | 9.0 | [5.0] | [24.0]-TT | 55 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-5. | | | | | | |

Table 6.2A.2.1.5-4: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, Non-contiguous allocation)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXB, CA\_nXD, CA\_XG, CA\_nXO Configuration | | | | | | |
| 1 | n257, n258, n261 | 40.0 | [14.4] | [7.0] | [18.6] –TT | 55 |
| 1 | n260 | 38.0 | [14.4] | [7.0] | [16.6] –TT | 55 |
| 2 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS |
| 2 | n260 | FFS | FFS | FFS | FFS | FFS |
| 3 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS |
| 3 | n260 | FFS | FFS | FFS | FFS | FFS |
| Test requirements for a CA\_nX(D-G), CA\_nX(D-O) Configuration | | | | | | |
| 1 | n257, n258, n261 | 40.0 | [14.4] | [7.0] | [18.6] –TT | 55 |
| 1 | n260 | 38.0 | [14.4] | [7.0] | [16.6] –TT | 55 |
| 2 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS |
| 2 | n260 | FFS | FFS | FFS | FFS | FFS |
| 3 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS |
| 3 | n260 | FFS | FFS | FFS | FFS | FFS |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-5. | | | | | | |

Table 6.2A.2.1.5-5: Test Tolerance (MPR for CA for Power class 1)

FFS

Table 6.2A.2.1.5-6: MPR requirements for Intra-band Contiguous UL CA (Power Class 2, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXG, CA\_nXO Configuration (Cumulative aggregated BWchannel <= 200MHz) | | | | | | |
| 1 | n257, n258, n261 | 29 | 0 | 0 | 29.0-TT | 43 |
| 2 | n257, n258, n261 | 29 | 2 | [1.5] | [25.5]-TT | 43 |
| Test requirements for a CA\_nXD Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 29 | 0 | 0 | 29.0-TT | 43 |
| 2 | n257, n258, n261 | 29 | 3 | [2.0] | [24.0]-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-9. | | | | | | |

Table 6.2A.2.1.5-7: MPR requirements for Intra-band Contiguous UL CA (Power Class 2, MPRC\_CA)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXB, nXC\_UL\_nXB Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | n257, n258, n261 | 29 | 8.2 | [5.0] | [15.8]-TT | 43 |
| 2 | n257, n258, n261 | 29 | 9.3 | [5.0] | [14.7]-TT | 43 |
| 3 | n257, n258, n261 | 29 | 8.0 | [5.0] | [16.0]-TT | 43 |
| 4 | n257, n258, n261 | 29 | 9.2 | [5.0] | [14.8]-TT | 43 |
| 5 | n257, n258, n261 | 29 | 11.2 | [7.0] | [10.8]-TT | 43 |
| Test requirements for a CA\_nXD, CA\_nXB Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | n257, n258, n261 | 29 | 7.7 | [5.0] | [16.3]-TT | 43 |
| 2 | n257, n258, n261 | 29 | 7.5 | [5.0] | [16.5]-TT | 43 |
| 3 | n257, n258, n261 | 29 | 8.7 | [5.0] | [15.3]-TT | 43 |
| 4 | n257, n258, n261 | 29 | 10.7 | [7.0] | [11.3]-TT | 43 |
| Test requirements for a CA\_nXG, CA\_nXO, CA\_nXD Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 29 | 5 | [4.0] | [20.0]-TT | 43 |
| 2 | n257, n258, n261 | 29 | 6.5 | [5.0] | [17.5]-TT | 43 |
| 3 | n257, n258, n261 | 29 | 9 | [5.0] | [15.0]-TT | 43 |
| Test requirements for a CA\_nX(D-G) )\_UL\_nXD, CA\_nX(D-G)\_UL\_nXG, CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXO, CA\_nX(D-H)\_UL\_nXD, CA\_nX(D-P)\_UL\_nXD, CA\_nX(E-O)\_UL\_nXO, CA\_nX(D-I)\_UL\_nXD, CA\_nX(D-Q)\_UL\_nXD, CA\_nX(G-I)\_UL\_nXG Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | n257, n258, n261 | 29 | 8.2 | [5.0] | [15.8]-TT | 43 |
| 2 | n257, n258, n261 | 29 | 9.3 | [5.0] | [14.7]-TT | 43 |
| 3 | n257, n258, n261 | 29 | 8.0 | [5.0] | [16.0]-TT | 43 |
| 4 | n257, n258, n261 | 29 | 9.2 | [5.0] | [14.8]-TT | 43 |
| 5 | n257, n258, n261 | 29 | 11.2 | [7.0] | [10.8]-TT | 43 |
| Test requirements for a CA\_nX(D-G)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-G)\_UL\_nXG, CA\_nX(D-O)\_UL\_nXO, CA\_nX(D-H)\_UL\_nXD, CA\_nX(D-P)\_UL\_nXD, CA\_nX(O-E)\_UL\_nXO, CA\_nX(D-I)\_UL\_nXD, CA\_nX(D-Q)\_UL\_nXD, CA\_nX(G-I)\_UL\_nXG Configuration (400MHz <= Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | n257, n258, n261 | 29 | 7.7 | [5.0] | [16.3]-TT | 43 |
| 2 | n257, n258, n261 | 29 | 7.5 | [5.0] | [16.5]-TT | 43 |
| 3 | n257, n258, n261 | 29 | 8.7 | [5.0] | [15.3]-TT | 43 |
| 4 | n257, n258, n261 | 29 | 10.7 | [7.0] | [11.3]-TT | 43 |
| Test requirements for a CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXO Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 29 | 7.7 | [5.0] | [16.3]-TT | 43 |
| 2 | n257, n258, n261 | 29 | 7.5 | [5.0] | [16.5]-TT | 43 |
| 3 | n257, n258, n261 | 29 | 8.7 | [5.0] | [15.3]-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-9. | | | | | | |

Table 6.2A.2.1.5-8: MPR requirements for Intra-band Contiguous UL CA (Power Class 2, Non-contiguous allocation)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXB, CA\_nXD, CA\_XG, CA\_nXO Configuration | | | | | | |
| 1 | n257, n258, n261 | 29 | 7 | [5.0] | [17.0] –TT | 43 |
| 2 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS |
| 3 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-9. | | | | | | |

Table 6.2A.2.1.5-9: Test Tolerance (MPR for CA for Power class 2)

FFS

Table 6.2A.2.1.5-10: MPR requirements for Intra-band Contiguous UL CA (Power Class 3, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXG, CA\_nXO Configuration (Cumulative aggregated BWchannel <= 200MHz) | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 0 | 0 | 22.4-TT | 43 |
| 1 | n260 | 20.6 | 0 | 0 | 20.6-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 2 | 1.5 | 18.9-TT | 43 |
| 2 | n260 | 20.6 | 2 | 1.5 | 17.1-TT | 43 |
| Test requirements for a CA\_nXD Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 0 | 0 | 22.4-TT | 43 |
| 1 | n260 | 20.6 | 0 | 0 | 20.6-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 3 | 2.0 | 17.4-TT | 43 |
| 2 | n260 | 20.6 | 3 | 2.0 | 15.6-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-13. | | | | | | |

Table 6.2A.2.1.5-11: MPR requirements for Intra-band Contiguous UL CA (Power Class 3, MPRC\_CA)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | Lower limit for test procedure with UPLF test mode (variant a, Rel-16 and later) | | Lower limit for test procedure with PHR (variant b, Rel-15 only) | | Upper limit (dBm) |
| T(MPR) (dB) | Lower limit (dBm) | T(MPR+ ΔPHR) (dB) | Lower limit PHR(dBm) |
| Test requirements for a CA\_nXB, nXC\_UL\_nXB Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 8.2 | 5.0 | 9.2-TT | 5.0 | 9.2-ΔPHR-TT | 43 |
| 1 | n260 | 20.6 | 8.2 | 5.0 | 7.4-TT | 5.0 | 7.4- ΔPHR-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 9.3 | 5.0 | 8.1-TT | 5.0+2 | 6.1- ΔPHR-TT | 43 |
| 2 | n260 | 20.6 | 9.3 | 5.0 | 6.3-TT | 5.0+2 | 4.3- ΔPHR-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 8.0 | 5.0 | 9.4-TT | 5.0 | 9.4- ΔPHR-TT | 43 |
| 3 | n260 | 20.6 | 8.0 | 5.0 | 7.6-TT | 5.0 | 7.6- ΔPHR-TT | 43 |
| 4 | n257, n258, n261 | 22.4 | 9.2 | 5.0 | 8.2-TT | 5.0+2 | 6.2- ΔPHR-TT | 43 |
| 4 | n260 | 20.6 | 9.2 | 5.0 | 6.4-TT | 5.0+2 | 4.4- ΔPHR-TT | 43 |
| 5 | n257, n258, n261 | 22.4 | 11.2 | 7.0 | 4.2-TT | 7.0 | 4.2- ΔPHR-TT | 43 |
| 5 | n260 | 20.6 | 11.2 | 7.0 | 2.4-TT | 7.0] | 2.4- ΔPHR-TT | 43 |
| Test requirements for a CA\_nXD, CA\_nXE\_UL\_nXD, CA\_nXF\_UL\_nXD, CA\_nXB Configuration (Cumulative aggregated BWchannel < 800MHz) | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 7.7 | 5.0 | 9.7-TT | 5.0 | 9.7- ΔPHR-TT | 43 |
| 1 | n260 | 20.6 | 7.7 | 5.0 | 7.9-TT | 5.0 | 7.9- ΔPHR-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 7.5 | 5.0 | 9.9-TT | 5.0 | 9.9- ΔPHR-TT | 43 |
| 2 | n260 | 20.6 | 7.5 | 5.0 | 8.1-TT | 5.0 | 8.1- ΔPHR-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 8.7 | 5.0 | 8.7-TT | 5.0 | 8.7- ΔPHR-TT | 43 |
| 3 | n260 | 20.6 | 8.7 | 5.0 | 6.9-TT | 5.0 | 6.9- ΔPHR-TT | 43 |
| 4 | n257, n258, n261 | 22.4 | 10.7 | 7.0 | 4.7-TT | 7.0 | 4.7- ΔPHR-TT | 43 |
| 4 | n260 | 20.6 | 10.7 | 7.0 | 2.9-TT | 7.0 | 2.9- ΔPHR-TT | 43 |
| Test requirements for a CA\_nXG, CA\_nXO, CA\_nXD Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 5 | 4.0 | 13.4-TT | 4.0+1 | 12.4- ΔPHR-TT | 43 |
| 1 | n260 | 20.6 | 5 | 4.0 | 11.6-TT | 4.0+1 | 10.6- ΔPHR-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 6.5 | 5.0 | 10.9-TT | 5.0 | 10.9- ΔPHR-TT | 43 |
| 2 | n260 | 20.6 | 6.5 | 5.0 | 9.1-TT | 5.0 | 9.1- ΔPHR-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 9 | 5.0 | 8.4-TT | 5.0 | 8.4- ΔPHR-TT | 43 |
| 3 | n260 | 20.6 | 9 | 5.0 | 6.6-TT | 5.0 | 6.6- ΔPHR-TT | 43 |
| Test requirements for a CA\_nX(D-A) )\_UL\_nXD, CA\_nX(A-G)\_UL\_nXG, CA\_nX(A-O)\_UL\_nXO Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 8.2 | 5.0 | 9.2-TT | 5.0 | 9.2- ΔPHR-TT | 43 |
| 1 | n260 | 20.6 | 8.2 | 5.0 | 7.4-TT | 5.0 | 7.4- ΔPHR-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 9.3 | 5.0 | 8.1-TT | 5.0+2 | 6.1- ΔPHR-TT | 43 |
| 2 | n260 | 20.6 | 9.3 | 5.0 | 6.3-TT | 5.0+2 | 4.3- ΔPHR-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 8.0 | 5.0 | 9.4-TT | 5.0 | 9.4- ΔPHR-TT | 43 |
| 3 | n260 | 20.6 | 8.0 | 5.0 | 7.6-TT | 5.0 | 7.6- ΔPHR-TT | 43 |
| 4 | n257, n258, n261 | 22.4 | 9.2 | 5.0 | 8.2-TT | 5.0+2 | 6.2- ΔPHR-TT | 43 |
| 4 | n260 | 20.6 | 9.2 | 5.0 | 6.4-TT | 5.0+2 | 4.4- ΔPHR-TT | 43 |
| 5 | n257, n258, n261 | 22.4 | 11.2 | 7.0 | 4.2-TT | 7.0 | 4.2- ΔPHR-TT | 43 |
| 5 | n260 | 20.6 | 11.2 | 7.0 | 2.4-TT | 7.0 | 2.4- ΔPHR-TT | 43 |
| Test requirements for a CA\_nX(D-A)\_UL\_nXD, CA\_nX(A-G)\_UL\_nXG, CA\_nX(A-O) Configuration (Cumulative aggregated BWchannel < 800MHz) | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 7.7 | [5.0] | 9.7-TT | 5.0 | 9.7- ΔPHR-TT | 43 |
| 1 | n260 | 20.6 | 7.7 | [5.0] | 7.9-TT | 5.0 | 7.9- ΔPHR-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 7.5 | [5.0] | 9.9-TT | 5.0 | 9.9- ΔPHR-TT | 43 |
| 2 | n260 | 20.6 | 7.5 | [5.0] | 8.1-TT | 5.0 | 8.1- ΔPHR-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 8.7 | [5.0] | 8.7-TT | 5.0 | 8.7- ΔPHR-TT | 43 |
| 3 | n260 | 20.6 | 8.7 | [5.0] | 6.9-TT | 5.0 | 6.9- ΔPHR-TT | 43 |
| 4 | n257, n258, n261 | 22.4 | 10.7 | [7.0] | 4.7-TT | 7.0 | 4.7- ΔPHR-TT | 43 |
| 4 | n260 | 20.6 | 10.7 | [7.0] | 2.9-TT | 7.0 | 2.9- ΔPHR-TT | 43 |
| Test requirements for a CA\_nX(D-A)\_UL\_nXD, CA\_nX(A-O)\_UL\_nXO Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 5 | 4.0 | 13.4-TT | 4.0+1 | 12.4- ΔPHR-TT | 43 |
| 1 | n260 | 20.6 | 5 | 4.0 | 11.6-TT | 4.0+1 | 10.6- ΔPHR-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 6.5 | 5.0 | 10.9-TT | 5.0 | 10.9- ΔPHR-TT | 43 |
| 2 | n260 | 20.6 | 6.5 | 5.0 | 9.1-TT | 5.0 | 9.1- ΔPHR-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 9 | 5.0 | 8.4-TT | 5.0 | 8.4- ΔPHR-TT | 43 |
| 3 | n260 | 20.6 | 9 | 5.0 | 6.6-TT | 5.0 | 6.6- ΔPHR-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-13.  NOTE 2: ΔPHR is defined in Table 6.2A.2.1.4.2-1  NOTE 3: test procedure with PHR (variant b) | | | | | | | | |

Table 6.2A.2.1.5-12: MPR requirements for Intra-band Contiguous UL CA (Power Class 3, Non-contiguous allocation)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | Lower limit for test procedure with UPLF test mode (variant a) | | Lower limit for test procedure with PHR (variant b) | | Upper limit (dBm) |
| T(MPR) (dB) | Lower limit (dBm) | T(MPR+ ΔPHR) (dB) | Lower limit PHR(dBm) |
| Test requirements for a CA\_nXB, CA\_nXD, CA\_XG, CA\_nXO Configuration | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 7 | [5.0] | [10.4]-TT | [5.0] | [10.4]- ΔPHR -TT | 43 |
| 1 | n260 | 20.6 | 7 | [5.0] | [8.6]-TT | [5.0] | [8.6]- ΔPHR -TT | 43 |
| 2 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS | FFS | FFS |
| 2 | n260 | FFS | FFS | FFS | FFS | FFS | FFS | FFS |
| 3 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS | FFS | FFS |
| 3 | n260 | FFS | FFS | FFS | FFS | FFS | FFS | FFS |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-13.  NOTE 2: ΔPHR is defined in Table 6.2A.2.1.4.2-1 | | | | | | | | |

Table 6.2A.2.1.5-13: Test Tolerance (MPR for CA for Power class 3) (Aggregated UL BW ≤ 400MHz)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 3.11 dB | 3.11 dB |

Table 6.2A.2.1.5-14: MPR requirements for Intra-band Contiguous UL CA (Power Class 4, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXG, CA\_nXO Configuration (Cumulative aggregated BWchannel <= 200MHz) | | | | | | |
| 1 | n257, n258, n261 | 34 | 0 | 0 | 34.0-TT | 43 |
| 1 | n260 | 31 | 0 | 0 | 31.0-TT | 43 |
| 2 | n257, n258, n261 | 34 | 2 | [1.5] | [30.5]-TT | 43 |
| 2 | n260 | 31 | 2 | [1.5] | [27.5]-TT | 43 |
| Test requirements for a CA\_nXD Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 34 | 0 | 0 | 34.0-TT | 43 |
| 1 | n260 | 31 | 0 | 0 | 31.0-TT | 43 |
| 2 | n257, n258, n261 | 34 | 3 | [2.0] | [29.0]-TT | 43 |
| 2 | n260 | 31 | 3 | [2.0] | [26.0]-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-17. | | | | | | |

Table 6.2A.2.1.5-15: MPR requirements for Intra-band Contiguous UL CA (Power Class 4, MPRC\_CA)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXB, nXC\_UL\_nXB Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | n257, n258, n261 | 34 | 8.2 | [5.0] | [20.8]-TT | 43 |
| 1 | n260 | 31 | 8.2 | [5.0] | [17.8]-TT | 43 |
| 2 | n257, n258, n261 | 34 | 9.3 | [5.0] | [19.7]-TT | 43 |
| 2 | n260 | 31 | 9.3 | [5.0] | [16.7]-TT | 43 |
| 3 | n257, n258, n261 | 34 | 8.0 | [5.0] | [21.0]-TT | 43 |
| 3 | n260 | 31 | 8.0 | [5.0] | [18.0]-TT | 43 |
| 4 | n257, n258, n261 | 34 | 9.2 | [5.0] | [19.8]-TT | 43 |
| 4 | n260 | 31 | 9.2 | [5.0] | [16.8]-TT | 43 |
| 5 | n257, n258, n261 | 34 | 11.2 | [7.0] | [15.8]-TT | 43 |
| 5 | n260 | 31 | 11.2 | [7.0] | [12.8]-TT | 43 |
| Test requirements for a CA\_nXD, CA\_nXB Configuration (Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | n257, n258, n261 | 34 | 7.7 | [5.0] | [21.3]-TT | 43 |
| 1 | n260 | 31 | 7.7 | [5.0] | [18.3]-TT | 43 |
| 2 | n257, n258, n261 | 34 | 7.5 | [5.0] | [21.5]-TT | 43 |
| 2 | n260 | 31 | 7.5 | [5.0] | [18.5]-TT | 43 |
| 3 | n257, n258, n261 | 34 | 8.7 | [5.0] | [20.3]-TT | 43 |
| 3 | n260 | 31 | 8.7 | [5.0] | [17.3]-TT | 43 |
| 4 | n257, n258, n261 | 34 | 10.7 | [7.0] | [16.3]-TT | 43 |
| 4 | n260 | 31 | 10.7 | [7.0] | [13.3]-TT | 43 |
| Test requirements for a CA\_nXG, CA\_nXO, CA\_nXD Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 34 | 5 | [4.0] | [25.0]-TT | 43 |
| 1 | n260 | 31 | 5 | [4.0] | [22.0]-TT | 43 |
| 2 | n257, n258, n261 | 34 | 6.5 | [5.0] | [22.5]-TT | 43 |
| 2 | n260 | 31 | 6.5 | [5.0] | [19.5]-TT | 43 |
| 3 | n257, n258, n261 | 34 | 9 | [5.0] | [20.0]-TT | 43 |
| 3 | n260 | 31 | 9 | [5.0] | [17.0]-TT | 43 |
| Test requirements for a CA\_nX(D-G) )\_UL\_nXD, CA\_nX(D-G)\_UL\_nXG, CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXO, CA\_nX(D-H)\_UL\_nXD, CA\_nX(D-P)\_UL\_nXD, CA\_nX(E-O)\_UL\_nXO, CA\_nX(D-I)\_UL\_nXD, CA\_nX(D-Q)\_UL\_nXD, CA\_nX(G-I)\_UL\_nXG Configuration (800MHz <= Cumulative aggregated BWchannel <= 1400MHz) | | | | | | |
| 1 | n257, n258, n261 | 34 | 8.2 | [5.0] | [20.8]-TT | 43 |
| 1 | n260 | 31 | 8.2 | [5.0] | [17.8]-TT | 43 |
| 2 | n257, n258, n261 | 34 | 9.3 | [5.0] | [19.7]-TT | 43 |
| 2 | n260 | 31 | 9.3 | [5.0] | [16.7]-TT | 43 |
| 3 | n257, n258, n261 | 34 | 8.0 | [5.0] | [21.0]-TT | 43 |
| 3 | n260 | 31 | 8.0 | [5.0] | [18.0]-TT | 43 |
| 4 | n257, n258, n261 | 34 | 9.2 | [5.0] | [19.8]-TT | 43 |
| 4 | n260 | 31 | 9.2 | [5.0] | [16.8]-TT | 43 |
| 5 | n257, n258, n261 | 34 | 11.2 | [7.0] | [15.8]-TT | 43 |
| 5 | n260 | 31 | 11.2 | [7.0] | [12.8]-TT | 43 |
| Test requirements for a CA\_nX(D-G)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-G)\_UL\_nXG, CA\_nX(D-O)\_UL\_nXO, CA\_nX(D-H)\_UL\_nXD, CA\_nX(D-P)\_UL\_nXD, CA\_nX(O-E)\_UL\_nXO, CA\_nX(D-I)\_UL\_nXD, CA\_nX(D-Q)\_UL\_nXD, CA\_nX(G-I)\_UL\_nXG Configuration (Cumulative aggregated BWchannel < 800MHz) | | | | | | |
| 1 | n257, n258, n261 | 34 | 7.7 | [5.0] | [21.3]-TT | 43 |
| 1 | n260 | 31 | 7.7 | [5.0] | [18.3]-TT | 43 |
| 2 | n257, n258, n261 | 34 | 7.5 | [5.0] | [21.5]-TT | 43 |
| 2 | n260 | 31 | 7.5 | [5.0] | [18.5]-TT | 43 |
| 3 | n257, n258, n261 | 34 | 8.7 | [5.0] | [20.3]-TT | 43 |
| 3 | n260 | 31 | 8.7 | [5.0] | [17.3]-TT | 43 |
| 4 | n257, n258, n261 | 34 | 10.7 | [7.0] | [16.3]-TT | 43 |
| 4 | n260 | 31 | 10.7 | [7.0] | [13.3]-TT | 43 |
| Test requirements for a CA\_nX(D-O)\_UL\_nXD, CA\_nX(D-O)\_UL\_nXO Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 34 | 5 | [4.0] | [25.0]-TT | 43 |
| 1 | n260 | 31 | 5 | [4.0] | [22.0]-TT | 43 |
| 2 | n257, n258, n261 | 34 | 6.5 | [5.0] | [22.5]-TT | 43 |
| 2 | n260 | 31 | 6.5 | [5.0] | [19.5]-TT | 43 |
| 3 | n257, n258, n261 | 34 | 9 | [5.0] | [20.0]-TT | 43 |
| 3 | n260 | 31 | 9 | [5.0] | [17.0]-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-17. | | | | | | |

Table 6.2A.2.1.5-16: MPR requirements for Intra-band Contiguous UL CA (Power Class 4, Non-contiguous allocation)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXB, CA\_nXD, CA\_XG, CA\_nXO Configuration | | | | | | |
| 1 | n257, n258, n261 | 34 | 7 | [5.0] | [22.0]-TT | 43 |
| 1 | n260 | 31 | 7 | [5.0] | [19.0]-TT | 43 |
| 2 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS |
| 2 | n260 | FFS | FFS | FFS | FFS | FFS |
| 3 | n257, n258, n261 | FFS | FFS | FFS | FFS | FFS |
| 3 | n260 | FFS | FFS | FFS | FFS | FFS |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-17. | | | | | | |

Table 6.2A.2.1.5-17: Test Tolerance (MPR for CA for Power class 4)

FFS

#### 6.2A.2.2 UE maximum output power reduction for CA (3UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

- The UPLF test mode is applicable to UEs Release 16 and forward.

- This test case is incomplete for Power classes 1, 2, 4 Release 15.

* For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

- Whether additional check is needed in the test procedure to ensure UE continues transmissions on the SCell is FFS

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and intra-band non-contiguous CA are TBD.

- The test points for higher bandwidth classes with testability problem need an update to decrease the UL bandwidth until they become testable.

- This test case is incomplete for intra-band non-contiguous CA

6.2A.2.2.1 Test purpose

The number of RB identified in 6.2.2.3 is based on meeting the requirements for the maximum power reduction (MPR) due to Cubic Metric (CM).

6.2A.2.2.2 Test applicability

The requirements of this test apply to all types of NR UE release 15 and forward supporting 3UL CA.

6.2A.2.2.3 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2A.2.

6.2A.2.2.4 Test description

6.2A.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, and CC combinations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration and subcarrier spacing, are shown in Table 6.2A.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 6.2A.2.2.4.1-1: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, MPRnarrow)

FFS

Table 6.2A.2.2.4.1-2: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, single CC MPR requirement)

FFS

Table 6.2A.2.2.4.1-3: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, MPRC\_CA)

FFS

Table 6.2A.2.2.4.1-4: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, Non-contiguous allocation)

FFS

Table 6.2A.2.2.4.1-5: Intra-band Contiguous UL CA Test Configuration Table (Power Class 2, 3 and 4, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low range, High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_nXH Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC/CC2 |  |  |  | - | - |
| SCC/CC3 |  |  |  | - | - |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  |  | - | - |
| SCC/CC3 |  |  |  | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10]. | | | | | | |

Table 6.2A.2.2.4.1-6: Intra-band Contiguous UL CA Test Configuration Table (Power Class 2, 3 and 4, MPRC\_CA)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for different CA bandwidth classes | | | | For intra-band contiguous CA: Mid range.  For intra-band non-contiguous CA: FFS | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_nXE, CA\_nXF\_UL\_nXE Configuration (400MHz <= Cumulative aggregated BWchannel <= 800MHz) | | | | | | |
| 1 | PCC/CC1 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC2/CC3 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| 2 | PCC/CC1 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| SCC2/CC3 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| 3 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC2/CC3 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| 4 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC2/CC3 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXH Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| SCC/CC3 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| 2 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC3 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC3 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10]. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2A.2.2.4.1-1 to Table 6.2A.2.2.4.1-6.

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 [10] clause 4.5. Message contents are defined in clause 6.2A.2.2.4.3.

6.2A.2.2.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 and Annex C.3.0 for all downlink physical channels

2. The SS shall configure SCC as per TS 38.508-1 [10] subclause 5.5.1 Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in subclause 6.2A.2.2.4.3.

3. Apply the test step based on the 5G NR UE Release:

3a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS applies a backoff on the PCell powerby activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using TOTAL NR AGGREGATED BANDWIDTH and PCELL NR bandwidth as per Test CC Combination setting. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

3b. For Release 15 5G NR UEs: No action.

3c. For testing single CC MPR requirement: No action.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321, clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 Table 6.2A.2.2.4.1-1 to Table 6.2A.2.1.4.1-6. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Apply the test step based on the 5G NR UE Release:

7a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.2.2.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

Table 6.2A.2.2.4.2-1: Power target values per UL CC for test procedure using PHR

FFS

7c. For testing single CC MPR requirement: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

9. Measure UE EIRP in the Tx beam peak direction in the accumulative aggregated channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in 6.2A.2.1.5. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

10. Apply the test step based on the 5G NR UE Release:

10a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

10b. For Release 15 5G NR UEs: No action.

10c. For testing single CC MPR requirement: No action.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.2A.2.2.4.1-1 to Table 6.2A.2.2.4.1-6, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.2A.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for Release 15 5G NR UE.

Table 6.2A.2.2.4.3-1: PUSCH-PowerControl

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-120 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-PowerControl ::= SEQUENCE { |  |  |  |
| p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE { | 1 entry |  |  |
| P0-PUSCH-AlphaSet[1] SEQUENCE { |  |  |  |
| alpha | alpha0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.2.2.4.3-2: *PUSCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -4 |  | 50 MHz |
| p0-NominalWithGrant | -8 |  | 100 MHz |
| p0-NominalWithGrant | -10 |  | 200 MHz |
| p0-NominalWithGrant | -14 |  | 400 MHz |
| } |  |  |  |

Table 6.2A.2.2.4.3-3: BSR-Config (Rel-15 UE only)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| BSR-Config ::= SEQUENCE { |  |  |  |
| periodicBSR-Timer | infinity |  |  |
| retxBSR-Timer | sf80 |  |  |
| logicalChannelSR-DelayTimer | Not present |  |  |
| } |  |  |  |

6.2A.2.2.5 Test requirement

The EIRP derived in step 8 shall be within the range prescribed by the nominal maximum output power and tolerance in the applicable table from Table 6.2A.2.2.5-1 to Table 6.2A.2.2.5-11.

Table 6.2A.2.2.5-1: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, MPRnarrow)

FFS

Table 6.2A.2.2.5-2: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, single CC MPR requirement)

FFS

Table 6.2A.2.2.5-3: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, MPRC\_CA)

FFS

Table 6.2A.2.2.5-4: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, Non-contiguous allocation)

FFS

Table 6.2A.2.2.5-5: Test Tolerance (MPR for CA for Power class 1)

FFS

Table 6.2A.2.2.5-6: MPR requirements for Intra-band Contiguous UL CA (Power Class 2, single CC MPR requirement)

FFS

Table 6.2A.2.2.5-7: MPR requirements for Intra-band Contiguous UL CA (Power Class 2, MPRC\_CA)

FFS

Table 6.2A.2.2.5-8: MPR requirements for Intra-band Contiguous UL CA (Power Class 2, Non-contiguous allocation)

FFS

Table 6.2A.2.2.5-9: Test Tolerance (MPR for CA for Power class 2)

FFS

Table 6.2A.2.2.5-10: MPR requirements for Intra-band Contiguous UL CA (Power Class 3, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXH UL Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 0 | 0 | 22.4-TT | 43 |
| 1 | n260 | 20.6 | 0 | 0 | 20.6-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 3 | 2.0 | 17.4-TT | 43 |
| 2 | n260 | 20.6 | 3 | 2.0 | 15.6-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-13. | | | | | | |

Table 6.2A.2.2.5-11: MPR requirements for Intra-band Contiguous UL CA (Power Class 3, MPRC\_CA)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | Lower limit for test procedure with UPLF test mode (variant a, Rel-16 and later) | | Lower limit for test procedure with PHR (variant b, Rel-15 only) | | | Upper limit (dBm) |
| T(MPR) (dB) | Lower limit (dBm) | MPR + ΔPHR (dB) | T(MPR+ ΔPHR) (dB) | Lower limit PHR (dBm) |
| Test requirements for a CA\_nXE, nXF\_UL\_nXE Configuration  (400MHz < Cumulative aggregated BWchannel < 800MHz) | | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 8.7 | 5 | 8.7-MPp-TT | 9.9 | 5 | 7.5-MPp-TT | 43 |
| 1 | n260 | 20.6 | 8.7 | 5 | 6.9-MPp-TT | 9.9 | 5 | 5.7-MPp-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 7.5 | 5 | 9.9-MPp-TT | 8.7 | 5 | 8.7-MPp-TT | 43 |
| 2 | n260 | 20.6 | 7.5 | 5 | 8.1-MPp-TT | 8.7 | 5 | 6.9-MPp-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 8.7 | 5 | 8.7-MPp-TT | 9.9 | 5 | 7.5-MPp-TT | 43 |
| 3 | n260 | 20.6 | 8.7 | 5 | 6.9-MPp-TT | 9.9 | 5 | 5.7-MPp-TT | 43 |
| 4 | n257, n258, n261 | 22.4 | 10.7 | 7 | 4.7-MPp-TT | 11.9 | 7 | 3.5-MPp-TT | 43 |
| 4 | n260 | 20.6 | 10.7 | 7 | 2.9-MPp-TT | 11.9 | 7 | 1.7-MPp-TT | 43 |
| Test requirements for a CA\_nXH. CA\_nXI\_UL\_nXH. CA\_nXJ\_UL\_nXH. CA\_nXK\_UL\_nXH, . CA\_nXL\_UL\_nXH. CA\_nXM\_UL\_nXH Configuration (Cumulative aggregated BWchannel ≤ 400MHz) | | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 5 | 4 | 13.4-MPp-TT | 6.2 | 5 | 11.2-MPp-TT | 43 |
| 1 | n260 | 20.6 | 5 | 4 | 11.6-MPp-TT | 6.2 | 5 | 9.4-MPp-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 6.5 | 5 | 10.9-MPp-TT | 7.7 | 5 | 9.7-MPp-TT | 43 |
| 2 | n260 | 20.6 | 6.5 | 5 | 9.1-MPp-TT | 7.7 | 5 | 7.9-MPp-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 9 | 5 | 8.4-MPp-TT | 10.2 | 7 | 5.2-MPp-TT | 43 |
| 3 | n260 | 20.6 | 9 | 5 | 6.6-MPp-TT | 10.2 | 7 | 3.4-MPp-TT | 43 |
| NOTE 1: MBp is the Multiband Relaxation factor declared by the UE for the tested band in Table A.4.3.9-2 of TS 38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  NOTE 2: ΔPHR is defined in Table 6.2A.2.1.4.2-1.  NOTE 3: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-13. | | | | | | | | | |

#### 6.2A.2.3 UE maximum output power reduction for CA (4UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

- The UPLF test mode is applicable to UEs Release 16 and forward.

- This test case is incomplete for Power classes 1, 2, 4 Release 15.

- For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

- Whether additional check is needed in the test procedure to ensure UE continues transmissions on the SCell is FFS

- Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and intra-band non-contiguous CA are TBD.

- The test points for higher bandwidth classes with testability problem need an update to decrease the UL bandwidth until they become testable.

- This test case is incomplete for intra-band non-contiguous CA

6.2A.2.3.1 Test purpose

The number of RB identified in 6.2.2.3 is based on meeting the requirements for the maximum power reduction (MPR) due to Cubic Metric (CM).

6.2A.2.3.2 Test applicability

The requirements of this test apply to all types of NR UE release 15 and forward supporting 3UL CA.

6.2A.2.3.3 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2A.2.

6.2A.2.3.4 Test description

6.2A.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, and CC combinations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration and subcarrier spacing, are shown in Table 6.2A.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 6.2A.2.3.4.1-1: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, MPRnarrow)

FFS

Table 6.2A.2.3.4.1-2: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, single CC MPR requirement)

FFS

Table 6.2A.2.3.4.1-3: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, MPRC\_CA)

FFS

Table 6.2A.2.3.4.1-4: Intra-band Contiguous UL CA Test Configuration Table (Power Class 1, Non-contiguous allocation)

FFS

Table 6.2A.2.3.4.1-5: Intra-band Contiguous UL CA Test Configuration Table (Power Class 2, 3 and 4, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low range, High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_nXH Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC/CC2 |  |  |  | - | - |
| SCC/CC3 |  |  |  | - | - |
| SCC/CC4 |  |  |  | - | - |
| 2 | PCC/CC1 |  |  |  | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  |  | - | - |
| SCC/CC3 |  |  |  | - | - |
| SCC/CC4 |  |  |  | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10]. | | | | | | |

Table 6.2A.2.3.4.1-6: Intra-band Contiguous UL CA Test Configuration Table (Power Class 2, 3 and 4, MPRC\_CA)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for different CA bandwidth classes | | | | For intra-band contiguous CA: Mid range.  For intra-band non-contiguous CA: FFS | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 and 4.3.1.2.4 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated channel bandwidth of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| Test ID | CC **& Mapping**  (NOTE 2) | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_nXF Configuration (400MHz <= Cumulative aggregated BWchannel <= 800MHz) | | | | | | |
| 1 | PCC/CC1 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC2/CC3 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| SCC3/CC4 |  |  |  | DFT-s-OFDM 16QAM | Outer\_Full |
| 2 | PCC/CC1 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| SCC2/CC3 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| SCC3/CC4 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| 3 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC2/CC3 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC3/CC4 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| 4 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC1/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC2/CC3 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC3/CC4 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| Default Test Settings for a CA\_nXI Configuration (Cumulative aggregated BWchannel ≤ 400MHz) | | | | | | |
| 1 | PCC/CC1 | Default | Default | - | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| SCC2/CC3 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| SCC3/CC4 |  |  |  | CP-OFDM QPSK | Outer\_Full |
| 2 | PCC/CC1 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC2/CC3 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| SCC3/CC4 |  |  |  | CP-OFDM 16QAM | Outer\_Full |
| 3 | PCC/CC1 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC/CC2 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC2/CC3 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| SCC3/CC4 |  |  |  | CP-OFDM 64QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.  NOTE 2: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10]. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2A.2.3.4.1-1 to Table 6.2A.2.3.4.1-6.

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 [10] clause 4.5. Message contents are defined in clause 6.2A.2.3.4.3.

6.2A.2.3.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 and Annex C.3.0 for all downlink physical channels

2. The SS shall configure SCC as per TS 38.508-1 [10] subclause 5.5.1 Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in subclause 6.2A.2.2.4.3.

3. Apply the test step based on the 5G NR UE Release:

3a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS applies a backoff on the PCell powerby activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using TOTAL NR AGGREGATED BANDWIDTH and PCELL NR bandwidth as per Test CC Combination setting. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

3b. For Release 15 5G NR UEs: No action.

3c. For testing single CC MPR requirement: No action.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321, clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 Table 6.2A.2.2.4.1-1 to Table 6.2A.2.1.4.1-6. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Apply the test step based on the 5G NR UE Release:

7a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.2.2.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

Table 6.2A.2.3.4.2-1: Power target values per UL CC for test procedure using PHR

FFS

7c. For testing single CC MPR requirement: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

9. Measure UE EIRP in the Tx beam peak direction in the accumulative aggregated channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in 6.2A.2.1.5. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

10. Apply the test step based on the 5G NR UE Release:

10a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

10b. For Release 15 5G NR UEs: No action.

10c. For testing single CC MPR requirement: No action.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.2A.2.2.4.1-1 to Table 6.2A.2.2.4.1-6, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.2A.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for Release 15 5G NR UE.

Table 6.2A.2.3.4.3-1: PUSCH-PowerControl

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-120 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-PowerControl ::= SEQUENCE { |  |  |  |
| p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE { | 1 entry |  |  |
| P0-PUSCH-AlphaSet[1] SEQUENCE { |  |  |  |
| alpha | alpha0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.2.3.4.3-2: *PUSCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -4 |  | 50 MHz |
| p0-NominalWithGrant | -8 |  | 100 MHz |
| p0-NominalWithGrant | -10 |  | 200 MHz |
| p0-NominalWithGrant | -14 |  | 400 MHz |
| } |  |  |  |

Table 6.2A.2.3.4.3-3: BSR-Config (Rel-15 UE only)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| BSR-Config ::= SEQUENCE { |  |  |  |
| periodicBSR-Timer | infinity |  |  |
| retxBSR-Timer | sf80 |  |  |
| logicalChannelSR-DelayTimer | Not present |  |  |
| } |  |  |  |

6.2A.2.3.5 Test requirement

The EIRP derived in step 8 shall be within the range prescribed by the nominal maximum output power and tolerance in the applicable table from Table 6.2A.2.2.5-1 to Table 6.2A.2.2.5-11.

Table 6.2A.2.3.5-1: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, MPRnarrow)

FFS

Table 6.2A.2.3.5-2: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, single CC MPR requirement)

FFS

Table 6.2A.2.3.5-3: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, MPRC\_CA)

FFS

Table 6.2A.2.3.5-4: MPR requirements for Intra-band Contiguous UL CA (Power Class 1, Non-contiguous allocation)

FFS

Table 6.2A.2.3.5-5: Test Tolerance (MPR for CA for Power class 1)

FFS

Table 6.2A.2.3.5-6: MPR requirements for Intra-band Contiguous UL CA (Power Class 2, single CC MPR requirement)

Table 6.2A.2.3.5-7: MPR requirements for Intra-band Contiguous UL CA (Power Class 2, MPRC\_CA)

FFS

Table 6.2A.2.3.5-8: MPR requirements for Intra-band Contiguous UL CA (Power Class 2, Non-contiguous allocation)

FFS

Table 6.2A.2.3.5-9: Test Tolerance (MPR for CA for Power class 2)

FFS

Table 6.2A.2.3.5-10: MPR requirements for Intra-band Contiguous UL CA (Power Class 3, single CC MPR requirement)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| Test requirements for a CA\_nXH UL Configuration (Cumulative aggregated BWchannel <= 400MHz) | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 0 | 0 | 22.4-TT | 43 |
| 1 | n260 | 20.6 | 0 | 0 | 20.6-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 3 | 2.0 | 17.4-TT | 43 |
| 2 | n260 | 20.6 | 3 | 2.0 | 15.6-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-13. | | | | | | |

Table 6.2A.2.3.5-11: MPR requirements for Intra-band Contiguous UL CA (Power Class 3, MPRC\_CA)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | Lower limit for test procedure with UPLF test mode (variant a, Rel-16 and later) | | Lower limit for test procedure with PHR (variant b, Rel-15 only) | | | Upper limit (dBm) |
| T(MPR) (dB) | Lower limit (dBm) | MPR + ΔPHR (dB) | T(MPR+ ΔPHR) (dB) | Lower limit PHR (dBm) |
| Test requirements for a CA\_nXF Configuration  (400MHz < Cumulative aggregated BWchannel < 800MHz) | | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 8.7 | 5 | 8.7-MPp-TT | 9.7 | 5 | 7.7-MPp-TT | 43 |
| 1 | n260 | 20.6 | 8.7 | 5 | 6.9-MPp-TT | 9.7 | 5 | 5.9-MPp-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 7.5 | 5 | 9.9-MPp-TT | 8.5 | 5 | 8.9-MPp-TT | 43 |
| 2 | n260 | 20.6 | 7.5 | 5 | 8.1-MPp-TT | 8.5 | 5 | 7.1-MPp-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 8.7 | 5 | 8.7-MPp-TT | 9.7 | 5 | 7.7-MPp-TT | 43 |
| 3 | n260 | 20.6 | 8.7 | 5 | 6.9-MPp-TT | 9.7 | 5 | 5.9-MPp-TT | 43 |
| 4 | n257, n258, n261 | 22.4 | 10.7 | 7 | 4.7-MPp-TT | 11.7 | 7 | 3.7-MPp-TT | 43 |
| 4 | n260 | 20.6 | 10.7 | 7 | 2.9-MPp-TT | 11.7 | 7 | 1.9-MPp-TT | 43 |
| Test requirements for a CA\_XI, CA\_nXJ\_UL\_nXI, CA\_nXK\_UL\_nXI, CA\_nXL\_UL\_nXI, CA\_nXM\_UL\_nXI (Cumulative aggregated BWchannel ≤ 400MHz) | | | | | | | | | |
| 1 | n257, n258, n261 | 22.4 | 5 | 4 | 13.4-MPp-TT | 6 | 5 | 11.4-MPp-TT | 43 |
| 1 | n260 | 20.6 | 5 | 4 | 11.6-MPp-TT | 6 | 5 | 9.6-MPp-TT | 43 |
| 2 | n257, n258, n261 | 22.4 | 6.5 | 5 | 10.9-MPp-TT | 7.5 | 5 | 9.9-MPp-TT | 43 |
| 2 | n260 | 20.6 | 6.5 | 5 | 9.1-MPp-TT | 7.5 | 5 | 8.1-MPp-TT | 43 |
| 3 | n257, n258, n261 | 22.4 | 9 | 5 | 8.4-MPp-TT | 10 | 5 | 7.4-MPp-TT | 43 |
| 3 | n260 | 20.6 | 9 | 5 | 6.6-MPp-TT | 10 | 5 | 5.6-MPp-TT | 43 |
| NOTE 1: MBp is the Multiband Relaxation factor declared by the UE for the tested band in Table A.4.3.9-2 of TS 38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  NOTE 2: ΔPHR is defined in Table 6.2A.2.1.4.2-1.  NOTE 3: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.2.1.5-13. | | | | | | | | | |

#### 6.2A.2.4 UE maximum output power reduction for CA (5UL CA)

FFS

#### 6.2A.2.5 UE maximum output power reduction for CA (6UL CA)

FFS

#### 6.2A.2.6 UE maximum output power reduction for CA (7UL CA)

FFS

#### 6.2A.2.7 UE maximum output power reduction for CA (8UL CA)

FFS

### 6.2A.3 UE maximum output power with additional requirements for CA

#### 6.2A.3.0 Minimum conformance requirements

##### 6.2A.3.0.1 General

Additional emission requirements can be signalled by the network with network signalling value indicated by the field *additionalSpectrumEmission.* To meet these additional requirements, additional maximum power reduction (A-MPR) is allowed for the maximum output power as specified in clause 6.2A.1.0. Unless stated otherwise, an A-MPR of 0 dB shall be used. Unless otherwise stated, the allowed total back off is maximum of A-MPR and MPR specified in clause 6.2A.2.0.

For intra-band contiguous aggregation with the UE configured for transmissions on two serving cells, the maximum output power reduction specified in Table 6.2A.3.0.1-1 is allowed for all serving cells of the applicable uplink contiguous CA configurations.

Table 6.2A.3.0.1-1 specifies the additional requirements and allowed A-MPR with corresponding network signalling label and operating band. The mapping between network signalling labels and the *additionalSpectrumEmission* IE defined in TS 38.331 [13] is specified in Table 6.2A.3.0.1-2. Unless otherwise stated, the allowed total back off is maximum of A-MPR and MPR specified in clause 6.2A.2.0.

Table 6.2A.3.0.1-1: Additional maximum power reduction (A-MPR)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Network Signalling value | Requirements (clause) | NR Band | Channel bandwidth (MHz) | Resources Blocks (*N*RB) | A-MPR (dB) |
| CA\_NS\_200 |  |  |  |  | N/A |
| CA\_NS\_201 |  | n258 |  |  | 6.2A.3.0.2 |
| CA\_NS\_202 | 6.5A.3.3.0 | n257, n258 |  |  | 6.2A.3.0.3 |
| CA\_NS\_203 | 6.5A.3.3.0 | n258 |  |  | 6.2A.3.0.4 |
| NOTE: CA\_NS\_201 is obsolete, the associated additional spurious emission requirements are not applicable. | | | | | |

Table 6.2A.3.0.1-2: Value of *additionalSpectrumEmission*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR Band | Value of *additionalSpectrumEmission* / NS number | | | | | | | |
|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| n257 | CA\_NS\_200 | CA\_NS\_202 |  |  |  |  |  |  |
| n258 | CA\_NS\_200 | CA\_NS\_201 | CA\_NS\_202 | CA\_NS\_203 |  |  |  |  |
| n259 | CA\_NS\_200 |  |  |  |  |  |  |  |
| n260 | CA\_NS\_200 |  |  |  |  |  |  |  |
| n261 | CA\_NS\_200 |  |  |  |  |  |  |  |
| NOTE 1: *additionalSpectrumEmission* corresponds to an information element of the same name defined in clause 6.3.2 of TS 38.331 [13].  NOTE 2: CA\_NS\_201 is obsolete, the associated additional spurious emission requirements are not applicable. | | | | | | | | |

##### 6.2A.3.0.2 Void

##### 6.2A.3.0.3 A-MPR for CA\_NS\_202

6.2A.3.0.3.1 A-MPR for CA\_NS\_202 for power class 1

For intra-band contiguous CA, A-MPR for CA\_NS\_202 shall be 11.0 dB.

6.2A.3.0.3.2 A-MPR for CA\_NS\_202 for power class 2

For intra-band contiguous CA, A-MPR for CA\_NS\_202 specified in sub-clause 6.2A.3.0.3.3 applies.

6.2A.3.0.3.3 A-MPR for CA\_NS\_202 for power class 3

For intra-band contiguous CA, A-MPR for CA\_NS\_202 shall be 2.0 dB.

6.2A.3.0.3.4 A-MPR for CA\_NS\_202 for power class 4

For intra-band contiguous CA, A-MPR for CA\_NS\_202 specified in sub-clause 6.2A.3.0.3.3 applies.

6.2A.3.0.3.5 A-MPR for CA\_NS\_202 for power class 5

For intra-band contiguous CA, A-MPR for CA\_NS\_202 specified in sub-clause 6.2A.3.0.3.3 applies.

##### 6.2A.3.0.4 A-MPR for CA\_NS\_203

6.2A.3.0.4.1 A-MPR for CA\_NS\_203 for power class 1

For intra-band contiguous CA, A-MPR for CA\_NS\_203 shall be 6.5 dB, if Offset frequency < BWChannel\_CA of the UL CA configuration, 0.0 dB, otherwise  
The Offset frequency is defined as the frequency from 24.25 GHz to the lower edge of the lowest CC among the configured UL CA.

6.2A.3.0.4.2 A-MPR for CA\_NS\_203 for power class 2

For intra-band contiguous CA, A-MPR specified in sub-clause 6.2A.3.0.4.3 applies.

6.2A.3.0.4.3 A-MPR for CA\_NS\_203 for power class 3

For intra-band contiguous CA, A-MPR for CA\_NS\_203 shall be 2.5 dB, if Offset frequency < BWChannel\_CA of the UL CA configuration, 0.0 dB otherwise.  
The Offset frequency is defined as the frequency from 24.25 GHz to the lower edge of the lowest CC among the configured UL CA.

6.2A.3.0.4.4 A-MPR for CA\_NS\_203 for power class 4

For intra-band contiguous CA, A-MPR specified in sub-clause 6.2A.3.0.4.3 applies.

6.2A.3.0.4.5 A-MPR for CA\_NS\_203 for power class 5

For intra-band contiguous CA, AeeeeMPR specified in sub-clause 6.2A.3.0.4.3 applies.

6.2A.3.0.4.6 A-MPR for CA\_NS\_203 for power class 6

For intra-band contiguous CA, A-MPR specified in sub-clause 6.2A.3.0.4.3 applies.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2A.3.

#### 6.2A.3.1 UE maximum output power with additional requirements for CA (2UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

- The UPLF test mode is applicable to UEs Release 16 and forward.

- This test case is incomplete for Power classes 1, 2, 3, 4 Release 15.

* For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

- Whether additional check is needed in the test procedure to ensure UE continues transmissions on the SCell is FFS

- Measurement Uncertainties and Test Tolerances are FFS for power class 1,2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and intra-band non-contiguous CA are TBD.

- The test points for higher bandwidth classes with testability problem need an update to decrease the UL bandwidth until they become testable.

6.2A.3.1.1 Test purpose

Additional emission requirements for CA 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 frequency band number of the applicable operating band, the IE *freqBandIndicatorNR* and an associated value of *additionalSpectrumEmission* in the relevant RRC information elements [6].

To meet the additional requirements, additional maximum power reduction (A-MPR) is allowed for the CA maximum output power as specified in Table 6.2A.1. Unless stated otherwise, the total reduction to UE maximum output power is max(MPR, A-MPR) where MPR is defined in clause 6.2A.2.

6.2A.3.1.2 Test applicability

The requirements of this test apply to all types of NR UE release 15 and forward supporting 2UL CA.

6.2A.3.1.3 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2A.3.

6.2A.3.1.4 Test description

6.2A.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, and CC combinations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration and subcarrier spacing, are shown in Table 6.2A.3.1.4.1-1 and Table 6.2A.3.1.4.1-2. 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 6.2A.3.1.4.1-1: Test Configuration Table for CA\_NS\_202 (Power Class 1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | Low range, High range | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | Maximum aggregated BW (contiguous CA) | |
| Test SCS as specified in Table 5.3.5-1 | | | 120kHz | |
| Test Parameters | | | | |
| Test ID | CC | Downlink Configuration | UL Modulation | UL RB allocation (NOTE 1) |
| 1 | PCC | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCCs | DFT-s-OFDM QPSK | Outer\_Full |
| 2 | PCC | DFT-s-OFDM 64QAM | Outer\_Full |
| SCCs | DFT-s-OFDM 64QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | |

Table 6.2A.3.1.4.1-2: Test Configuration Table for CA\_NS\_203 (Power Class 1, 2, 3 and 4)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | Low range | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | Maximum aggregated BW (contiguous CA) with cumulative aggregated BW <= 400MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | 120kHz | |
| Test Parameters | | | | |
| Test ID | CC | Downlink Configuration | UL Modulation | UL RB allocation (NOTE 1) |
| 1 | PCC | - | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3  PC4  Inner\_Full\_Region1 for  PC1 |
| SCCs | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2A.3.1.4.1-1 to Table 6.2A.3.1.4.1-2.

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

6. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.2A.3.1.4.3.

6.2A.3.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 and Annex C.3.0 for all downlink physical channels

2. The SS shall configure SCC as per TS 38.508-1 [10] subclause 5.5.1 Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in subclause 6.2A.3.1.4.3.

3. Apply the test step based on the 5G NR UE Release:

3a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS applies a backoff on the PCell powerby activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using TOTAL NR AGGREGATED BANDWIDTH and PCELL NR bandwidth as per Test CC Combination setting. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

3b. For Release 15 5G NR UEs: No action.

3c. For testing single CC A-MPR requirement: No action.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321, clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 Table 6.2A.3.1.4.1-1 to Table 6.2A.3.1.4.1-2. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Apply the test step based on the 5G NR UE Release:

7a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.3.1.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

Table 6.2A.3.1.4.2-1: Power target values per UL CC for test procedure using PHR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BW ratio (Note 1) | Xmax [dB] (Note 2) | Target PHR | ΔPHR [dB] (Note 3) | BW combination examples |
| 1/2 | 3.0 | POWER\_HEADROOM\_36 (3  PH  4) | 1 | 2CC equal BW |
| 1/3 | 4.8 | POWER\_HEADROOM\_38 (5  PH  6) | 1.2 | 2CC 50+100 MHz CC1 |
| 2/3 | 1.8 | POWER\_HEADROOM\_35 (2  PH  3) | 1.2 | 2CC 50+100 MHz CC2 |
| 1/5 | 7.0 | POWER\_HEADROOM\_40 (7  PH  8) | 1.0 | 2CC 50+200 MHz CC1 |
| 4/5 | 1.0 | POWER\_HEADROOM\_34 (1  PH  2) | 1.0 | 2CC 50+200 MHz CC2 |
| 1/9 | 9.5 | POWER\_HEADROOM\_43 (10  PH  11) | 1.5 | 2CC 50+400 MHz CC1 |
| 8/9 | 0.5 | POWER\_HEADROOM\_34 (1  PH  2) | 1.5 | 2CC 50+400 MHz CC2 |
| Note 1: The BW ratio is the ratio of BW of the CC over the total Aggregated UL BW  Note 2: Xmax = 10log(BW ratio)  Note 3: ΔPHR is the worst case UE output power decrease due to Xmax and 1 dB reporting granularity of PHR according to TS38.133 [25]. | | | | |

7c. For testing single CC A-MPR requirement: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

9. Measure UE EIRP in the Tx beam peak direction in the accumulative aggregated channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in 6.2A.3.1.5. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

10. Apply the test step based on the 5G NR UE Release:

10a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

10b. For Release 15 5G NR UEs: No action.

10c. For testing single CC A-MPR requirement: No action.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.2A.3.1.4.1-1 to Table 6.2A.3.1.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.2A.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for Release 15 5G NR UE.

Table 6.2A.3.1.4.3-1: PUSCH-PowerControl

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-120 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-PowerControl ::= SEQUENCE { |  |  |  |
| p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE { | 1 entry |  |  |
| P0-PUSCH-AlphaSet[1] SEQUENCE { |  |  |  |
| alpha | alpha0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.3.1.4.3-2: *PUSCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -4 |  | 50 MHz |
| p0-NominalWithGrant | -8 |  | 100 MHz |
| p0-NominalWithGrant | -10 |  | 200 MHz |
| p0-NominalWithGrant | -14 |  | 400 MHz |
| } |  |  |  |

Table 6.2A.3.1.4.3-3: BSR-Config (Rel-15 UE only)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| BSR-Config ::= SEQUENCE { |  |  |  |
| periodicBSR-Timer | infinity |  |  |
| retxBSR-Timer | sf80 |  |  |
| logicalChannelSR-DelayTimer | Not present |  |  |
| } |  |  |  |

6.2A.3.1.4.3.1 Message contents exceptions (network signalling value " CA\_NS\_202" on PCC and SCC)

Table 6.2A.3.1.4.3.1-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "CA\_NS\_202"

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 *AdditionalSpectrumEmission* | | | |
| Information Element | Value/remark | Comment | Condition |
| AdditionalSpectrumEmission | 1 (CA\_NS\_202) |  | band n257 |
| 2 (CA\_NS\_202) |  | band 258 |

6.2A.3.1.4.3.2 Message contents exceptions (network signalling value " CA\_NS\_203" on PCC and SCC)

Table 6.2A.3.1.4.3.2-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "CA\_NS\_203"

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 *AdditionalSpectrumEmission* | | | |
| Information Element | Value/remark | Comment | Condition |
| AdditionalSpectrumEmission | 3 (CA\_NS\_203) |  | band n258 |

6.2A.3.1.5 Test requirement

The EIRP derived in step 9 shall be within the range prescribed by the nominal maximum output power and tolerance in the applicable table from Table 6.2A.3.1.5-1 to Table 6.2A.3.1.5-5.

Table 6.2A.3.1.5-0: Test Tolerance (A-MPR for CA) (Aggregated BW ≤ 400MHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Power Class | Test Metric | FR2a | FR2b |
| PC1 | Max device size ≤ 30 cm | 3.38 dB, NTC | 3.38 dB, NTC |
| PC2 | Max device size ≤ 30 cm | FFS | FFS |
| PC3 | Max device size ≤ 30 cm | 3.24 dB, NTC | 3.24 dB, NTC |
| PC4 | Max device size ≤ 30 cm | FFS | FFS |

Table 6.2A.3.1.5-1: A-MPR requirements for CA\_NS\_202 (Power Class 1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n257, n258 | 40.0 | 6.5~9.7 | 11.0 | 7.0 | 22-TT | 55 |
| 2 | n257, n258 (NOTE 2) | 40.0 | 9~10.7 | 11.0 | 7.0 | 22-TT | 55 |
| 2 | n257, n258 (NOTE 3) | 40.0 | 11.2 | 11.0 | 7.0 | 21.8-TT | 55 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.1.5-0.  NOTE 2: Cumulative aggregated BW < 800MHz.  NOTE 3: Cumulative aggregated BW = 800MHz. | | | | | | | |

Table 6.2A.3.1.5-2: A-MPR requirements for CA\_NS\_203 (Power Class 1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 40.0 | 0 | 6.5 | 5.0 | 28.5-TT | 55 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.1.5-0. | | | | | | | |

Table 6.2A.3.1.5-3: A-MPR requirements for CA\_NS\_203 (Power Class 2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 29.0 | 0 | 6.5 | 5.0 | 17.5-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.1.5-0. | | | | | | | |

Table 6.2A.3.1.5-4: A-MPR requirements for CA\_NS\_203 (Power Class 3)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 22.4 | 0 | 6.5 | 5.0 | 10.9-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.1.5-0. | | | | | | | |

Table 6.2A.3.1.5-5: A-MPR requirements for CA\_NS\_203 (Power Class 4)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 34.0 | 0 | 6.5 | 5.0 | 22.5-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.1.5-0. | | | | | | | |

#### 6.2A.3.2 UE maximum output power with additional requirements for CA (3UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

- The UPLF test mode is applicable to UEs Release 16 and forward.

- This test case is incomplete for Power classes 1, 2, 3, 4 Release 15.

* For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

- Whether additional check is needed in the test procedure to ensure UE continues transmissions on the SCell is FFS

- Measurement Uncertainties and Test Tolerances are are FFS for power class 1,2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and intra-band non-contiguous CA are TBD.

- The test points for higher bandwidth classes with testability problem need an update to decrease the UL bandwidth until they become testable.

6.2A.3.2.1 Test purpose

Same as test purpose in 6.2A.3.1.1.

6.2A.3.2.2 Test applicability

The requirements of this test apply to all types of NR UE release 15 and forward supporting 3UL CA.

6.2A.3.2.3 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2A.3.

6.2A.3.2.4 Test description

6.2A.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 CC combinations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration and subcarrier spacing, are shown in Table 6.2A.3.2.4.1-1 and Table 6.2A.3.2.4.1-2. 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 6.2A.3.2.4.1-1: Test Configuration Table for CA\_NS\_202 (Power Class 1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | Low range, High range | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | Maximum aggregated BW (contiguous CA) | |
| Test SCS as specified in Table 5.3.5-1 | | | 120kHz | |
| Test Parameters | | | | |
| Test ID | CC | Downlink Configuration | UL Modulation | UL RB allocation (NOTE 1) |
| 1 | PCC | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCCs | DFT-s-OFDM QPSK | Outer\_Full |
| 2 | PCC | DFT-s-OFDM 64QAM | Outer\_Full |
| SCCs | DFT-s-OFDM 64QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | |

Table 6.2A.3.2.4.1-2: Test Configuration Table for CA\_NS\_203 (Power Class 1, 2, 3 and 4)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | Low range | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | Maximum aggregated BW (contiguous CA) with cumulative aggregated BW <= 400MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | 120kHz | |
| Test Parameters | | | | |
| Test ID | CC | Downlink Configuration | UL Modulation | UL RB allocation (NOTE 1) |
| 1 | PCC | - | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3  PC4  Inner\_Full\_Region1 for  PC1 |
| SCCs | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2A.3.2.4.1-1 to Table 6.2A.3.2.4.1-2.

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

6. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.2A.3.2.4.3.

6.2A.3.2.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 and Annex C.3.0 for all downlink physical channels

2. The SS shall configure SCC as per TS 38.508-1 [10] subclause 5.5.1 Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in subclause 6.2A.3.2.4.3.

3. Apply the test step based on the 5G NR UE Release:

3a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS applies a backoff on the PCell powerby activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using TOTAL NR AGGREGATED BANDWIDTH and PCELL NR bandwidth as per Test CC Combination setting. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

3b. For Release 15 5G NR UEs: No action.

3c. For testing single CC A-MPR requirement: No action.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321, clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 Table 6.2A.3.2.4.1-1 to Table 6.2A.3.2.4.1-2. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Apply the test step based on the 5G NR UE Release:

7a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.3.2.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

Table 6.2A.3.2.4.2-1: Power target values per UL CC for test procedure using PHR

FFS

7c. For testing single CC A-MPR requirement: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

9. Measure UE EIRP in the Tx beam peak direction in the accumulative aggregated channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in 6.2A.3.2.5. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

10. Apply the test step based on the 5G NR UE Release:

10a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

10b. For Release 15 5G NR UEs: No action.

10c. For testing single CC A-MPR requirement: No action.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.2A.3.2.4.1-1 to Table 6.2A.3.2.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.2A.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for Release 15 5G NR UE.

Table 6.2A.3.2.4.3-1: PUSCH-PowerControl

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-120 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-PowerControl ::= SEQUENCE { |  |  |  |
| p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE { | 1 entry |  |  |
| P0-PUSCH-AlphaSet[1] SEQUENCE { |  |  |  |
| alpha | alpha0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.3.2.4.3-2: *PUSCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -4 |  | 50 MHz |
| p0-NominalWithGrant | -8 |  | 100 MHz |
| p0-NominalWithGrant | -10 |  | 200 MHz |
| p0-NominalWithGrant | -14 |  | 400 MHz |
| } |  |  |  |

Table 6.2A.3.2.4.3-3: BSR-Config (Rel-15 UE only)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| BSR-Config ::= SEQUENCE { |  |  |  |
| periodicBSR-Timer | infinity |  |  |
| retxBSR-Timer | sf80 |  |  |
| logicalChannelSR-DelayTimer | Not present |  |  |
| } |  |  |  |

6.2A.3.2.4.3.1 Message contents exceptions (network signalling value " CA\_NS\_202" on PCC and SCC)

Table 6.2A.3.2.4.3.1-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "CA\_NS\_202"

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 *AdditionalSpectrumEmission* | | | |
| Information Element | Value/remark | Comment | Condition |
| AdditionalSpectrumEmission | 1 (CA\_NS\_202) |  | band n257 |
| 2 (CA\_NS\_202) |  | band 258 |

6.2A.3.2.4.3.2 Message contents exceptions (network signalling value " CA\_NS\_203" on PCC and SCC)

Table 6.2A.3.2.4.3.2-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "CA\_NS\_203"

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 *AdditionalSpectrumEmission* | | | |
| Information Element | Value/remark | Comment | Condition |
| AdditionalSpectrumEmission | 3 (CA\_NS\_203) |  | band n258 |

6.2A.3.2.5 Test requirement

The EIRP derived in step 9 shall be within the range prescribed by the nominal maximum output power and tolerance in the applicable table from Table 6.2A.3.2.5-1 to Table 6.2A.3.2.5-5.

Table 6.2A.3.2.5-0: Test Tolerance (A-MPR for CA) (Aggregated BW ≤ 400MHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Power Class | Test Metric | FR2a | FR2b |
| PC1 | Max device size ≤ 30 cm | 3.38 dB, NTC | 3.38 dB, NTC |
| PC2 | Max device size ≤ 30 cm | FFS | FFS |
| PC3 | Max device size ≤ 30 cm | 3.24 dB, NTC | 3.24 dB, NTC |
| PC4 | Max device size ≤ 30 cm | FFS | FFS |

Table 6.2A.3.2.5-1: A-MPR requirements for CA\_NS\_202 (Power Class 1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n257, n258 | 40.0 | 6.5~9.7 | 11.0 | 7.0 | 22-TT | 55 |
| 2 | n257, n258 (NOTE 2) | 40.0 | 9~10.7 | 11.0 | 7.0 | 22-TT | 55 |
| 2 | n257, n258 (NOTE 3) | 40.0 | 11.2 | 11.0 | 7.0 | 21.8-TT | 55 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.2.5-0.  NOTE 2: Cumulative aggregated BW < 800MHz.  NOTE 3: 800MHz <= Cumulative aggregated BW < 1400MHz. | | | | | | | |

Table 6.2A.3.2.5-2: A-MPR requirements for CA\_NS\_203 (Power Class 1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 40.0 | 0 | 6.5 | 5.0 | 28.5-TT | 55 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.2.5-0. | | | | | | | |

Table 6.2A.3.2.5-3: A-MPR requirements for CA\_NS\_203 (Power Class 2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 29.0 | 0 | 6.5 | 5.0 | 17.5-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.2.5-0. | | | | | | | |

Table 6.2A.3.2.5-4: A-MPR requirements for CA\_NS\_203 (Power Class 3)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 22.4 | 0 | 6.5 | 5.0 | 10.9-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.2.5-0. | | | | | | | |

Table 6.2A.3.2.5-5: A-MPR requirements for CA\_NS\_203 (Power Class 4)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 34.0 | 0 | 6.5 | 5.0 | 22.5-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.2.5-0. | | | | | | | |

#### 6.2A.3.3 UE maximum output power with additional requirements for CA (4UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

- The UPLF test mode is applicable to UEs Release 16 and forward.

- This test case is incomplete for Power classes 1, 2, 3, 4 Release 15.

* For a transition period until RAN#99, the stability and repeatability of test procedure with PHR (variant b) for Rel-15 UEs is under evaluation.

- Whether additional check is needed in the test procedure to ensure UE continues transmissions on the SCell is FFS

- Measurement Uncertainties and Test Tolerances are FFS for power class 1,2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz and intra-band non-contiguous CA are TBD.

- The test points for higher bandwidth classes with testability problem need an update to decrease the UL bandwidth until they become testable.

6.2A.3.3.1 Test purpose

Same as test purpose in 6.2A.3.1.1.

6.2A.3.3.2 Test applicability

The requirements of this test apply to all types of NR UE release 15 and forward supporting 4UL CA.

6.2A.3.3.3 Minimum conformance requirements

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2A.3.

6.2A.3.3.4 Test description

6.2A.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, and CC combinations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration and subcarrier spacing, are shown in Table 6.2A.3.3.4.1-1 and Table 6.2A.3.3.4.1-2. 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 6.2A.3.3.4.1-1: Test Configuration Table for CA\_NS\_202 (Power Class 1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | Low range, High range | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | Maximum aggregated BW (contiguous CA) | |
| Test SCS as specified in Table 5.3.5-1 | | | 120kHz | |
| Test Parameters | | | | |
| Test ID | CC | Downlink Configuration | UL Modulation | UL RB allocation (NOTE 1) |
| 1 | PCC | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCCs | DFT-s-OFDM QPSK | Outer\_Full |
| 2 | PCC | DFT-s-OFDM 64QAM | Outer\_Full |
| SCCs | DFT-s-OFDM 64QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | |

Table 6.2A.3.3.4.1-2: Test Configuration Table for CA\_NS\_203 (Power Class 1, 2, 3 and 4)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | Low range | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | Maximum aggregated BW (contiguous CA) with cumulative aggregated BW <= 400MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | 120kHz | |
| Test Parameters | | | | |
| Test ID | CC | Downlink Configuration | UL Modulation | UL RB allocation (NOTE 1) |
| 1 | PCC | - | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3  PC4  Inner\_Full\_Region1 for  PC1 |
| SCCs | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2A.3.3.4.1-1 to Table 6.2A.3.3.4.1-2.

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

6. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.2A.3.3.4.3.

6.2A.3.3.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 and Annex C.3.0 for all downlink physical channels

2. The SS shall configure SCC as per TS 38.508-1 [10] subclause 5.5.1 Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in subclause 6.2A.3.3.4.3.

3. Apply the test step based on the 5G NR UE Release:

3a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS applies a backoff on the PCell powerby activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using TOTAL NR AGGREGATED BANDWIDTH and PCELL NR bandwidth as per Test CC Combination setting. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

3b. For Release 15 5G NR UEs: No action.

3c. For testing single CC A-MPR requirement: No action.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321, clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 Table 6.2A.3.3.4.1-1 to Table 6.2A.3.3.4.1-2. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Apply the test step based on the 5G NR UE Release:

7a. For Release 16 and forward 5G NR UEs: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7b. For Release 15 5G NR UEs: Send uplink power control commands in uplink scheduling information to the UE per UL CC until the Power Headroom Report (PHR) from the UE for each UL CC is at the target value according to Table 6.2A.3.3.4.2-1; allow at least 200 ms for the UE to reach maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

Table 6.2A.3.3.4.2-1: Power target values per UL CC for test procedure using PHR

FFS

7c. For testing single CC A-MPR requirement: Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

9. Measure UE EIRP in the Tx beam peak direction in the accumulative aggregated channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in 6.2A.3.3.5. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

10. Apply the test step based on the 5G NR UE Release:

10a. For Release 16 and forward 5G NR UEs supporting the UPLF test mode: SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

10b. For Release 15 5G NR UEs: No action.

10c. For testing single CC A-MPR requirement: No action.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.2A.3.3.4.1-1 to Table 6.2A.3.3.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.2A.3.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for Release 15 5G NR UE.

Table 6.2A.3.3.4.3-1: PUSCH-PowerControl

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-120 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-PowerControl ::= SEQUENCE { |  |  |  |
| p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE { | 1 entry |  |  |
| P0-PUSCH-AlphaSet[1] SEQUENCE { |  |  |  |
| alpha | alpha0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.3.3.4.3-2: *PUSCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -4 |  | 50 MHz |
| p0-NominalWithGrant | -8 |  | 100 MHz |
| p0-NominalWithGrant | -10 |  | 200 MHz |
| p0-NominalWithGrant | -14 |  | 400 MHz |
| } |  |  |  |

Table 6.2A.3.3.4.3-3: BSR-Config (Rel-15 UE only)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| BSR-Config ::= SEQUENCE { |  |  |  |
| periodicBSR-Timer | infinity |  |  |
| retxBSR-Timer | sf80 |  |  |
| logicalChannelSR-DelayTimer | Not present |  |  |
| } |  |  |  |

6.2A.3.3.4.3.1 Message contents exceptions (network signalling value " CA\_NS\_202" on PCC and SCC)

Table 6.2A.3.3.4.3.1-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "CA\_NS\_202"

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 *AdditionalSpectrumEmission* | | | |
| Information Element | Value/remark | Comment | Condition |
| AdditionalSpectrumEmission | 1 (CA\_NS\_202) |  | band n257 |
| 2 (CA\_NS\_202) |  | band 258 |

6.2A.3.3.4.3.2 Message contents exceptions (network signalling value " CA\_NS\_203" on PCC and SCC)

Table 6.2A.3.3.4.3.2-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "CA\_NS\_203"

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1 *AdditionalSpectrumEmission* | | | |
| Information Element | Value/remark | Comment | Condition |
| AdditionalSpectrumEmission | 3 (CA\_NS\_203) |  | band n258 |

6.2A.3.3.5 Test requirement

The EIRP derived in step 9 shall be within the range prescribed by the nominal maximum output power and tolerance in the applicable table from Table 6.2A.3.3.5-1 to Table 6.2A.3.3.5-5.

Table 6.2A.3.3.5-0: Test Tolerance (A-MPR for CA) (Aggregated BW ≤ 400MHz)

|  |  |  |  |
| --- | --- | --- | --- |
| Power Class | Test Metric | FR2a | FR2b |
| PC1 | Max device size ≤ 30 cm | 3.38 dB, NTC | 3.38 dB, NTC |
| PC2 | Max device size ≤ 30 cm | FFS | FFS |
| PC3 | Max device size ≤ 30 cm | 3.24 dB, NTC | 3.24 dB, NTC |
| PC4 | Max device size ≤ 30 cm | FFS | FFS |

Table 6.2A.3.3.5-1: A-MPR requirements for CA\_NS\_202 (Power Class 1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n257, n258 | 40.0 | 6.5~9.7 | 11.0 | 7.0 | 22-TT | 55 |
| 2 | n257, n258 (NOTE 2) | 40.0 | 9~10.7 | 11.0 | 7.0 | 22-TT | 55 |
| 2 | n257, n258 (NOTE 3) | 40.0 | 11.2 | 11.0 | 7.0 | 21.8-TT | 55 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.3.5-0.  NOTE 2: Cumulative aggregated BW < 800MHz.  NOTE 3: 800MHz <= Cumulative aggregated BW < 1400MHz. | | | | | | | |

Table 6.2A.3.3.5-2: A-MPR requirements for CA\_NS\_203 (Power Class 1)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 40.0 | 0 | 6.5 | 5.0 | 28.5-TT | 55 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.3.5-0. | | | | | | | |

Table 6.2A.3.3.5-3: A-MPR requirements for CA\_NS\_203 (Power Class 2)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 29.0 | 0 | 6.5 | 5.0 | 17.5-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.3.5-0. | | | | | | | |

Table 6.2A.3.3.5-4: A-MPR requirements for CA\_NS\_203 (Power Class 3)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 22.4 | 0 | 6.5 | 5.0 | 10.9-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.3.5-0. | | | | | | | |

Table 6.2A.3.3.5-5: A-MPR requirements for CA\_NS\_203 (Power Class 4)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test ID | Band | Min peak EIRP (dBm) | MPR (dB) | A-MPR (dB) | T(MPR) (dB) | Lower limit (dBm) | Upper limit (dBm) |
| 1 | n258 | 34.0 | 0 | 6.5 | 5.0 | 22.5-TT | 43 |
| NOTE 1: TT for each band and accumulative aggregated bandwidth is specified in Table 6.2A.3.3.5-0. | | | | | | | |

#### 6.2A.3.4 UE maximum output power with additional requirements for CA (5UL CA)

FFS

#### 6.2A.3.5 UE maximum output power with additional requirements for CA (6UL CA)

FFS

#### 6.2A.3.6 UE maximum output power with additional requirements for CA (7UL CA)

FFS

#### 6.2A.3.7 UE maximum output power with additional requirements for CA (8UL CA)

FFS

### 6.2A.4 Configured transmitted power for CA

#### 6.2A.4.0 Minimum conformance requirements

A UE configured with carrier aggregation can configure its maximum output power for each uplink carrier *f* of activated serving cell *c* and its total configured output power PCMAX. The definition of the configured UE maximum output power PCMAX,*f,c* for each carrier *f* of a serving cell *c* is used for power headroom reporting for carrier *f* of serving cell *c* only and is in accordance with that specified in clause 6.2.4 with parameters MPR, A-MPR and P-MPR replaced with those specified below. The UE maximum configured power PCMAX in a transmission occasion is determined by the UL grants for carriers *f* of all serving cells *c* with non-zero granted power in the respective reference point.

For uplink intra-band contiguous carrier aggregation, MPR is specified in subclause 6.2A.2. PCMAX is calculated under the assumption that power spectral density for each RB in each component carrier is same.

The configured UE maximum output power PCMAX shall be set such that the corresponding measured total peak EIRP PUMAX is within the following bounds

PPowerclass – MAX(MAX(MPR, A-MPR) + ΔMBP,n, P-MPR) – MAX{T(MAX(MPR, A-MPR)),T(P-MPR)} ≤ PUMAX ≤ EIRPmax

with PPowerclass the peak EIRP as specified in sub-clause 6.2A.1, EIRPmax the applicable maximum EIRP as specified in sub-clause 6.2A.1, MPR as specified in sub-clause 6.2A.2, A-MPR as specified in sub-clause 6.2A.3, ΔMBP,n the peak EIRP relaxation as specified in clause 6.2.1, P-MPR the power management term for the UE as described in 6.2.4.

The measured configured power PUMAX for carrier aggregation is defined as

where pUMAX,f,c is the linear value of the measured power PUMAX,f,c for carrier *f=f(c)* of serving cell *c*. The measured total radiated power PTMAX for carrier aggregation is defined as

where pTMAX,f,c is the linear value of the measured total radiated power PTMAX,f,c for carrier *f* = *f*(*c*) of serving cell *c*. The total radiated power PTMAX is bounded by

PTMAX ≤ TRPmax

where TRPmax the maximum TRP for the UE power class as specified in sub-clause 6.2A.1.

The tolerance T(ΔP) for applicable values of ΔP (values in dB) is specified in Table 6.2A.4.0-1.

Table 6.2A.4.0-1: PUMAX tolerance

|  |  |  |
| --- | --- | --- |
| Operating Band | ∆P (dB) | Tolerance T(∆P)  (dB) |
| n257, n258, n260, n261 | P = 0 | 0 |
| 0 < P ≤ 2 | 1.5 |
| 2 < P ≤ 3 | 2.0 |
| 3 < P ≤ 4 | 3.0 |
| 4 < P ≤ 5 | 4.0 |
| 5 < P ≤ 10 | 5.0 |
| 10 < P ≤ 15 | 7.0 |
| 15 < P ≤ X | 8.0 |
| NOTE: X is the value such that Pumax lower bound, PPowerclass - P – T(P) = minimum output power specified in subclause 6.3A.1 | | |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2A.4.

#### 6.2A.4.1 Configured transmitted power for CA (2UL CA)

6.2A.4.1.1 Test purpose

To verify the UE measured configured maximum power PUMAX is within the range defined prescribed by the specified nominal maximum output power and tolerance.

6.2A.4.1.2 Test applicability

The requirements of this test are covered in test cases 6.2A.1.1.1 UE maximum output power - EIRP and TRP for CA (2UL CA), 6.2A.2.1 Maximum output power reduction for CA (2UL CA) and 6.2A.3.1 UE maximum output power with additional requirements for CA (2UL CA) to all types of NR UE release 15 and forward supporting 2UL CA.

6.2A.4.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.2A.4.0.

6.2A.4.1.4 Test description

This test is covered by clause 6.2A.1.1.1 UE maximum output power - EIRP and TRP for CA (2UL CA), 6.2A.2.1 Maximum output power reduction for CA (2UL CA) and 6.2A.3.1 UE maximum output power with additional requirements for CA (2UL CA).

6.2A.4.1.5 Test requirements

This test is covered by clause 6.2A.1.1.1 UE maximum output power - EIRP and TRP for CA (2UL CA), 6.2A.2.1 Maximum output power reduction for CA (2UL CA) and 6.2A.3.1 UE maximum output power with additional requirements for CA (2UL CA).

#### 6.2A.4.2 Configured transmitted power for CA (3UL CA)

FFS

#### 6.2A.4.3 Configured transmitted power for CA (4UL CA)

FFS

#### 6.2A.4.4 Configured transmitted power for CA (5UL CA)

FFS

#### 6.2A.4.5 Configured transmitted power for CA (6UL CA)

FFS

#### 6.2A.4.6 Configured transmitted power for CA (7UL CA)

FFS

#### 6.2A.4.7 Configured transmitted power for CA (8UL CA)

FFS

##### 6.2A.5 UE maximum output power - EIRP and TRP for CA (2UL CA) with UL Gaps

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

* Measurement Uncertainties and Test Tolerances are FFS

6.2A.5.1.1.1 Test purpose

The objective of this test is to determine the impact of UL-gaps on TX power management by measuring the EIRP with and without UL-Gaps configured for FR2 Carrier Aggregation.

6.2A.5.1.1.2 Test applicability

This test case applies to all types of NR UEs release 17 and forward supporting  *ul-GapFR2-r17*, *tdd-MPE-P-MPR-Reporting-r16* and FR2 2UL CA.

For bandwidth class B, this test case is not testable due to lack of appropriate test points since there is no configuration satisfying MPR=0dB requirements in TS 38.101-2.

6.2A.5.1.1.3 Minimum conformance requirements

The difference of the measured peak EIRP PUMAX\_GAP\_ON for CA when UL gap for TX power management is configured and activated, and the measured peak EIRP PUMAX\_GAP\_OFF when UL gap is not configured or de-activated, shall meet the following requirement:

PUMAX\_GAP\_ON - PUMAX\_GAP\_OFF max((EIRPmeas\_peak – 23) + 10 \* log10(Z/20), 3)dB

where EIRPmeas\_peak  is the measured UE peak EIRP with zero MPR/A-MPR/P-MPR in clause 6.2A.1 for the corresponding power class, and Z% is duty cycle of the reference measurement channel. PUMAX,f,c\_GAP\_ONshall be measured outside of the UL gap symbol(s)*.* The period of measurement shall be at least 4 seconds. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle) and in the test Z is set to 20 when *maxUplinkDutyCycle-FR2* is less than 20 or not reported, and should be larger than *maxUplinkDutyCycle-FR2* when *maxUplinkDutyCycle-FR2* is equal to or greater than 20, assuming all CCs share the same TX beam peak direction. The reference measurement channel is specified in Annex A.2.3.

When UL gap for Tx power management is configured and activated, the reported P-MPRf,c shall be less than 3dB. When UL gap for Tx power management is not configured and activated, UE shall set the P bit in PHR to 1 in the test when PHR is configured. P-bit is defined in TS 38.321 clause 6.1.3.8 and 6.1.3.9.

NOTE 1: As mentioned in 6.2.4.3 - for UE conformance testing P-MPRf,c shall be 0 dB, except for the testing of UL gap for Tx power management, where P-MPRf,c may be non-zero dB – which is relevant to this test case

6.2A.5.1.1.4 Test description

6.2A.5.1.1.4.1 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, and channel bandwidths based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.2A.5.1.1.4.1-1. 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 6.2A.5.1.1.4.1-1: Intra-band Contiguous CA Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Highest aggregated BW of the CA configuration  (≤ 400 MHz aggregated channel bandwidth) | | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120 kHz | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping  ( NOTE 4） | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 100 | - | | DFT-s-OFDM QPSK | Inner Full for PC2, PC3 and PC4 |
| SCC/CC2 | 100 |  | | - | - |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 4: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: *“The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier”*. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2A.1.1.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.2A.1.1.1.4.3

6.2A.1.1.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [10] subclause 5.5.1. Message contents are defined in clause 6.2A.1.1.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 6.2A.1.1.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.2A.1.1.1.4.3.

4a. If the UE does not support beamCorrespondenceWithoutULBeamSweeping, the side conditions for SSB-based and CSI-RS based L1-RSRP measurements are applied as per Table 6.6.1.3.3.1.1-1 and Table 6.6.1.3.3.1.1-2 respectively.

5. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

6. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

ACTIVATE Uplink Gaps

8. SS configures and activates UL-gaps via message contents defined in section 6.2.5.4.3-1. P-MPR reporting is also enabled via the message contents defined in 6.2.5.4.3-2.

9. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration. EIRP test procedure is defined in Annex K.1.3. The period of measurement shall be at least 4 seconds. EIRP is calculated considering both polarizations, theta and phi. Record this as peak EIRP PUMAX,f,c\_GAP\_ON

10. SS detects and record the value within the P-MPR reports. Call this value P-MPRULgapON

DE-ACTIVATE Uplink Gaps

11. SS de-activates UL-gaps via message contents defined in section 6.2.5.4.3-1.

12. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration. EIRP test procedure is defined in Annex K.1.3. The period of measurement shall be at least 4 seconds. EIRP is calculated considering both polarizations, theta and phi. Record this value as peak EIRP PUMAX,f,c\_GAP\_OFF

13. SS detects and record the value of the P bit within the PHR.

14. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

15. Compute the difference between PUMAX,f,c\_GAP\_ON and PUMAX,f,c\_GAP\_OFF

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2A.1.1.1.4.3 Message contents

The message contents are configured the same as clause 6.2.5.4.3

6.2A.1.1.1.5 Test Requirements

FFS

## 6.2D Transmit power for UL MIMO

### 6.2D.1 UE maximum output power for UL MIMO

#### 6.2D.1.0 General

The requirements in the following clauses define the maximum output power radiated by the UE with *nrofSRS-Ports* set to 2, for any transmission bandwidth within the channel bandwidth for non-CA configuration, unless otherwise stated. MPR shall be applied as specified in clause 6.2D.2

For the maximum output power requirement for 2-layer UL MIMO operation, a UE shall be configured for 2-layer UL MIMO transmission as specified in Table 6.2D.1.0-1.

Table 6.2D.1.0-1: UL MIMO configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Transmission scheme | DCI format | Number of layers | TPMI index |
| Codebook based uplink | DCI format 0\_1 | 2 | 0 |

The maximum output power requirement for single layer transmission shall apply to a UE that supports ULFPTx feature and is configured for single layer transmission in its declared full power mode [22, TS 38.213] as specified in Table 6.2D.1.0-2.

Table 6.2D.1.0-2: PUSCH Configuration for uplink full power transmission (ULFPTx)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ULFPTx Mode | Transmission scheme | DCI format | Modulation | Number of layers | TPMI index |
| Mode-1 | Codebook based uplink | DCI format 0\_1 | DFT-s-OFDM, CP-OFDM 1 | 1 | 2 |
| Mode-2 | Codebook based uplink | DCI format 0\_1 | DFT-s-OFDM, CP-OFDM | 1 | 0 or 12 |
| Mode-full power | Codebook based uplink | DCI format 0\_1 | DFT-s-OFDM, CP-OFDM | 1 | 0,1 |
| NOTE 1: For PUSCH configured with ULFPTxModes set to Mode-1, all requirements for 1-layer CP-OFDM based modulation in subsection 6.2D are assumed to be met if the requirement for 2-layer UL MIMO has been validated.  NOTE 2: TPMI index selected shall be based upon the full power TPMI reported by the UE [22, TS 38.213]. | | | | | |

#### 6.2D.1.1 UE maximum output power - EIRP and TRP for UL MIMO

Editor’s note: The following aspects are either missing or not yet determined:

- No test points are defined for 2-layer UL MIMO since there is no configuration satisfying MPR=0dB requirements in RAN4.

- Measurement Uncertainties and Test Tolerances are FFS for power classes other than 1, 3 and 5.

- The test case is incomplete for band n259.

- Test Procedures for EIRP beam peak Extreme Conditions are FFS.

6.2D.1.1.1 Test purpose

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

6.2D.1.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports UL MIMO.

6.2D.1.1.3 Minimum conformance requirements

6.2D.1.1.3.1 UE maximum output power for UL MIMO for power class 1

The following requirements define the maximum output power radiated by the PC1 UE. Requirements apply to UEs when configured for 2-layer transmission as well as when configured for single layer uplink full power transmission (ULFPTx), with configuration per clause 6.2D.1.0.

The minimum peak EIRP requirements are found in Table 6.2D.1.1.3.1-1 below. The period of measurement shall be at least one sub frame (1ms). The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle). Power class 1 UE is used for fixed wireless access (FWA).

Table 6.2D.1.1.3.1-1: UE minimum peak EIRP for UL MIMO for power class 1

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 40.0 |
| n258 | 40.0 |
| n260 | 38.0 |
| n261 | 40.0 |
| n262 | 34.2 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance. | |

Table 6.2D.1.1.3.1-2: Void

The maximum output power values for TRP and EIRP are found in Table 6.2D.1.1.3.1-3 below for UE with UL MIMO. The maximum allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.1-3: UE maximum output power limits for UL MIMO for power class 1

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 35 | 55 |
| n258 | 35 | 55 |
| n260 | 35 | 55 |
| n261 | 35 | 55 |
| n262 | 35 | 55 |

The minimum EIRP at the 85th percentile of the distribution of radiated power measured over the full sphere around the UE with UL MIMO is defined as the spherical coverage requirement and is found in Table 6.2D.1.1.3.1-4 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2D.1.1.3.1-4: UE spherical coverage for UL MIMO for power class 1

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85 %-tile CDF (dBm) |
| n257 | 32.0 |
| n258 | 32.0 |
| n260 | 30.0 |
| n261 | 32.0 |
| n262 | 26.0 |
| NOTE 1: Minimum EIRP at 85 %-tile CDF is defined as the lower limit without tolerance. | |

6.2D.1.1.3.2 UE maximum output power for UL MIMO for power class 2

The following requirements define the maximum output power radiated by the PC2 UE. Requirements apply to UEs when configured for 2-layer transmission as well as when configured for single layer uplink full power transmission (ULFPTx), with configuration per clause 6.2D.1.0.

The minimum peak EIRP requirements are found in Table 6.2D.1.1.3.2-1 below. The period of measurement shall be at least one sub frame (1ms). The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.2-1: UE minimum peak EIRP for UL MIMO for power class 2

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 29 |
| n258 | 29 |
| n261 | 29 |
| n262 | 22.9 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance.  NOTE 2: Min Peak EIRP refers to the total EIRP for the UL beams peaks. | |

The maximum output power values for TRP and EIRP are found in Table 6.2D.1.1.3.2-2 below. The maximum allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.2-2: UE maximum output power limits for UL MIMO for power class 2

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |
| n261 | 23 | 43 |
| n262 | 23 | 43 |

Table 6.2D.1.1.3.2-3: Void

The minimum EIRP at the 60th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2D.1.1.3.2-4 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2D.1.1.3.2-4: UE spherical coverage for UL MIMO for power class 2

|  |  |
| --- | --- |
| Operating band | Min EIRP at 60 %-tile CDF (dBm) |
| n257 | 18.0 |
| n258 | 18.0 |
| n261 | 18.0 |
| n262 | 11.0 |
| NOTE 1: Minimum EIRP at 60 %-tile CDF is defined as the lower limit without tolerance | |

6.2D.1.1.3.3 UE maximum output power for UL MIMO for power class 3

The following requirements define the maximum output power radiated by the PC3 UE.. Requirements apply to UEs when configured for 2-layer transmission as well as when configured for single layer uplink full power transmission (ULFPTx), with configuration per clause 6.2D.1.0.

The minimum peak EIRP requirements are found in Table 6.2D.1.1.3.3-1 below. The period of measurement shall be at least one sub frame (1 ms). The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.3-1: UE minimum peak EIRP for UL MIMO for power class 3

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 22.4 |
| n258 | 22.4 |
| n259 | 18.7 |
| n260 | 20.6 |
| n261 | 22.4 |
| n262 | 16.0 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance.  NOTE 2: Min Peak EIRP refers to the total EIRP for the UL beams peaks. | |

The maximum output power values for TRP and EIRP are found in Table 6.2D.1.1.3.3-2 below. The maximum allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.3-2: UE maximum output power limits for UL MIMO for power class 3

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |
| n259 | 23 | 43 |
| n260 | 23 | 43 |
| n261 | 23 | 43 |
| n262 | 23 | 43 |

Table 6.2D.1.1.3.3-3: Void

The minimum EIRP at the 50th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2D.1.1.3.3-4 below. The requirement is verified with the test metric of EIRP (Link=spherical coverage grid, Meas=Link angle).

Table 6.2D.1.1.3.3-4: UE spherical coverage for UL MIMO for power class 3

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50%-tile CDF (dBm) |
| n257 | 11.5 |
| n258 | 11.5 |
| n259 | 5.8 |
| n260 | 8 |
| n261 | 11.5 |
| NOTE 1: Minimum EIRP at 50 %-tile CDF is defined as the lower limit without tolerance  NOTE 2: The requirements in this table are only applicable for UE which supports single band in FR2 | |

6.2D.1.1.3.4 UE maximum output power for UL MIMO for power class 4

The following requirements define the maximum output power radiated by the PC4 UE. Requirements apply to UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), with configuration per clause 6.2D.1.0.

The minimum peak EIRP requirements are found in Table 6.2D.1.1.3.4-1 below. The period of measurement shall be at least one sub frame (1ms). The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.4-1: UE minimum peak EIRP for UL MIMO for power class 4

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 34 |
| n258 | 34 |
| n260 | 31 |
| n261 | 34 |
| n262 | 28.3 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance.  NOTE 2: Min Peak EIRP refers to the total EIRP for the UL beams peaks. | |

The maximum output power values for TRP and EIRP are found in Table 6.2D.1.1.3.4-2 below. The maximum allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.4-2: UE maximum output power limits for UL MIMO for power class 4

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |
| n260 | 23 | 43 |
| n261 | 23 | 43 |
| n262 | 23 | 43 |

Table 6.2D.1.1.3.4-3: Void

The minimum EIRP at the 20th percentile of the distribution of radiated power measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 6.2D.1.1.3.4-4 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2D.1.1.3.4-4: UE spherical coverage for UL MIMO for power class 4

|  |  |
| --- | --- |
| Operating band | Min EIRP at 20 %-tile CDF (dBm) |
| n257 | 25 |
| n258 | 25 |
| n260 | 19 |
| n261 | 25 |
| n262 | 16.2 |
| NOTE 1: Minimum EIRP at 20 %-tile CDF is defined as the lower limit without tolerance | |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2.1.

6.2D.1.1.3.5 UE maximum output power for UL MIMO for power class 5

The following requirements define the maximum output power radiated by the PC4 UE. Requirements apply to UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), with configuration per clause 6.2D.1.0.

The minimum peak EIRP requirements are found in Table Table 6.2D.1.1.3.5-1 below. The period of measurement shall be at least one sub frame (1ms). The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle). Power class 5 UE is used for fixed wireless access (FWA).

Table 6.2D.1.1.3.5-1: UE minimum peak EIRP for UL MIMO for power class 5

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 30 |
| n258 | 30.4 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance | |

The maximum output power values for TRP and EIRP are found in Table Table 6.2D.1.1.3.5-2 below for UE with UL MIMO. The maximum allowed EIRP is derived from regulatory requirements. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.5-2: UE maximum output power limits for UL MIMO for power class 5

|  |  |  |
| --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |

The minimum EIRP at the 85th percentile of the distribution of radiated power measured over the full sphere around the UE with UL MIMO is defined as the spherical coverage requirement and is found in Table Table 6.2D.1.1.3.5-3 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2D.1.1.3.5-3: UE spherical coverage for UL MIMO for power class 5

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85 %-tile CDF (dBm) |
| n257 | 22 |
| n258 | 22.4 |
| NOTE 1: Minimum EIRP at 85 %-tile CDF is defined as the lower limit without tolerance | |

6.2D.1.1.3.6 UE maximum output power for UL MIMO for power class 6

The following requirements define the maximum output power radiated by the PC6 UE. Requirements apply to UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), with configuration per clause 6.2D.1.0.

The minimum peak EIRP requirements are found in Table 6.2D.1.1.3.6-1 below. The period of measurement shall be at least one sub frame (1ms). The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.6-1: UE minimum peak EIRP for UL MIMO for power class 6

|  |  |
| --- | --- |
| **Operating band** | **Min peak EIRP (dBm)** |
| n257 | 30 |
| n258 | 30.4 |
| n261 | 30 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance | |

The maximum output power values for TRP and EIRP are found in Table 6.2D. 1.1.3.6-2 below for UE with UL MIMO. The maximum allowed EIRP is derived from regulatory requirements [8]. The requirements are verified with the test metrics of TRP (Link=TX beam peak direction, Meas=TRP grid) in beam locked mode and EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2D.1.1.3.6-2: UE maximum output power limits for UL MIMO for power class 6

|  |  |  |
| --- | --- | --- |
| **Operating band** | **Max TRP (dBm)** | **Max EIRP (dBm)** |
| n257 | 23 | 43 |
| n258 | 23 | 43 |
| n261 | 23 | 43 |

The minimum EIRP measured over the spherical coverage evaluation areas is defined as the spherical coverage requirement and is found in Table 6.2D. 1.1.3.6-3 below. UE spherical coverage evaluation areas are found in Table 6.2.1.1.3.6-3a in clause 6.2.1.1.3.6, by consisting of Area-1 and Area-2, in the reference coordinate system in Annex J.1. The requirement is verified with the test metric of EIRP (Link= Spherical coverage grid, Meas=Link angle).

Table 6.2D.1.1.3.6-3: UE spherical coverage for UL MIMO for power class 6

|  |  |
| --- | --- |
| **Operating band** | **Min EIRP over UE spherical coverage evaluation areas (dBm)** |
| n257 | 20 |
| n258 | 20.4 |
| n261 | 20 |
| NOTE 1: Minimum EIRP over UE spherical coverage evaluation areas is defined as the lower limit without tolerance  NOTE 2: The requirements in this table are verified only under normal temperature conditions as defined in Annex E.2.1.  NOTE 3: The requirements in this table are applicable to FR2 PC6 UE with the network signalling *[highSpeedMeasFlag-r17]* configured as *[set2]*. | |

6.2D.1.1.4 Test description

6.2D.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, 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 subcarrier spacing, are shown in Table 6.2D.1.1.4.1-1 and Table 6.2D.1.1.4.1-2. 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 6.2D.1.1.4.1-1: Test Configuration Table for 2-layer UL MIMO

NOTE: No test points are defined since there is no configuration satisfying MPR=0dB requirements in RAN4.

Table 6.2D.1.1.4.1-2: Test Configuration Table for uplink full power transmission (ULFPTx)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid Range, High range | | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest, 100 MHz, Highest | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120 kHz | | |
| Test Parameters | | | | | | | |
| Test ID | ChBw | SCS | Downlink Configuration | Uplink Configuration | | | |
|  |  | Default | N/A | Modulation | | RB allocation (NOTE 1) | |
| 1 | 50 |  | DFT-s-OFDM QPSK | | Inner\_Full for PC2, PC3 | |
| 2 | 100 |  |  |  | | , PC4 and PC6 | |
| 3 | 200 |  |  |  | | Inner\_Full\_Region1 for | |
| 4 | 400 |  |  |  | | PC1 | |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3, PC4 and PC6 or Table 6.1-2 for PC1. | | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.2D.1.1.4.1-2.

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

6. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.2D.1.1.4.3

6.2D.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 6.2D.1.1.4.1-2. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.2D.1.1.4.3.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Tables 6.2D.1.1.5-1 to 6.2D.1.1.5-4. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6. Measure TRP of the transmitted signal for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.5.2.3.5-1. Total radiated power is measured according to TRP measurement procedure defined in Annex K.1.7 and measurement grid specified in Annex M.4. TRP is calculated considering both polarizations, theta and phi.

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

8. If UE supports ULFPTx, repeat test steps 1~7 with UL RMC according to Table 6.2D.1.1.4.1-2. The PDCCH DCI format 0\_1 is specified with the condition ULFPTx\_Mode1, ULFPTx\_Mode2 or ULFPTx\_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability. Message contents are according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 with condition TRANSFORM\_PRECODER\_ENABLED.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2D.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.

6.2D.1.1.5 Test requirement

The EIRP derived in step 4, TRP derived in step 5, and EIRP and TRP derived in step 8 shall not exceed the values specified in Table 6.2D.1.1.5-1 to Table 6.2D.1.1.5-4.

Table 6.2D.1.1.5-1: UE maximum output test requirements for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 35+TT | 55 | 40.0-TT |
| n258 | 35+TT | 55 | 40.0-TT |
| n260 | 35+TT | 55 | 38.0-TT |
| n261 | 35+TT | 55 | 40.0-TT |

Table 6.2D.1.1.5-1a: Test Tolerance (Max TRP for Power class 1)

|  |  |  |
| --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** |
| Max device size ≤ 30 cm | 2.78 dB, NTC  2.94 dB, ETC | 2.87 dB, NTC  3.03 dB, ETC |

Table 6.2D.1.1.5-1b: Test Tolerance (Min peak EIRP for Power class 1)

|  |  |  |
| --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** |
| Max device size ≤ 30 cm | 3.12 dB, NTC  3.28 dB, ETC | 3.12 dB, NTC  3.28 dB, ETC |

Table 6.2D.1.1.5-2: UE maximum output test requirements for power class 2

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 29-TT |
| n258 | 23+TT | 43 | 29-TT |
| n260 |  |  |  |
| n261 | 23+TT | 43 | 29-TT |
| n262 | 23+TT | 43 | 22.9-TT |

Table 6.2D.1.1.5-3: UE maximum output test requirements for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 22.4-TT |
| n258 | 23+TT | 43 | 22.4-TT |
| n260 | 23+TT | 43 | 20.6-TT |
| n261 | 23+TT | 43 | 22.4-TT |
| n262 | 23+TT | 43 | 16.0-TT |

Table 6.2D.1.1.5-3a: Test Tolerance (Max TRP for Power class 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Test Metric | FR2a | FR2b | FR2c |
| Max device size ≤ 30 cm | 2.77 dB, NTC  2.91 dB, ETC | 2.89 dB, NTC  3.04 dB, ETC | 3.70 dB, NTC  TBD dB, ETC |

Table 6.2D.1.1.5-3b: Test Tolerance (Min peak EIRP for Power class 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Test Metric | FR2a | FR2b | FR2c |
| Max device size ≤ 30 cm | 2.99 dB, NTC  3.15 dB, ETC | 2.99 dB, NTC  3.15 dB, ETC | 3.80 dB, NTC  3.89 dB, ETC |

Table 6.2D.1.1.5-4: UE maximum output power test requirements for power class 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 34-TT |
| n258 | 23+TT | 43 | 34-TT |
| n260 | 23+TT | 43 | 31-TT |
| n261 | 23+TT | 43 | 34-TT |

Table 6.2D.1.1.5-5: UE maximum output power test requirements for power class 5

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 30.0-TT-MBP,n |
| n258 | 23+TT | 43 | 30.4-TT-MBP,n |
| Note 1: MBP,n = 0 for single band UE. For multi-band UEs, MBP,n is defined in table 6.2.1.1.3.5-4. | | | |

Table 6.2D.1.1.5-5a: Test Tolerance (Max TRP for Power class 5)

|  |  |
| --- | --- |
| **Test Metric** | **FR2a** |
| Max device size ≤ 30 cm | 2.78 dB, NTC  2.94 dB, ETC |

Table 6.2D.1.1.5-5b: Test Tolerance (Min peak EIRP for Power class 5)

|  |  |
| --- | --- |
| **Test Metric** | **FR2a** |
| Max device size ≤ 30 cm | 3.12 dB, NTC  3.28 dB, ETC |

Table 6.2D.1.1.5-6: UE maximum output power test requirements for power class 6

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Min peak EIRP (dBm) |
| n257 | 23+TT | 43 | 30+TT |
| n258 | 23+TT | 43 | 30.4+TT |
| n261 | 23+TT | 43 | 30+TT |

#### 6.2D.1.2 UE maximum output power - Spherical coverage for UL MIMO

Editor’s note: The following aspects are either missing or not yet determined:

- No test points are defined for 2-layer UL MIMO since there is no configuration satisfying MPR=0dB requirements in RAN4.

- Measurement Uncertainties and Test Tolerances are FFS for power classes other than 1, 3 and 5.

- The test case is incomplete for band n259.

6.2D.1.2.1 Test purpose

To verify that the spatial coverage of the UE in expected directions is acceptable.

6.2D.1.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support beam correspondence without UL beam sweeping.

6.2D.1.2.3 Minimum conformance requirements

Minimum conformance requirements are defined in clause 6.2D.1.1.3.

6.2D.1.2.4 Test description

6.2D.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, 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 subcarrier spacing, are shown in Table 6.2D.1.2.4.1-1 and Table 6.2D.1.2.4.1-2. 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 6.2D.1.2.4.1-1: Test Configuration Table for 2-layer UL MIMO

NOTE: No test points are defined since there is no configuration satisfying MPR=0dB requirements in RAN4.

Table 6.2D.1.2.4.1-2: Test Configuration Table for uplink full power transmission (ULFPTx)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid Range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest, Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120 kHz | |
| Test Parameters | | | | | | |
| Test ID | ChBw | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | N/A | Modulation | | RB allocation (NOTE 1) |
| 1 | 50 |  | DFT-s-OFDM QPSK | | Inner\_Full for PC2, PC3 |
| 2 | 100 |  |  |  | | and PC4 |
| 3 | 200 |  |  |  | | Inner\_Full\_Region1 for |
| 4 | 400 |  |  |  | | PC1 |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.2 and TS 38.508-1 [10] subclause 5.2.1.1.1, and uplink signals according to Annex G.0, G.1 and G.3.0.

4. The UL Reference Measurement channels are set according to Table 6.2D.1.2.4.1-2.

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

6. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.2D.1.2.4.3

6.2D.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 6.2D.1.2.4.1-2. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. Messages to configure the appropriate uplink modulation in section 6.2D.1.2.4.3.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. Through its beam correspondence procedure, DUT refines its TX beam toward that direction depending on DUT’s beam correspondence capability which shall match OEM declaration:

4a If the DUT’s beam correspondence capability beamCorrespondenceWithoutUL-BeamSweeping is supported, then DUT autonomously chooses the corresponding TX beam for PUSCH transmission using downlink reference signals to transmit in the direction of the incoming DL signal, which is based on beam correspondence without relying on UL beam sweeping;

4b If the DUT’s beam correspondence capability beamCorrespondenceWithoutUL-BeamSweeping is not present, then DUT chooses the TX beam for PUSCH transmission which is based on beam correspondence with relying on both DL measurements on downlink reference signals and network-assisted uplink beam sweeping:

4b.1) DUT uses downlink reference signals to select proper RX beam and uses autonomous beam correspondence to select the TX beam.

4b.2) SS configures M=8 SRS resources to DUT, with the field *spatialRelationInfo* omitted and the field usage set as ‘beamManagement’. In case DUT supports less than 8 SRS resources, SS configures the number of SRS resources according to the maximum number of SRS resources indicated by UE capability signalling. Additionally, for codebook based PUSCH transmission, SS configures a semi-persistent SRS resource set with the field *usage* as 'codebook'.

4b.3) Based on the TX beam autonomously selected by DUT, DUT chooses TX beams to transmit SRS-resources configured by SS.

4b.4) Based on measurement of the received *beamManagement* SRS, SS chooses the best SRS beam and, if needed, updates the spatial relation information between the semi-persistent *codebook* SRS resources and the SS selected *beamManagement* SRS resource in the activation MAC CE of the semi-persistent SRS resource. The SS indicates in the SRS Resource Indicator (SRI) field in the scheduling grant for PUSCH, if present, the SRS resource within the semi-persistent SRS resource set whose spatial relation is linked to the best detected SRS beam.

4b.5) DUT transmits PUSCH corresponding to the SRS resource indicated by the SRI.

5. Measure UE EIRP value for each grid point according to the EIRP spherical coverage procedure defined in Annex K.1.5.0, and obtain a cumulative distribution function (CDF) of all EIRP dBm values. Alternatively, UE EIRP measurement for each grid point could be done according to Tx Fast spherical coverage procedure defined in Annex K.1.5.1. After a rotation, allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for UE to find the best beam to use. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6. Identify the EIRP dBm value corresponding to %-tile (UE power class dependent) value in the applicable test requirement table in section 6.2D.1.2.5.

7. If UE supports ULFPTx, repeat test steps 1~6 with UL RMC according to Table 6.2D.1.2.4.1-2. The PDCCH DCI format 0\_1 is specified with the condition ULFPTx\_Mode1, ULFPTx\_Mode2 or ULFPTx\_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability. Message contents are according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 with condition TRANSFORM\_PRECODER\_ENABLED.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2D.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.

6.2D.1.2.5 Test requirement

The defined %-tile EIRP in measurement distribution derived in step 5 and step 6 shall exceed the values specified in Table 6.2D.1.2.5-1 to Table 6.2D.1.2.5-6.

Table 6.2D.1.2.5-1: UE spherical coverage for power class 1

|  |  |
| --- | --- |
| Operating band | Min EIRP at 85%-tile CDF (dBm) |
| n257 | 32.0-TT |
| n258 | 32.0-TT |
| n260 | 30.0-TT |
| n261 | 32.0-TT |
| n262 | 26.0-TT |

Table 6.2D.1.2.5-1a: Test Tolerance (UE spherical coverage for Power class 1)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 2.69 dB | 2.69 dB |

Table 6.2D.1.2.5-2: UE spherical coverage for power class 2

|  |  |
| --- | --- |
| Operating band | Min EIRP at 60%-tile CDF (dBm) |
| n257 | 18.0-TT |
| n258 | 18.0-TT |
| n260 |  |
| n261 | 18.0-TT |
| n262 | 11.0-TT |

Table 6.2D.1.2.5-3: UE spherical coverage for power class 3

|  |  |
| --- | --- |
| Operating band | Min EIRP at 50t%-tile CDF (dBm) |
| n257 | 11.5-TT |
| n258 | 11.5-TT |
| n259 | 5.8-TT |
| n260 | 8-TT |
| n261 | 11.5-TT |

Table 6.2D.1.2.5-3b: Test Tolerance (UE spherical coverage for Power class 3)

|  |  |  |  |
| --- | --- | --- | --- |
| Test Metric | FR2a | FR2b | FR2c |
| Max device size ≤ 30 cm | 2.69 dB | 2.69 dB | TBD |

Table 6.2D.1.2.5-4: UE spherical coverage for power class 4

|  |  |
| --- | --- |
| Operating band | Min EIRP at 20%-tile CDF (dBm) |
| n257 | 25-TT |
| n258 | 25-TT |
| n260 | 19-TT |
| n261 | 25-TT |
| n262 | 16.2-TT |

**Table 6.2D.1.2.5-5: UE spherical coverage for power class 5**

|  |  |
| --- | --- |
| **Operating band** | **Min EIRP at 85 %-tile CDF (dBm)** |
| n257 | 22-TT |
| n258 | 22.4-TT |

Table 6.2D.1.2.5-5a: Test Tolerance (UE spherical coverage for Power class 5)

|  |  |
| --- | --- |
| Test Metric | FR2a |
| Max device size ≤ 30 cm | 2.69 dB |

**Table 6.2D.1.2.5-6: UE spherical coverage for power class 6**

|  |  |
| --- | --- |
| **Operating band** | **Min EIRP over UE spherical coverage evaluation areas (dBm)** |
| n257 | 20-TT |
| n258 | 20.4-TT |
| n261 | 20-TT |

### 6.2D.2 UE maximum output power reduction for UL MIMO

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

* OTA test procedure for UL MIMO is still under investigation
* Measurement Uncertainties and Test Tolerances are FFS.

6.2D.2.1 Test purpose

The number of RB identified in 6.2D.2.3 is based on meeting the requirements for the maximum power reduction (MPR) due to Cubic Metric (CM).

6.2D.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.2D.2.3 Minimum conformance requirements

##### 6.2D.2.3.1 UE maximum output power reduction for modulation / channel bandwidth for UL MIMO for power class 1

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2D.1.1.3.1-1 is specified in sub-clause 6.2.2.3.1. The requirements shall be met with configurations specified in sub-clause 6.2D.1.0.

For the UE maximum output power modified by MPR, the power limits specified in clause 6.2D.4 apply.

##### 6.2D.2.3.2 UE maximum output power reduction for modulation / channel bandwidth for UL MIMO for power class 2

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2D.1.1.3.2-1 is specified in sub-clause 6.2.2.3.2. The requirements shall be met with configurations specified in sub-clause 6.2D.1.0.

For the UE maximum output power modified by MPR, the power limits specified in clause 6.2D.4 apply.

##### 6.2D.2.3.3 UE maximum output power reduction for modulation / channel bandwidth for UL MIMO for power class 3

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2D.1.1.3.3-1 is specified in sub-clause 6.2.2.3.3. The requirements shall be met with configurations specified in sub-clause 6.2D.1.0.

For the UE maximum output power modified by MPR, the power limits specified in clause 6.2D.4 apply.

##### 6.2D.2.3.4 UE maximum output power reduction for modulation / channel bandwidth for UL MIMO for power class 4

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2D.1.1.3.4-1 is specified in sub-clause 6.2.2.3.4. The requirements shall be met with configurations specified in sub-clause 6.2D.1.0.

For the UE maximum output power modified by MPR, the power limits specified in clause 6.2D.4 apply.

##### 6.2D.2.3.5 UE maximum output power reduction for modulation / channel bandwidth for UL MIMO for power class 5

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2D.1.1.3.4-1 is specified in sub-clause 6.2.2.3.4. The requirements shall be met with configurations specified in sub-clause 6.2D.1.0.

For the UE maximum output power modified by MPR, the power limits specified in clause 6.2D.4 apply.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2D.2.

6.2D.2.4 Test description

6.2D.2.4.1 Initial condition

Same initial condition in clause 6.2.2.4.1, with following exceptions:

- Instead of Table 6.2.2.4.1-1🡪 use Table 6.2D.2.4.1-1.

- Instead of Table 6.2.2.4.1-2🡪 use Table 6.2D.2.4.1-2.

- Instead of Table 6.2.2.4.1-3🡪 use Table 6.2D.2.4.1-3.

- Instead of Table 6.2.2.4.1-7🡪 use Table 6.2D.2.4.1-4.

- Instead of Table 6.2.2.4.1-8🡪 use Table 6.2D.2.4.1-5.

- Instead of Table 6.2.2.4.1-9🡪 use Table 6.2D.2.4.1-6.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 6.2D.2.4.1-1: Test Configuration Table (Power Class 1, MPRnarrow) Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | | |
| Test Parameters | | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) | |
| SCS 60 kHz | SCS 120 kHz |
| 1 | Low |  |  |  | CP-OFDM 64 QAM | Outer\_1RB\_Left | Outer\_1RB\_Left |
| 2 | High |  |  |  | CP-OFDM 64 QAM | Outer\_1RB\_Right | Outer\_1RB\_Right |
| 3 | Low |  |  |  | CP-OFDM 64 QAM | 3@0 | 2@0 |
| 4 | High |  |  |  | CP-OFDM 64 QAM | 3@NRB-3 | 2@NRB-2 |
| 5 | Low |  |  |  | CP-OFDM 64 QAM | 15@0 | 7@0 |
| 6 | High |  |  |  | CP-OFDM 64 QAM | 15@NRB-15 | 7@NRB-7 |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-2. | | | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 6.2D.2.4.1-2: Test Configuration Table (Power Class 1, MPRWT, BWchannel ≤ 200 MHz) Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | | |
| Test Parameters | | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) | |
| SCS 60 kHz | SCS 120 kHz |
| 1 | Mid |  |  |  | CP-OFDM QPSK | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 2 | Low |  |  |  | CP-OFDM QPSK | 16@0 | 8@0 |
| 3 | High |  |  |  | CP-OFDM QPSK | 16@NRB-16 | 8@NRB-8 |
| 4 | Mid |  |  |  | CP-OFDM QPSK | Outer\_Full | Outer\_Full |
| 5 | Low |  |  |  | CP-OFDM 16 QAM | 16@0 | 8@0 |
| 6 | High |  |  |  | CP-OFDM 16 QAM | 16@NRB-16 | 8@NRB-8 |
| 7 | Mid |  |  |  | CP-OFDM 16 QAM | Outer\_Full | Outer\_Full |
| 8 | Mid |  |  |  | CP-OFDM 16 QAM | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 9 | Low |  |  |  | CP-OFDM 64 QAM | 16@0 | 8@0 |
| 10 | High |  |  |  | CP-OFDM 64 QAM | 16@NRB-16 | 8@NRB-8 |
| 11 | Mid |  |  |  | CP-OFDM 64 QAM | Outer\_Full | Outer\_Full |
| 12 | Mid |  |  |  | CP-OFDM 64 QAM | Inner\_Full | Inner\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in clause 6.1-2. | | | | | | | |

Table 6.2D.2.4.1-3: Test Configuration Table (Power Class 1, MPRWT, BWchannel = 400 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | 400 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120kHz | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) |
| 1 | Mid | CP-OFDM QPSK | Inner\_Full\_Region2 |
| 2 | Low | CP-OFDM QPSK | 8@0 |
| 3 | High | CP-OFDM QPSK | 8@NRB-8 |
| 4 | Mid | CP-OFDM QPSK | Outer\_Full |
| 5 | Low | CP-OFDM 16 QAM | 8@0 |
| 6 | High | CP-OFDM 16 QAM | 8@NRB-8 |
| 7 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 8 | Mid | CP-OFDM 16 QAM | Inner\_Full\_Region2 |
| 9 | Low | CP-OFDM 64 QAM | 8@0 |
| 10 | High | CP-OFDM 64 QAM | 8@NRB-8 |
| 11 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in clause 6.1-2. | | | | | | |

Table 6.2D.2.4.1-4: Test Configuration Table (Power Class 2, 3 and 4, MPRnarrow, BWchannel ≤ 200 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz t | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) |
| 1 | Low | CP-OFDM QPSK | Outer\_1RB\_Left |
| 2 | High | CP-OFDM QPSK | Outer\_1RB\_Right |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

Table 6.2D.2.4.1-5: Test Configuration Table (Power Class 2, 3 and 4, MPRWT, BWchannel ≤ 200 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) |
| 1 | Mid | CP-OFDM QPSK | Inner\_Full |
| 2 | Low | CP-OFDM QPSK | Outer\_1RB\_Left |
| 3 | High | CP-OFDM QPSK | Outer\_1RB\_Right |
| 4 | Mid | CP-OFDM QPSK | Outer\_Full |
| 5 | Mid | CP-OFDM 16 QAM | Inner\_Full |
| 6 | Low | CP-OFDM 16 QAM | Outer\_1RB\_Left |
| 7 | High | CP-OFDM 16 QAM | Outer\_1RB\_Right |
| 8 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 9 | Mid | CP-OFDM 64 QAM | Inner\_Full |
| 10 | Low | CP-OFDM 64 QAM | Outer\_1RB\_Left |
| 11 | High | CP-OFDM 64 QAM | Outer\_1RB\_Right |
| 12 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

Table 6.2D.2.4.1-6: Test Configuration Table (Power Class 2, 3 and 4, MPRWT, BWchannel = 400 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | 400 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120kHz | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | - | Modulation | RB allocation (NOTE 1) |
| 1 | Low | CP-OFDM QPSK | Outer\_1RB\_Left |
| 2 | High | CP-OFDM QPSK | Outer\_1RB\_Right |
| 3 | Mid | CP-OFDM QPSK | Outer\_Full |
| 4 | Low | CP-OFDM 16 QAM | Outer\_1RB\_Left |
| 5 | High | CP-OFDM 16 QAM | Outer\_1RB\_Right |
| 6 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 7 | Low | CP-OFDM 64 QAM | Outer\_1RB\_Left |
| 8 | High | CP-OFDM 64 QAM | Outer\_1RB\_Right |
| 9 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 6.2D.2.4.1-7: Test Configuration Table for ULFPTx (Power Class 1, MPRnarrow) Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | | |
| Test Parameters | | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | Default | N/A for Maximum Power Reduction (MPR) test case | Modulation | RB allocation (NOTE 1) | |
| SCS 60 kHz | SCS 120 kHz |
| 1 | Low |  |  |  | CP-OFDM 64 QAM | Outer\_1RB\_Left | Outer\_1RB\_Left |
| 2 | High |  |  |  | CP-OFDM 64 QAM | Outer\_1RB\_Right | Outer\_1RB\_Right |
| 3 | Low |  |  |  | CP-OFDM 64 QAM | 3@0 | 2@0 |
| 4 | High |  |  |  | CP-OFDM 64 QAM | 3@NRB-3 | 2@NRB-2 |
| 5 | Low |  |  |  | CP-OFDM 64 QAM | 15@0 | 7@0 |
| 6 | High |  |  |  | CP-OFDM 64 QAM | 15@NRB-15 | 7@NRB-7 |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-2.  NOTE 2: Test IDs 1 ~ 6 with CP-OFDM modulation are not needed if PDCCH DCI format 0\_1 indicates ULFPTx\_Mode1. | | | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Table 6.2D.2.4.1-8: Test Configuration Table for ULFPTx (Power Class 1, MPRWT, BWchannel ≤ 200 MHz) Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range,High range | | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | | |
| Test Parameters | | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | Default | N/A for Maximum Power Reduction (MPR) test case | Modulation | RB allocation (NOTE 1) | |
| SCS 60 kHz | SCS 120 kHz |
| 1 | Low |  |  |  | DFT-s-OFDM PI/2 BPSK | 16@0 | 8@0 |
| 2 | High |  |  |  | DFT-s-OFDM PI/2 BPSK | 16@NRB-16 | 8@NRB-8 |
| 3 | Mid |  |  |  | DFT-s-OFDM PI/2 BPSK | Outer\_Full | Outer\_Full |
| 4 | Mid |  |  |  | DFT-s-OFDM QPSK | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 5 | Low |  |  |  | DFT-s-OFDM QPSK | 16@0 | 8@0 |
| 6 | High |  |  |  | DFT-s-OFDM QPSK | 16@NRB-16 | 8@NRB-8 |
| 7 | Mid |  |  |  | DFT-s-OFDM QPSK | Outer\_Full | Outer\_Full |
| 8 | Mid |  |  |  | DFT-s-OFDM 16 QAM | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 9 | Low |  |  |  | DFT-s-OFDM 16 QAM | 16@0 | 8@0 |
| 10 | High |  |  |  | DFT-s-OFDM 16 QAM | 16@NRB-16 | 8@NRB-8 |
| 11 | Mid |  |  |  | DFT-s-OFDM 16 QAM | Outer\_Full | Outer\_Full |
| 12 | Low |  |  |  | DFT-s-OFDM 64 QAM | 16@0 | 8@0 |
| 13 | High |  |  |  | DFT-s-OFDM 64 QAM | 16@NRB-16 | 8@NRB-8 |
| 14 | Mid |  |  |  | DFT-s-OFDM 64 QAM | Outer\_Full | Outer\_Full |
| 15 | Mid |  |  |  | DFT-s-OFDM 64 QAM | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 16 | Mid |  |  |  | CP-OFDM QPSK | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 17 | Low |  |  |  | CP-OFDM QPSK | 16@0 | 8@0 |
| 18 | High |  |  |  | CP-OFDM QPSK | 16@NRB-16 | 8@NRB-8 |
| 19 | Mid |  |  |  | CP-OFDM QPSK | Outer\_Full | Outer\_Full |
| 20 | Low |  |  |  | CP-OFDM 16 QAM | 16@0 | 8@0 |
| 21 | High |  |  |  | CP-OFDM 16 QAM | 16@NRB-16 | 8@NRB-8 |
| 22 | Mid |  |  |  | CP-OFDM 16 QAM | Outer\_Full | Outer\_Full |
| 23 | Mid |  |  |  | CP-OFDM 16 QAM | Inner\_Full\_Region2 | Inner\_Full\_Region2 |
| 24 | Low |  |  |  | CP-OFDM 64 QAM | 16@0 | 8@0 |
| 25 | High |  |  |  | CP-OFDM 64 QAM | 16@NRB-16 | 8@NRB-8 |
| 26 | Mid |  |  |  | CP-OFDM 64 QAM | Outer\_Full | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in clause 6.1-2.  NOTE 2: Test IDs 16 ~ 26 with CP-OFDM modulation are not needed if PDCCH DCI format 0\_1 indicates ULFPTx\_Mode1. | | | | | | | |

Table 6.2D.2.4.1-9: Test Configuration Table for ULFPTx (Power Class 1, MPRWT, BWchannel = 400 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | 400 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120kHz | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | N/A for Maximum Power Reduction (MPR) test case | Modulation | RB allocation (NOTE 1) |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | 8@0 |
| 2 | High | DFT-s-OFDM PI/2 BPSK | 8@NRB-8 |
| 3 | Mid | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| 4 | Mid | DFT-s-OFDM PI/2 BPSK | Inner\_Full\_Region2 |
| 5 | Mid | DFT-s-OFDM QPSK | Inner\_Full\_Region2 |
| 6 | Low | DFT-s-OFDM QPSK | 8@0 |
| 7 | High | DFT-s-OFDM QPSK | 8@NRB-8 |
| 8 | Mid | DFT-s-OFDM QPSK | Outer\_Full |
| 9 | Mid | DFT-s-OFDM 16 QAM | Inner\_Full\_Region2 |
| 10 | Low | DFT-s-OFDM 16 QAM | 8@0 |
| 11 | High | DFT-s-OFDM 16 QAM | 8@NRB-8 |
| 12 | Mid | DFT-s-OFDM 16 QAM | Outer\_Full |
| 13 | Low | DFT-s-OFDM 64 QAM | 8@0 |
| 14 | High | DFT-s-OFDM 64 QAM | 8@NRB-8 |
| 15 | Mid | DFT-s-OFDM 64 QAM | Outer\_Full |
| 16 | Mid | CP-OFDM QPSK | Inner\_Full\_Region2 |
| 17 | Low | CP-OFDM QPSK | 8@0 |
| 18 | High | CP-OFDM QPSK | 8@NRB-8 |
| 19 | Mid | CP-OFDM QPSK | Outer\_Full |
| 20 | Low | CP-OFDM 16 QAM | 8@0 |
| 21 | High | CP-OFDM 16 QAM | 8@NRB-8 |
| 22 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 23 | Mid | CP-OFDM 16 QAM | Inner\_Full\_Region2 |
| 24 | Low | CP-OFDM 64 QAM | 8@0 |
| 25 | High | CP-OFDM 64 QAM | 8@NRB-8 |
| 26 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in clause 6.1-2.  NOTE 2: Test IDs 16 ~ 26 with CP-OFDM modulation are not needed if PDCCH DCI format 0\_1 indicates ULFPTx\_Mode1. | | | | | | |

Table 6.2D.2.4.1-10: Test Configuration Table for ULFPTx (Power Class 2, 3 and 4, MPRnarrow, BWchannel ≤ 200 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highes supported channel bandwidth that ≤ 200 MHz t | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | N/A for Maximum Power Reduction (MPR) test case | Modulation | RB allocation (NOTE 1) |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Left |
| 2 | High | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Right |
| 3 | Low | DFT-s-OFDM QPSK | Outer\_1RB\_Left |
| 4 | High | DFT-s-OFDM QPSK | Outer\_1RB\_Right |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1. | | | | | | |

Table 6.2D.2.4.1-11: Test Configuration Table for ULFPTx (Power Class 2, 3 and 4, MPRWT, BWchannel ≤ 200 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest and Highest supported channel bandwidth that ≤ 200 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest, Highest | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | N/A for Maximum Power Reduction (MPR) test case | Modulation | RB allocation (NOTE 1) |
| 1 | Mid | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| 2 | Mid | DFT-s-OFDM QPSK | Outer\_Full |
| 3 | Mid | DFT-s-OFDM 16 QAM | Inner\_Full |
| 4 | Low | DFT-s-OFDM 16 QAM | Outer\_1RB\_Left |
| 5 | High | DFT-s-OFDM 16 QAM | Outer\_1RB\_Right |
| 6 | Mid | DFT-s-OFDM 16 QAM | Outer\_Full |
| 7 | Mid | DFT-s-OFDM 64 QAM | Inner\_Full |
| 8 | Low | DFT-s-OFDM 64 QAM | Outer\_1RB\_Left |
| 9 | High | DFT-s-OFDM 64 QAM | Outer\_1RB\_Right |
| 10 | Mid | DFT-s-OFDM 64 QAM | Outer\_Full |
| 11 | Mid | CP-OFDM QPSK | Inner\_Full |
| 12 | Low | CP-OFDM QPSK | Outer\_1RB\_Left |
| 13 | High | CP-OFDM QPSK | Outer\_1RB\_Right |
| 14 | Mid | CP-OFDM QPSK | Outer\_Full |
| 15 | Low | CP-OFDM 16 QAM | Outer\_1RB\_Left |
| 16 | High | CP-OFDM 16 QAM | Outer\_1RB\_Right |
| 17 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 18 | Low | CP-OFDM 64 QAM | Outer\_1RB\_Left |
| 19 | High | CP-OFDM 64 QAM | Outer\_1RB\_Right |
| 20 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1.  NOTE 2: Test IDs 11 ~ 20 with CP-OFDM modulation are not needed if PDCCH DCI format 0\_1 indicates ULFPTx\_Mode1. | | | | | | |

Table 6.2D.2.4.1-12: Test Configuration Table for ULFPTx (Power Class 2, 3 and 4, MPRWT, BWchannel = 400 MHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | 400 MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120kHz | |
| Test Parameters | | | | | | |
| Test ID | Freq | ChBw | SCS | Downlink Configuration | Uplink Configuration | |
|  |  | Default | Default | N/A for Maximum Power Reduction (MPR) test case | Modulation | RB allocation (NOTE 1) |
| 1 | Low | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Left |
| 2 | High | DFT-s-OFDM PI/2 BPSK | Outer\_1RB\_Right |
| 3 | Mid | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| 4 | Low | DFT-s-OFDM QPSK | Outer\_1RB\_Left |
| 5 | High | DFT-s-OFDM QPSK | Outer\_1RB\_Right |
| 6 | Mid | DFT-s-OFDM QPSK | Outer\_Full |
| 7 | Low | DFT-s-OFDM 16 QAM | Outer\_1RB\_Left |
| 8 | High | DFT-s-OFDM 16 QAM | Outer\_1RB\_Right |
| 9 | Mid | DFT-s-OFDM 16 QAM | Outer\_Full |
| 10 | Low | DFT-s-OFDM 64 QAM | Outer\_1RB\_Left |
| 11 | High | DFT-s-OFDM 64 QAM | Outer\_1RB\_Right |
| 12 | Mid | DFT-s-OFDM 64 QAM | Outer\_Full |
| 13 | Low | CP-OFDM QPSK | Outer\_1RB\_Left |
| 14 | High | CP-OFDM QPSK | Outer\_1RB\_Right |
| 15 | Mid | CP-OFDM QPSK | Outer\_Full |
| 16 | Low | CP-OFDM 16 QAM | Outer\_1RB\_Left |
| 17 | High | CP-OFDM 16 QAM | Outer\_1RB\_Right |
| 18 | Mid | CP-OFDM 16 QAM | Outer\_Full |
| 19 | Low | CP-OFDM 64 QAM | Outer\_1RB\_Left |
| 20 | High | CP-OFDM 64 QAM | Outer\_1RB\_Right |
| 21 | Mid | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1.  NOTE 2: Test IDs 13 ~ 21 with CP-OFDM modulation are not needed if PDCCH DCI format 0\_1 indicates ULFPTx\_Mode1. | | | | | | |

6.2D.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 to Table 6.2.2.4.1-9. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (Note 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in 6.2.2.5. EIRP test procedure is defined in Annex K.1.3. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

7. If UE supports ULFPTx, repeat test steps 1~6 with UL RMC according to Table 6.2D.2.4.1-7 through Table 6.2D.2.4.1-12. The PDCCH DCI format 0\_1 is specified with the condition ULFPTx\_Mode1, ULFPTx\_Mode2 or ULFPTx\_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability. Message contents are according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 with condition TRANSFORM\_PRECODER\_ENABLED.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.2.2.4.1-1 to Table 6.2.2.4.1-9, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.2D.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO.

6.2D.2.5 Test requirements

The maximum output power, derived in step 5 shall be within the range prescribed by the nominal maximum output power and tolerance in following tables.

Table 6.2D.2.5-1: UE Power Class test requirements for Power Class 1 (for Bands n257, n258, n261)

FFS

Table 6.2D.2.5-2: UE Power Class test requirements for Power Class 1 (for Bands n260)

FFS

Table 6.2D.2.5-3: UE Power Class test requirements for Power Class 2 (n257, 258, 261)

FFS

Table 6.2.2D.5-4: UE Power Class test requirements for Power Class 3 (n257, 258, 261)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | BW (MHz) | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2D.2.4.1-4 | 1 | <=200MHz | 22.4 | 4.0 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 400MHz | 22.4 | 5.0 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 2 | <=200MHz | 22.4 | 4.0 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 400MHz | 22.4 | 5.0 | 4 | 13.4-TT-ΔMBP,n | 43 |
| Table 6.2D.2.4.1-5 | 1 | <=200MHz | 22.4 | 3.5 | 3 | 15.9-TT-ΔMBP,n | 43 |
| 2 | <=200MHz | 22.4 | 4.0 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 3 | <=200MHz | 22.4 | 4.0 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 4 | <=200MHz | 22.4 | 4.0 | 3 | 15.4-TT-ΔMBP,n | 43 |
| 5 | <=200MHz | 22.4 | 5.0 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 6 | <=200MHz | 22.4 | 5.0 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 7 | <=200MHz | 22.4 | 5.0 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 8 | <=200MHz | 22.4 | 5.0 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 9 | <=200MHz | 22.4 | 7.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| 10 | <=200MHz | 22.4 | 7.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| 11 | <=200MHz | 22.4 | 7.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| 12 | <=200MHz | 22.4 | 7.5 | 5 | 11.9-TT-ΔMBP,n | 43 |
| Table 6.2D.2.4.1-6 | 1 | 400MHz | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 2 | 400MHz | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 3 | 400MHz | 22.4 | 5 | 4 | 13.4-TT-ΔMBP,n | 43 |
| 4 | 400MHz | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 5 | 400MHz | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 6 | 400MHz | 22.4 | 6.5 | 5 | 10.9-TT-ΔMBP,n | 43 |
| 7 | 400MHz | 22.4 | 9 | 5 | 8.4-TT-ΔMBP,n | 43 |
| 8 | 400MHz | 22.4 | 9 | 5 | 8.4-TT-ΔMBP,n | 43 |
| 9 | 400MHz | 22.4 | 9 | 5 | 8.4-TT-ΔMBP,n | 43 |
| Note 1: ΔMBP,n is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant.  Note 3: Max allowed sum of ΔMBP,n over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: ΔMBP,n is 0 for single band UE. | | | | | | | |

Table 6.2D.2.5-5: UE Power Class test requirements for Power Class 3 (n260)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test Configuration Table | Test ID | BW (MHz) | PPowerclass | MPRf,c | T(MPRf,c) | Lower limit  (dBm) | Upper limit  (dBm) |
| Table 6.2D.2.4.1-4 | 1 | <=200MHz | 20.6 | 4.0 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 400MHz | 20.6 | 5.0 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 2 | <=200MHz | 20.6 | 4.0 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 400MHz | 20.6 | 5.0 | 4 | 11.6-TT-ΔMBP,n | 43 |
| Table 6.2D.2.4.1-5 | 1 | <=200MHz | 20.6 | 3.5 | 3 | 14.1-TT-ΔMBP,n | 43 |
| 2 | <=200MHz | 20.6 | 4.0 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 3 | <=200MHz | 20.6 | 4.0 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 4 | <=200MHz | 20.6 | 4.0 | 3 | 13.6-TT-ΔMBP,n | 43 |
| 5 | <=200MHz | 20.6 | 5.0 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 6 | <=200MHz | 20.6 | 5.0 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 7 | <=200MHz | 20.6 | 5.0 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 8 | <=200MHz | 20.6 | 5.0 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 9 | <=200MHz | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| 10 | <=200MHz | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| 11 | <=200MHz | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| 12 | <=200MHz | 20.6 | 7.5 | 5 | 8.1-TT-ΔMBP,n | 43 |
| Table 6.2D.2.4.1-6 | 1 | 400MHz | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 2 | 400MHz | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 3 | 400MHz | 20.6 | 5 | 4 | 11.6-TT-ΔMBP,n | 43 |
| 4 | 400MHz | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 5 | 400MHz | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 6 | 400MHz | 20.6 | 6.5 | 5 | 9.1-TT-ΔMBP,n | 43 |
| 7 | 400MHz | 20.6 | 9 | 5 | 6.6-TT-ΔMBP,n | 43 |
| 8 | 400MHz | 20.6 | 9 | 5 | 6.6-TT-ΔMBP,n | 43 |
| 9 | 400MHz | 20.6 | 9 | 5 | 6.6-TT-ΔMBP,n | 43 |
| Note 1: ΔMBP,n is the Multiband Relaxation factor declared by the UE for the tested band in table A.4.3.9-2 of TS38.508-2. This declaration shall fulfil the requirements in clause 6.2.1.1.3.3.  Note 2: All UE supported bands needs to be tested to ensure the multiband relaxation declaration is compliant.  Note 3: Max allowed sum of ΔMBP,n over all supported FR2 bands as defined in clause 6.2.1.1.3.3.  Note 4: ΔMBP,n is 0 for single band UE. | | | | | | | |

Table 6.2D.2.5-5a: Test Tolerance (Power class 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

Table 6.2D.2.5-6: UE Power Class test requirements for Power Class 4 (for Bands n257, n258, n261)

FFS

Table 6.2D.2.5-7: UE Power Class test requirements for Power Class 4 (for Bands n260)

FFS

### 6.2D.3 UE maximum output power with additional requirements for UL MIMO

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

* Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.
* OTA test procedure for UL MIMO is still under investigation

6.2D.3.1 Test purpose

Additional spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power.

6.2D.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.2D.3.3 Minimum conformance requirements

6.2D.3.3.1 UE maximum output power reduction with additional requirements for UL MIMO for power class 1

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the A-MPR values specified in clause 6.2.3.3 shall apply to the maximum output power specified in Table 6.2D.1.1.3.1-1. The requirements shall be met with the configurations specified in sub-clause 6.2D.1.0.

For the UE maximum output power modified by A-MPR, the power limits specified in clause 6.2D.4.3 apply.

6.2D.3.3.2 UE maximum output power reduction with additional requirements for UL MIMO for power class 2

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the A-MPR values specified in clause 6.2.3.3 shall apply to the maximum output power specified in Table 6.2D.1.1.3.2-1. The requirements shall be met with the configurations specified in clause 6.2D.1.0.

For the UE maximum output power modified by A-MPR, the power limits specified in clause 6.2D.4.3 apply.

6.2D.3.3.3 UE maximum output power reduction with additional requirements for UL MIMO for power class 3

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the A-MPR values specified in clause 6.2.3.3 shall apply to the maximum output power specified in Table 6.2D.1.1.3.3-1. The requirements shall be met with the configurations specified in clause 6.2D.1.0.

For the UE maximum output power modified by A-MPR, the power limits specified in clause 6.2D.4.3 apply.

6.2D.3.3.4 UE maximum output power reduction with additional requirements for UL MIMO for power class 4

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the A-MPR values specified in clause 6.2.3.3 shall apply to the maximum output power specified in Table 6.2D.1.1.3.4-1. The requirements shall be met with the configurations specified in clause 6.2D.1.0.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2D.3.

6.2D.3.4 Test description

6.2D.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, 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 subcarrier spacing, are shown in Table 6.2D.3.4.1-1 to Table 6.2D.3.4.1-4. 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 6.2D.3.4.1-1: Test configuration table for 2-layer UL-MIMO for NS\_202

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | 120kHz | |
| Test Parameters | | | | |
| Test ID | Downlink Configuration | Uplink Configuration | | |
|  | - | Modulation | | RB allocation  (NOTE 1) |
| 1 (NOTE 4) | CP-OFDM QPSK | | Inner\_Full |
| 2 | CP-OFDM QPSK | | Inner\_1RB\_Left for PC2, PC3 and PC4  Inner\_Partial for PC1 (NOTE 2) |
| 3 (NOTE 3) | CP-OFDM 64QAM | | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: When testing Low range configure uplink RB to Inner\_1RB\_Left for PC2, PC3 and PC4 or Inner\_Partial\_Left\_Region1 for PC1 and when testing High range configure uplink RB to Inner\_1RB\_Right for PC2, PC3 and PC4 or Inner\_Partial\_Right\_Region1 for PC1.  NOTE 3: Test ID only applicable to PC1  NOTE 4: Test ID only applicable to PC2, PC3 and PC4 | | | | |

Table 6.2D.3.4.1-2: Test configuration table for 2-layer UL-MIMO for NS\_203

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Initial Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | Low range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120kHz | |
| Test Parameters | | | | | |
| Test ID | Frequency | Channel Bandwidth | Downlink Configuration | Uplink Configuration | |
|  |  |  | - | Modulation | RB allocation  (NOTE 1) |
| 1 | Default | Default | CP-OFDM QPSK | Inner\_Full |
| 2 | Default | Default | CP-OFDM QPSK | Inner\_1RB\_Left for PC2, PC3 and PC4  Inner\_Partial for PC1 (NOTE 2) |
| 3 (NOTE 2) | Low range + Channel Bandwidth | Default | CP-OFDM QPSK | Inner\_Partial |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Test ID only applicable to PC1 | | | | | |

Table 6.2D.3.4.1-3: Test configuration table for ULFPTx for NS\_202

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Low range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | 120kHz | |
| Test Parameters | | | | |
| Test ID | Downlink Configuration | Uplink Configuration | | |
|  | - | Modulation | | RB allocation  (NOTE 1) |
| 1 (NOTE 4) | DFT-s-OFDM QPSK | | Inner\_Full |
| 2 | DFT-s-OFDM QPSK | | Inner\_1RB\_Left for PC2, PC3 and PC4  Inner\_Partial for PC1 (NOTE 2) |
| 3 (NOTE 3) | DFT-s-OFDM 64QAM | | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: When testing Low range configure uplink RB to Inner\_1RB\_Left for PC2, PC3 and PC4 or Inner\_Partial\_Left\_Region1 for PC1 and when testing High range configure uplink RB to Inner\_1RB\_Right for PC2, PC3 and PC4 or Inner\_Partial\_Right\_Region1 for PC1.  NOTE 3: Test ID only applicable to PC1  NOTE 4: Test ID only applicable to PC2, PC3 and PC4 | | | | |

Table 6.2D.3.4.1-4: Test configuration table for ULFPTx for NS\_203

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Initial Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | Low range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | | 120kHz | |
| Test Parameters | | | | | |
| Test ID | Frequency | Channel Bandwidth | Downlink Configuration | Uplink Configuration | |
|  |  |  | - | Modulation | RB allocation  (NOTE 1) |
| 1 | Default | Default | DFT-s-OFDM QPSK | Inner\_Full |
| 2 | Default | Default | DFT-s-OFDM QPSK | Inner\_1RB\_Left for PC2, PC3 and PC4  Inner\_Partial for PC1 (NOTE 2) |
| 3 (NOTE 2) | Low range + Channel Bandwidth | Default | DFT-s-OFDM QPSK | Inner\_Partial |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Test ID only applicable to PC1 | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The DL and UL Reference Measurement channels are set according to Table 6.2D.3.4.1-1 to Table 6.2D.3.4.1-4.

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 [10] clause 4.5. Message contents are defined in clause 6.2D.3.4.3

6.2D.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 6.2D.3.4.1-1 to Table 6.2D.3.4.1-2. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in clause 6.2D.3.5. EIRP test procedure is defined in Annex K. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi.

6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

7. If UE supports ULFPTx, repeat test steps 1~6 with UL RMC according to Table 6.2D.3.4.1-3 and 6.2D.3.4.1-4. The PDCCH DCI format 0\_1 is specified with the condition ULFPTx\_Mode1, ULFPTx\_Mode2 or ULFPTx\_ModeFull in 38.508-1 [5] subclause 4.3.6.1.1.2 depending on UE reported capability. Message contents are according to TS 38.508-1 [5] clause 4.6.3 Table 4.6.3-118 with condition TRANSFORM\_PRECODER\_ENABLED.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.2D.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO, with the following exceptions for each network signalling value.

1. Information element *AdditionalSpectrumEmission* for NR can be set in SIB1 according to TS 38.331[19]. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 6.2D.3.4.3-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10] clause 4.6.3, Table 4.6.3-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| *AdditionalSpectrumEmission* | 1 (NS\_202) | for band n257 |  |
| *AdditionalSpectrumEmission* | 2 (NS\_202) | for band n258 |  |
| *AdditionalSpectrumEmission* | 3 (NS\_203) | for band n258 |  |

6.2D.3.5 Test requirement

The UE EIRP derived in step 5 shall not exceed the values specified in Table 6.2D.3.5-1 to Table 6.2D.3.5-8. The UE EIRP derived in step 7 shall not exceed the values specified in Table 6.2D.3.5-9 to Table 6.2D.3.5-16.

Table 6.2D.3.5-1: UE Power Class 1 test requirements for 2-layer UL-MIMO (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 2 | 40 | 4.51  5.02 | 11 | 7 | 22-TT | 55 |
|  | 3 |  | 7.51  9.02 | 11 | 7 | 22-TT | 55 |
| NOTE 1 Applicable to BWchannel ≤ 200 MHz  NOTE 2 Applicable to BWchannel = 400 MHz | | | | | | | |

Table 6.2D.3.5-2: UE Power Class 2 test requirements for 2-layer UL-MIMO (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 29 | 3.51  5.02 | 1 | 3.01  4.02 | 22.5-TT1  20-TT2 | 43 |
|  | 2 |  | 3.51  5.02 | 1 | 3.01  4.02 | 22.5-TT1  20-TT2 | 43 |
| NOTE 1 Applicable to BWchannel ≤ 200 MHz  NOTE 2 Applicable to BWchannel = 400 MHz | | | | | | | |

Table 6.2D.3.5-3: UE Power Class 3 test requirements for 2-layer UL-MIMO (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 22.4 | 3.51  5.02 | 1 | 3.01  4.02 | 15.9 -TT-MBP,n 1  13.4 -TT-MBP,n 2 | 43 |
|  | 2 |  | 3.51  5.02 | 1 | 3.01  4.02 | 15.9 -TT-MBP,n 1  13.4 -TT-MBP,n 2 | 43 |
| NOTE 1 Applicable to BWchannel ≤ 200 MHz  NOTE 2 Applicable to BWchannel = 400 MHz  NOTE 3: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2D.3.5-4: UE Power Class 4 test requirements for 2-layer UL-MIMO (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 34 | 3.51  5.02 | 1 | 3.01  4.02 | 27.5 -TT1  25.0 -TT2 | 43 |
|  | 2 |  | 3.51  5.02 | 1 | 3.01  4.02 | 27.5 -TT1  25.0 -TT2 | 43 |
| NOTE 1 Applicable to BWchannel ≤ 200 MHz  NOTE 2 Applicable to BWchannel = 400 MHz | | | | | | | |

Table 6.2D.3.5-5: UE Power Class 1 test requirements for 2-layer UL-MIMO (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 40 | 4.51  5.02 | 3 | 4 | 31.5 - TT1  31.0 - TT2 | 55 |
|  | 2 |  | 4.51  5.02 | 3 | 4 | 31.5 - TT1  31.0 - TT2 | 55 |
|  | 3 |  | 4.51  5.02 | 0 | 4 | 31.5 - TT1  31.0 - TT2 | 55 |
| NOTE 1 Applicable to BWchannel ≤ 200 MHz  NOTE 2 Applicable to BWchannel = 400 MHz | | | | | | | |

Table 6.2D.3.5-6: UE Power Class 2 test requirements for 2-layer UL-MIMO (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 29 | 3.51  5.02 | 0 | 3.01  4.02 | 22.5-TT1  20.0-TT2 | 43 |
|  | 2 |  | 3.51  5.02 | 0 | 3.01  4.02 | 22.5-TT1  20.0-TT2 | 43 |
| NOTE 1 Applicable to BWchannel ≤ 200 MHz  NOTE 2 Applicable to BWchannel = 400 MHz | | | | | | | |

Table 6.2D.3.5-7: UE Power Class 3 test requirements for 2-layer UL-MIMO (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 22.4 | 3.51  5.02 | 0 | 3.01  4.02 | 15.9-TT-ΔMBP,n 1  13.4-TT-ΔMBP,n 2 | 43 |
|  | 2 |  | 3.51  5.02 | 0 | 3.01  4.02 | 15.9-TT-ΔMBP,n 1  13.4-TT-ΔMBP,n 2 | 43 |
| NOTE 1 Applicable to BWchannel ≤ 200 MHz  NOTE 2 Applicable to BWchannel = 400 MHz  NOTE 3: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2D.3.5-8: UE Power Class 4 test requirements for 2-layer UL-MIMO (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 34 | 3.51  5.02 | 0 | 3.01  4.02 | 27.5-TT1  25-TT2 | 43 |
|  | 2 |  | 3.51  5.02 | 0 | 3.01  4.02 | 27.5-TT1  25-TT2 | 43 |
| NOTE 1 Applicable to BWchannel ≤ 200 MHz  NOTE 2 Applicable to BWchannel = 400 MHz | | | | | | | |

Table 6.2D.3.5-9: UE Power Class 1 test requirements for ULFPTx (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 2 | 40 | 0 | 11 | 7 | 22-TT | 55 |
|  | 3 |  | 6.5 | 11 | 7 | 22-TT | 55 |

Table 6.2D.3.5-10: UE Power Class 2 test requirements for ULFPTx (network signalling value “NS\_202”)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 29 | 0 | 1 | 1.5 | 26.5-TT | 43 |
|  | 2 |  | 0 | 1 | 1.5 | 26.5-TT | 43 |

Table 6.2D.3.5-11 UE Power Class 3 test requirements for ULFPTx (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 22.4 | 0 | 1 | 1.5 | 19.2-TT-MBP,n | 43 |
|  | 2 |  | 0 | 1 | 1.5 | 19.2-TT-MBP,n | 43 |
| Note 1: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2D.3.5-12: UE Power Class 4 test requirements for ULFPTx (network signalling value "NS\_202")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n257, n258 | 1 | 34 | 0 | 1 | 1.5 | 31.5-TT | 43 |
|  | 2 |  | 0 | 1 | 1.5 | 31.5-TT | 43 |

Table 6.2D.3.5-13: UE Power Class 1 test requirements for ULFPTx (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 40 | 0 | 3 | 2 | 35-TT | 55 |
|  | 2 |  | 0 | 3 | 2 | 35-TT | 55 |
|  | 3 |  | 0 | 0 | 0 | 40-TT | 55 |

Table 6.2D.3.5-14: UE Power Class 2 test requirements for ULFPTx (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 29 | 0 | 0 | 0 | 29-TT | 43 |
|  | 2 |  | 0 | 0 | 0 | 29-TT | 43 |

Table 6.2D.3.5-15: UE Power Class 3 test requirements for ULFPTx (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 22.4 | 0 | 0 | 0 | 22.4-TT-ΔMBP,n | 43 |
|  | 2 |  | 0 | 0 | 0 | 22.4-TT-ΔMBP,n | 43 |
| Note 1: MBP,n is the Multiband Relaxation factor for the tested band. This shall fulfil the requirements in Table 6.2.1.1.3.3-5. | | | | | | | |

Table 6.2D.3.5-16: UE Power Class 4 test requirements for ULFPTx (network signalling value "NS\_203")

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Band | Test ID | PPowerclass | MPRf,c | A- MPRf,c | T(MAX(MPRf,c, A- MPRf,c,)) | Lower limit  (dBm) | Upper limit  (dBm) |
| n258 | 1 | 34 | 0 | 0 | 0 | 34-TT | 43 |
|  | 2 |  | 0 | 0 | 0 | 34-TT | 43 |

Table 6.2D.3.5-17: Test Tolerance (Power class 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 3.11 dB | 3.11 dB |

### 6.2D.4 Configured transmitted power for UL MIMO

6.2D.4.1 Test purpose

To verify the UE transmitted power PUMAX,f,c is within the range defined prescribed by the specified nominal maximum output power and tolerance.

6.2D.4.2 Test applicability

The requirements of this test are covered in test cases 6.2D.1 UE Maximum output power for UL MIMO, 6.2D.2 UE maximum output power reduction for UL MIMO and 6.2D.3 UE Maximum output power with additional requirements for UL MIMO to all types of NR UE release 15 and forward that supports UL MIMO.

6.2D.4.3 Minimum conformance requirements

For UEs configured for 2-layer transmission as well as UEs configured for single layer uplink full power transmission (ULFPTx), the configured maximum output power PCMAX,c for serving cell c is defined as sum of all streams and is bound by limits set in section 6.2.4.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.2D.4.

6.2D.4.4 Test description

This test is covered by clause 6.2D.1 UE Maximum output power for UL MIMO, 6.2D.2 UE maximum output power reduction for UL MIMO and 6.2D.3 UE Maximum output power with additional requirements for UL MIMO.

6.2D.4.5 Test requirements

This test is covered by clause 6.2D.1 UE Maximum output power for UL MIMO, 6.2D.2 UE maximum output power reduction for UL MIMO and 6.2D.3 UE Maximum output power with additional requirements for UL MIMO.

## 6.3 Output power dynamics

### 6.3.1 Minimum output power

Editor’s Note: The following aspects of the clause are for future consideration:

- Relaxation, Measurement Uncertainties and Test Tolerances are FFS for power class 2, 4, 6 and 7.

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 UE release 15 and forward.

6.3.1.3 Minimum conformance requirements

The minimum controlled output power of the UE is defined as the EIRP 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 subframe (1ms).

6.3.1.3.1 Minimum output power for power class 1

For power class 1 UE, the minimum output power shall not exceed the values specified in Table 6.3.1.3.1-1 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3.1.3.1-1: Minimum output power for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | 4 | 47.58 |
| 100 | 4 | 95.16 |
| 200 | 4 | 190.20 |
| 400 | 4 | 380.28 |

6.3.1.3.2 Minimum output power for power class 2, 3, and 4

The minimum output power shall not exceed the values specified in Table 6.3.1.3.2-1 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3.1.3.2-1: Minimum output power for power class 2, 3, and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n259, n260, n261 | 50 | -13 | 47.58 |
| 100 | -13 | 95.16 |
| 200 | -13 | 190.20 |
| 400 | -13 | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3.1.

6.3.1.3.3 Minimum output power for power class 6

The minimum output power shall not exceed the values specified in Table 6.3.1.3.3-1 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3.1.3.3-1: Minimum output power for power class 5 and 6

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n261 | 50 | -6 | 47.52 |
| 100 | -6 | 95.04 |
| 200 | -6 | 190.08 |
| 400 | -6 | 380.16 |

6.3.1.3.4 Minimum output power for power class 7

The minimum output power shall not exceed the values specified in Table 6.3.1.3.4-1 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3.1.3.4-1: Minimum output power for power class 7

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n261 | 50 | -13 | 47.58 |
|  | 100 | -13 | 95.16 |

6.3.1.4 Test description

6.3.1.4.1 Initial condition

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

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

Table 6.3.1.4.1-1: Test Configuration Table

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 (NOTE 1) |
| 1 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3, PC4, PC6 and PC7 or Table 6.1-2 for PC1. | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.

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

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. 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 [10] 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. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power. If UE is disconnected, repeat the test case. Optionally, send continuously uplink power control “down” commands in every uplink scheduling information to the UE until the UE EIRP measured by the test system is at a level just before the UE was disconnected. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP in the Tx beam peak direction in the measurement bandwidth specified in Table 6.3.1.5-1 and Table 6.3.1.5-2 for the specific channel bandwidth under test. EIRP test procedure is defined in Annex K.1.3. The measuring duration is at least one active subframe (1ms). EIRP is calculated considering both polarizations, theta and phi. For TDD, only slots consisting of only UL symbols are under test.

6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.3.1.5 Test requirement

The maximum EIRP, derived in step 5 shall not exceed the values specified in Table 6.3.1.5-1 and Table 6.3.1.5-4.

Table 6.3.1.5-1: Minimum output power for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | 4 +TT | 47.58 |
| 100 | 4 +TT | 95.16 |
| 200 | 4 +TT | 190.20 |
| 400 | 4 +TT | 380.28 |

Table 6.3.1.5-1a: Test Tolerance Minimum output power for power class 1

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 3.79 dB, NTC  3.95 dB, ETC | 4.09 dB, NTC  4.25 dB, ETC |

Table 6.3.1.5-2: Minimum output power for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Test Tolerance TT (dB) | Measurement bandwidth  (MHz) |
| n257, n258, n261 | 50 | -13+TT | 4.21 | 47.58 |
| 100 | -13+2.4+TT1 | 2.52 | 95.16 |
| 200 | -13+5.4+TT1 | 0.66 | 190.20 |
| 400 | -13+8.4+TT1 | 0 | 380.28 |
| n260 | 50 | -13+4.5+TT1 | 1.17 | 47.58 |
| 100 | -13+7.5+TT1 | 0 | 95.16 |
| 200 | -13+10.5+TT1 | 0 | 190.20 |
| 400 | -13+13.5+TT1 | 0 | 380.28 |
| n259 | 50 | -13+[5.5]+TT1 | [1.39] | 47.58 |
| 100 | -13+[8.5]+TT1 | [0.06] | 95.16 |
| 200 | -13+[11.5]+TT1 | [0] | 190.20 |
| 400 | -13+[14.5]+TT1 | [0] | 380.28 |
| NOTE 1: Core requirement cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement result = 1.0 dB (Minimum requirement + relaxation). | | | | |

Table 6.3.1.5-2a: Minimum output power for power class 2 and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | -13+TBD+TT | 47.58 |
| 100 | -13+TBD+TT | 95.16 |
| 200 | -13+TBD+TT | 190.20 |
| 400 | -13+TBD+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3.1.5-2b: Minimum output power for power class 6

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n261 | 50 | -6+TBD+TT | 47.52 |
| 100 | -6+TBD+TT | 95.04 |
| 200 | -6+TBD+TT | 190.08 |
| 400 | -6+TBD+TT | 380.16 |

Table 6.3.1.5-3: Minimum output power for power class 5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Test Tolerance TT (dB) | Measurement bandwidth  (MHz) |
| n257, n258 | 50 | -6+TT | 3.67 dB, NTC  3.84 dB, ETC | 47.58 |
| 100 | -6+TT | 3.85 dB, NTC  4.02 dB, ETC | 95.16 |
| 200 | -6+TT | 4.18 dB, NTC  4.35 dB, ETC | 190.20 |
| 400 | -6+1.4+TT1 | 3.38 dB, NTC  3.55 dB, ETC | 380.28 |
| NOTE 1: Core requirement cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement result = 1.0 dB (Minimum requirement + relaxation). | | | | |

Table 6.3.1.5-4: Void

Table 6.3.1.5-5: Minimum output power for power class 7

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Test Tolerance TT (dB) | Measurement bandwidth  (MHz) |
| n257, n258, n261 | 50 | -13+TT | FFS | 47.58 |
| 100 | -13+TBD+TT | FFS | 95.16 |

### 6.3.2 Transmit OFF power

Editor's note: Following aspects are either missing or not yet determined otherwise:

- Measurement Uncertainties and Test Tolerances are FFS for power class 1 FR2b, 2 and 4.

- Measurement grid for PC2/4 in Annex M.4 is TBD.

- The testability of this test case is pending further analysis on relaxation of the requirement for other than Band n257.

- Test Procedure aspects for UE indicating *ul-GapFR2-r17* is FFS

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 applies to all types of NR UE release 15 and forward.

NOTE: Currently, this test case can only support Band n257 and PC3.

6.3.2.3 Minimum conformance requirements

The transmit OFF power is defined as the TRP 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 shall not exceed the values specified in Table 6.3.2.3-1 for each operating band supported. The requirement is verified with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

Table 6.3.2.3-1: Transmit OFF power

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n259, n260, n261 | -35 | -35 | -35 | -35 |
| 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |

For UE indicating *ul-GapFR2-r17*, UE shall meet OFF power requirement defined in this clause for the band for which UL transmission is stopped in the activated UL gap.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3.2.

6.3.2.4 Test description

6.3.2.4.1 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 6.3.2.4.1-1. 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 6.3.2.4.1-1: Test Configuration Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Lowest | |
| 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 | **-** | **-** | **-** | **-** |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement Channels are set according to Table 6.3.2.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.3.2.4.3.

6.3.2.4.2 Test procedure

Editor's note: Test Procedure aspects for UE indicating *ul-GapFR2-r17* is FFS

1. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE) for the UE Tx beam selection to complete.

2. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

3. Measure UE TRP for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.3.2.5-1. Total radiated power is measured according to TRP measurement procedure defined in Annex K. TRP is calculated considering both polarizations, theta and phi.

NOTE: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n2572 | -35+21.4 | -35+24.4 | -35+27.4 | -35+30.4 |
| 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| n258, n261 | -35+[21.4] | -35+[24.4] | -35+[27.4] | -35+[30.4] |
| 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| n260 | -35+[24.1] | -35+[27.1] | -35+[30.1] | -35+[33.1] |
| 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| NOTE 1: Core requirement cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement result = 1.0 dB (Minimum requirement + relaxation).  NOTE 2: Relaxed n257 test requirement is testable for PC3 and PC1. | | | | |

### 6.3.3 Transmit ON/OFF time mask

#### 6.3.3.1 General

The transmit ON/OFF time mask defines the transient period(s) allowed

- between transmit OFF power and transmit ON power symbols (transmit ON/OFF)

- between continuous ON-power transmissions when power change or RB hopping is applied.

In case of RB hopping, transition period is shared symmetrically.

Unless otherwise stated the minimum requirements in clause 6.5 apply also in transient periods.

The transmit ON/OFF time mask is defined as a directional requirement. The requirement is verified in beam locked mode at beam peak direction. The maximum allowed EIRP OFF power level is -30dBm at beam peak direction. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

In the following sub-clauses, following definitions apply:

- A slot transmission is a Type A transmission.

- A long subslot transmission is a Type B transmission with more than 2 symbols.

- A short subslot transmission is a Type B transmission with 1 or 2 symbols.

#### 6.3.3.2 General ON/OFF time mask

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

* Measurement Uncertainty and Test Tolerances are FFS for power class 1, 2 and 4.
* Measurement Uncertainty and Test Tolerances are FFS for band n259.

6.3.3.2.1 Test purpose

To verify that the general ON/OFF time mask meets the requirements given in 6.3.3.2.5.

The transmit ON/OFF time mask defines the transient period(s) allowed

- between transmit OFF power and transmit ON power symbols (transmit ON/OFF)

Unless otherwise stated the minimum requirements in clause 6.5 apply also in transient periods.

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

6.3.3.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

6.3.3.2.3 Minimum conformance requirements

The transmit ON/OFF time mask is defined as a directional requirement. The requirement is verified in beam locked mode at beam peak direction. The maximum allowed EIRP OFF power level is -30dBm at beam peak direction. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle)

The general ON/OFF time mask defines the observation period allowed between transmit OFF and ON power. ON/OFF scenarios include: contiguous, and non-contiguous transmission, etc.

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



Figure 6.3.3.2.3-1: General ON/OFF time mask for NR UL transmission in FR2

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3.3.2.

6.3.3.2.4 Test description

6.3.3.2.4.1 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 5.2-1. 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 6.3.3.2.4.1-1. 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 6.3.3.2.4.1-1: Test Configuration Table

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 (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 for PC2, PC3, PC4 and PC7 or Table 6.1-2 for PC1. | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement Channels are set according to Table 6.3.3.2.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.3.3.2.4.3.

6.3.3.2.4.2 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 6.3.3.2.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slot 37 for 60kHz SCS and on slot 74 for 120kHz SCS.

2. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 msec starting from the first TPC command in this step to ensure that the UE transmits at its maximum output power. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. ON power sub test:

5.1. For UE transmission ON power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3.3.2.5-2. EIRP test procedure is defined in Annex K. The period of the measurement shall be one slot with PUSCH transmission. EIRP is calculated considering both polarizations, theta and phi. For TDD, only slots consisting of only UL symbols are under test.

6. OFF power sub test:

6.1. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3.3.2.5-1. EIRP test procedure is defined in Annex K.1.3. The period of the measurement shall be the slot prior to the PUSCH transmission, excluding a transient period of 5 µs in the end of the slot and any DL periods. EIRP is calculated considering both polarizations, theta and phi.

6.2. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3.3.2.5-1. EIRP test procedure is defined in Annex K.1.3 The period of the measurement shall be the slot following the PUSCH transmission, excluding a transient period of 5 µs at the beginning of the slot and any DL periods. EIRP is calculated considering both polarizations, theta and phi.

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

Table 6.3.3.2.4.3-1: Void

Table 6.3.3.2.4.3-2: Void

Table 6.3.3.2.4.3-3: Void

6.3.3.2.5 Test requirement

The requirement for the EIRP measured in steps 5 and 6 of the test procedure shall not exceed the values specified in Table 6.3.3.2.5-1 and 6.3.3.2.5-2.

Table 6.3.3.2.5-1: Test requirement of OFF power of General ON/OFF time mask

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel bandwidth / minimum output power / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Transmit OFF power | ≤ -30+TT+R dBm | | | |
| Transmission OFF Measurement bandwidth | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| NOTE 1: Core requirement cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement result = 1.0 dB (Minimum requirement + relaxation R).  NOTE 2: Relaxation R is specified in Table 6.3.3.2.5-5.  NOTE 3: TT = 0 dB. | | | | |

Table 6.3.3.2.5-2: Test requirement of ON power of General ON/OFF time mask

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel bandwidth / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Transmit ON power | Same as the EIRP requirements described in 6.2.1.1.5 | | | |
| NOTE 1: Void. | | | | |

Table 6.3.3.2.5-3: Void

Table 6.3.3.2.5-4: Void

Table 6.3.3.2.5-5: Relaxation required for OFF power for PC1 and PC3 UEs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n261 | EIRP - 1 dB | EIRP + 2 dB | EIRP + 5 dB | EIRP + 8 dB |
| n260 | EIRP + 2 dB | EIRP + 5 dB | EIRP + 8 dB | EIRP + 11 dB |
| NOTE 1: EIRP is measured value in the ON power sub test, and the unit is dBm. | | | | |

#### 6.3.3.3 Transmit power time mask for slot and short or long subslot boundaries

No test case details are specified. Current test procedures for time masks are based on power measurement in relatively long period compared with transient period. For time masks between 2 active time slots with different power level, the test procedure can’t provide enough resolution to identify non-conformant UEs. Therefore the minimum requirement is not testable.

#### 6.3.3.4 PRACH time mask

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

- Message contents are not complete

- Measurement uncertainty and Test tolerance are not complete

- Test requirements are not complete

- PRACH configuration index is not complete

- The further investigation is essential that how does beamforming affect the initial access procedure

- TP analysis is FFS.

6.3.3.4.1 Test purpose

To verify that the PRACH time mask meets the requirements given in 6.3.3.4.5.

The time mask for PRACH time mask defines the transient period(s) allowed between transmit OFF power and transmit ON power when transmitting the PRACH.

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

6.3.3.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

6.3.3.4.3 Minimum conformance requirements

The transmit ON/OFF time mask is defined as a directional requirement. The requirement is verified in beam locked mode at beam peak direction. The maximum allowed EIRP OFF power level is -30dBm at beam peak direction. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

The PRACH ON power is specified as the mean power over the PRACH measurement period excluding any transient periods as shown in Figure 6.3.3.4.3-1. The measurement period for different PRACH preamble format is specified in Table 6.3.3.4.3-1.

Table 6.3.3.4.3-1: PRACH ON power measurement period

|  |  |  |
| --- | --- | --- |
| Format | SCS | Measurement period |
| A1 | 60 kHz | 0.035677 ms |
| 120 kHz | 0.017839 ms |
| A2 | 60 kHz | 0.071354 ms |
| 120 kHz | 0.035677 ms |
| A3 | 60 kHz | 0.107031 ms |
| 120 kHz | 0.053516 ms |
| B1 | 60 kHz | 0.035091 ms |
| 120 kHz | 0.0175455 ms |
| B4 | 60 kHz | 0.207617 ms |
| 120 kHz | 0.103809 ms |
| A1/B1 | 60 kHz | 0.035677 ms for front X1 occasion 0.035091 ms for last occasion  X1 = [2,5] |
| 120 kHz | 0.017839 ms for front X1occasion 0.017546 ms for last occasion  X1 = [2,5] |
| A2/B2 | 60 kHz | 0.071354 ms for front X2 occasion 0.069596 ms for last occasion  X2 = [1,2] |
| 120 kHz | 0.035677 ms for front X2 occasion 0.034798 ms for last occasion  X2 = [1,2] |
| A3/B3 | 60 kHz | 0.107031 ms for first occasion 0.104101 ms for second occasion |
| 120 kHz | 0.053515 ms for first occasion 0.052050 ms for second occasion |
| C0 | 60 kHz | 0.026758 ms |
| 120 kHz | 0.013379 ms |
| C2 | 60 kHz | 0.083333 ms |
| 120 kHz | 0.0416667 ms |
| NOTE: For PRACH on PRACH occasion start from begin of 0ms or 0.5ms boundary, the measurement period will plus 0.032552μs | | |



Figure 6.3.3.4.3-1: PRACH ON/OFF time mask

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3.3.4.

6.3.3.4.4 Test description

6.3.3.4.4.1 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 6.3.3.4.4.1-1. 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 6.3.3.4.4.1-1: Test Configuration Table

|  |  |
| --- | --- |
| Initial Conditions | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | Normal, TL, TH |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | Mid range |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | Lowest, Mid, Highest |
| Test SCS as specified in Table 5.3.5-1 | SCS defined in TS 38.211 [8] subclause 6.3.3.2 |
| PRACH preamble format | |
| PRACH Configuration Index | [0] |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

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*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.3.3.4.4.3.

6.3.3.4.4.2 Test procedure

1. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

2. 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. The UE shall send the signalled preamble to the SS.

4. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3.3.4.5-1. EIRP test procedure is defined in Annex K.1.3. The period of the measurement shall be the slot prior to the PRACH transmission, excluding a transient period of 5 µs in the end of the slot and any DL periods. EIRP is calculated considering both polarizations, theta and phi.

5. For UE transmission ON power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3.3.4.5-1. EIRP test procedure is defined in Annex K.1.3. The period of the measurement shall be the slot during the PRACH preamble transmission. EIRP is calculated considering both polarizations, theta and phi. For TDD, only slots consisting of only UL symbols are under test.

6. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3.3.2.5-1. EIRP test procedure is defined in Annex K.1.3. The period of the measurement shall be the slot following the PUSCH transmission, excluding a transient period of 5 µs at the beginning of the slot and any DL periods. EIRP is calculated considering both polarizations, theta and phi.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3.3.4.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with following exceptions:

Table 6.3.3.4.4.3-1: *RACH-ConfigCommon:* PRACH measurement

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[5], 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 | n4 |  | FR2 |
| } |  |  |  |
| groupBconfigured | Not present |  |  |
| ra-ContentionResolutionTimer | sf64 |  |  |
| rsrp-ThresholdSSB | RSRP-Range |  |  |
| rsrp-ThresholdSSB-SUL | Not present |  |  |
|  | RSRP-Range |  | SUL |
| prach-RootSequenceIndex CHOICE { |  |  |  |
| l139 | Set according to table 4.4.2-2 for the NR Cell. |  | PRACH Format A3 |
| } |  |  |  |
| 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 6.3.3.4.4.3-2: *RACH-ConfigGeneric:* PRACH measurement

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[5], Table 4.6.3-130 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| RACH-ConfigGeneric ::= SEQUENCE { |  |  |  |
| prach-ConfigurationIndex | [TBD] | Unpaired Spectrum | PRACH Format A3 |
| msg1-FDM | one |  | FR2 |
| msg1-FrequencyStart | 0 |  |  |
| zeroCorrelationZoneConfig | 15 |  |  |
| preambleReceivedTargetPower | [TBD] |  | PRACH Format A3 |
| preambleTransMax | n7 |  |  |
| powerRampingStep | dB0 |  |  |
| ra-ResponseWindow | sl20 |  |  |
| } |  |  |  |

Table 6.3.3.4.4.3-3: *ServingCellConfigCommonSIB: PRACH measurement*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[5], Table 4.6.3-169 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| ServingCellConfigCommonSIB ::= SEQUENCE { |  |  |  |
| ssb-PositionsInBurst SEQUENCE { |  |  |  |
| inOneGroup | '1000 0000'B |  |  |
| groupPresence | Not present |  |  |
| } |  |  |  |
| ss-PBCH-BlockPower | [TBD] |  |  |
| } |  |  |  |

6.3.3.4.5 Test requirement

The requirement for the power measured in steps 4, 5 and 6 of the test procedure shall not exceed the values specified in Table 6.3.3.4.5-1.

Table 6.3.3.4.5-1: PRACH time mask

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel bandwidth / Output Power [dBm] / measurement bandwidth | | | |
| 50MHz | 100MHz | 200MHz | 400MHz |
| Transmit OFF power | ≤ -30+TT + R | | | |
| Transmission OFF Measurement bandwidth | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| Expected PRACH Transmission ON Measured power | FFS | FFS | FFS | FFS |
| ON power tolerance  FFS | FFS | FFS | FFS | FFS |
| NOTE 1: Core requirement cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement result = 1.0 dB (Minimum requirement + relaxation R).  NOTE 2: Relaxation R is specified in Table 6.3.3.4.5-2. | | | | |

Table 6.3.3.4.5-2: Relaxations for OFF power for PC3 UEs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n261 | 19.4 dB | 22.4 dB | 25.4 dB | 28.4 dB |
| n260 | 21.5 dB | 24.5 dB | 27.5 dB | 30.5 dB |

Table 6.3.3.4.5-3: Relaxations for ON power

FFS

#### 6.3.3.5 Void

#### 6.3.3.6 SRS time mask

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

- TP analysis is FFS.

- Message contents are not complete

- Measurement uncertainty and Test tolerance are not complete

6.3.3.6.1 Test purpose

To verify that the SRS time mask meets the requirements given in 6.3.3.6.5.

The time mask for SRS time mask defines the transient period(s) allowed between transmit OFF power and transmit ON power when transmitting the SRS.

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

6.3.3.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

6.3.3.6.3 Minimum conformance requirements

In the case a single SRS transmission, the ON power is defined as the mean power over the symbol duration excluding any transient period; Figure 6.3.3.6.3-1.



Figure 6.3.3.6.3-1: Single SRS time mask for NR UL transmission

In the case multiple consecutive SRS transmission, the ON power is defined as the mean power for each symbol duration excluding any transient period. See Figure 7.7.4-2



Figure 6.3.3.6.3-2: Consecutive SRS time mask for the case when no power change is required

When power change between consecutive SRS transmissions is required, then Figure 6.3.3.6-3 and Figure 6.3.3.6-4 apply.



Figure 6.3.3.6.3-3: Consecutive SRS time mask for the case when power change is required and when 60kHz SCS is used in FR2



Figure 6.3.3.6.3-4: Consecutive SRS time mask for the case when power change is required and when 120kHz SCS is used in FR2

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3.3.6.

6.3.3.6.4 Test description

6.3.3.6.4.1 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 6.3.3.6.4.1-1. 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 6.3.3.6.4.1-1: Test Configuration Table

|  |  |
| --- | --- |
| Initial Conditions | |
| Test Environment as specified in TS 38.508-1 [5] subclause 4.1 | FFS |
| Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1 | FFS |
| Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1 | FFS |
| Test SCS as specified in Table 5.3.5-1 | FFS |
| SRS configuration | |
| c-SRS (SRS bandwidth configuration) | 17 (64 RB for BW 50 MHz)  33 (132 RB for BW 100 MHz)  60 (264 RB for BW 200 MHz)  for SCS 60 KHz |
| 9 (32 RB for BW 50 MHz)  17 (64 RB for BW 100 MHz)  33 (132 RB for BW 200 MHz)  60 (264 RB for BW 400 MHz)  for SCS 120 KHz |
| b-SRS | 0 |
| b-hop | 3 |
| freqDomainPosition | 0 |
| SRS-PeriodicityAndOffset | sl40  for SCS 60 KHz |
| sl80  for SCS 120 KHz |
| transmissionComb | n2 |
| CombOffset | 0 |
| cyclicShift | 0 |
| startPosition | 0 |
| nrofSymbols | n1 |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

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*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.3.3.6.4.3.

6.3.3.6.4.2 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 6.3.3.2.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slot 16 for 60kHz SCS and on slot 32 for 120kHz SCS. PUSCH is transmitted in the first half of the frame.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. ON power sub test:

5.1. Measure UE EIRP of the transmitted SRS transmission in the Tx beam peak direction during 1 OFDM symbol. The SRS transmission in the second half of the frame is used for measurement since there is no PUSCH transmission before and after. EIRP test procedure is defined in Annex K. EIRP is calculated considering both polarizations, theta and phi.

6. OFF power sub test:

6.1. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3.3.2.5-1. The period of the measurement shall be the 13 OFDM symbols preceding the SRS symbol excluding a transient period of 5 μs. EIRP test procedure is defined in Annex K.1.3. EIRP is calculated considering both polarizations, theta and phi.

6.2. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3.3.2.5-1. The period of the measurement shall be the slot following the SRS symbol excluding a transient period of 5 μs. EIRP test procedure is defined in Annex K.1.3. EIRP is calculated considering both polarizations, theta and phi.

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3.3.6.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with following exceptions:

Table 6.3.3.6.4.3-1: *BWP-UplinkDedicated*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[5], Table 4.6.3-15 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| BWP-UplinkDedicated ::= SEQUENCE { |  |  |  |
| srs-Config | *SRS-Config* in Table 6.3.3.6.4.3-2 |  |  |
| } |  |  |  |
| Note: This message exception is only valid for the initial BWP and not for an additional BWP inside BWP-Uplink. | | | |

Table 6.3.3.6.4.3-2: *SRS-Config*: SRS time mask measurement

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[5], Table 4.6.3-182 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| SRS-Config ::= SEQUENCE { |  |  |  |
| srs-ResourceSetToAddModList SEQUENCE (SIZE(0..maxNrofSRS-ResourceSets)) OF SEQUENCE { | 1 entry |  |  |
| resourceType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| srs-ResourceToAddModList SEQUENCE (SIZE(1..maxNrofSRS-Resources)) OF SEQUENCE { | 1 entry |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| startPosition | 0 |  |  |
| nrofSymbols | n1 |  |  |
| repetitionFactor | n1 |  |  |
| } |  |  |  |
| freqHopping SEQUENCE { |  |  |  |
| c-SRS |  |  |  |
|  | 17 (64 RB for BW 50 MHz)  33 (132 RB for BW 100 MHz)  60 (264 RB for BW 200 MHz) |  | SCS 60 KHz |
|  | 9 (32 RB for BW 50 MHz)  17 (64 RB for BW 100 MHz)  33 (132 RB for BW 200 MHz)  60 (264 RB for BW 400 MHz) |  | SCS 120 KHz |
| b-SRS | 0 |  |  |
| b-hop | 3 |  |  |
| } |  |  |  |
| resourceType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| periodicityAndOffset-p CHOICE{ |  |  |  |
| sl40 | 36 |  | SCS 60 KHz |
| sl80 | 72 |  | SCS 120 KHz |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

|  |  |
| --- | --- |
| **Condition** | **Explanation** |
| SCS\_60kHz | SCS=60kHz for SS/PBCH block |
| SCS\_120kHz | SCS=120kHz for SS/PBCH block |

6.3.3.6.5 Test requirement

The requirement for the power measured in steps 5 and 6 of the test procedure shall not exceed the values specified in Table 6.3.3.6.5-1 and 6.3.3.6.5-2.

Table 6.3.3.6.5-1: Test requirement of OFF power of SRS ON/OFF time mask

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel bandwidth / minimum output power / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Transmit OFF power | ≤ -30+[TT+R] dBm | | | |
| Transmission OFF Measurement bandwidth | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| NOTE 1: Core requirement cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement result = 1.0 dB (Minimum requirement + relaxation R).  NOTE 2: Relaxation R is specified in Table FFS.  NOTE 3: TT = FFS. | | | | |

Table 6.3.3.6.5-2: Test requirement of ON power of SRS ON/OFF time mask

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel bandwidth / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Transmit ON power | Same as the MPR requirements described in 6.2.2.5 for QPSK and Outer\_Full allocation. | | | |
| NOTE 1: Void. | | | | |

#### 6.3.3.7 PUSCH-PUCCH and PUSCH-SRS time masks

No test case details are specified. Current test procedures for time masks are based on power measurement in relatively long period compared with transient period. For time masks between 2 active time slots with different power level, the test procedure can’t provide enough resolution to identify non-conformant UEs. Therefore the minimum requirement is not testable.

#### 6.3.3.8 Transmit power time mask for consecutive slot or long subslot transmission and short subslot transmission boundaries

No test case details are specified. Current test procedures for time masks are based on power measurement in relatively long period compared with transient period. For time masks between 2 active time slots with different power level, the test procedure can’t provide enough resolution to identify non-conformant UEs. Therefore the minimum requirement is not testable.

#### 6.3.3.9 Transmit power time mask for consecutive short subslot transmissions boundaries

No test case details are specified. Current test procedures for time masks are based on power measurement in relatively long period compared with transient period. For time masks between 2 active time slots with different power level, the test procedure can’t provide enough resolution to identify non-conformant UEs. Therefore the minimum requirement is not testable.

### 6.3.4 Power control

#### 6.3.4.1 General

The requirements on power control accuracy apply under normal conditions and are defined as a directional requirement. The requirements are verified in beam locked mode on beam peak direction.

#### 6.3.4.2 Absolute power tolerance

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

* Testing of extreme conditions for FR2 is FFS.
* UE transmitted power for PC 1, 2 and 4 are FFS
* The reduction of the impact of DL MU by choosing alpha < 1 is FFS.

6.3.4.2.1 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.

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 20 ms.

6.3.4.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

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 20 ms. The tolerance includes the channel estimation error RSRP estimate.

The minimum requirements 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 (Pmin) and the maximum output power as specified in sub-clause 6.2.1.1 as minimum peak EIRP (‘Pmax’). The intermediate power point 'Pint' is defined in table 6.3.4.2.3-2.

Table 6.3.4.2.3-1: Absolute power tolerance

|  |  |
| --- | --- |
| Power Range | Tolerance |
| Pint ≥ P ≥ Pmin | ± 14.0 dB |
| Pmax ≥ P > Pint | ± 12.0 dB |

Table 6.3.4.2.3-2: Intermediate power point

|  |  |
| --- | --- |
| Power Parameter | Value |
| Pint | Pmax – 12.0 dB |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3.4.2.

6.3.4.2.4 Test description

6.3.4.2.4.1 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 6.3.4.2.4.1-1. 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 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Mid range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | 50 MHz, 100 MHz, 200 MHz, 400 MHz (NOTE 2) | |
| Test SCS as specified in Table 5.3.5-1. | | Highest | |
| Test Parameters | | | |
|  | Downlink Configuration | Uplink Configuration | |
| Test ID | - | 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 for PC2, PC3, PC4 and PC7 or Table 6.1-2 for PC1.  NOTE 2: Test is required only for CBWs supported by the UE. | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.

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

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. 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 [10] clause 4.5. Message contents are defined in clause 6.3.4.2.4.3.

6.3.4.2.4.2 Test procedure

1. SS sends uplink scheduling information 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. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Configure the UE transmitted output power to test point 1 in section 6.3.4.2.4.3. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP of the first subframe in the Tx beam peak direction in the measurement bandwidth specified in Table 6.3.1.5-1 and Table 6.3.1.5-2 for the specific channel bandwidth under test. EIRP test procedure is defined in Annex K. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi. For TDD slots with transient periods are not under test.

6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

7. Repeat test steps 1~6 for measurement of test point 2~3. The timing of the execution between the two test points shall be larger than 20ms.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config and with following exceptions:

Table 6.3.4.2.4.3-1: PUSCH-ConfigCommon (Test point 1) for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -132 |  | FR2a, 50MHz |
|  | -134 |  | FR2a, 100MHz |
|  | -138 |  | FR2a, 200MHz |
|  | -140 |  | FR2a, 400MHz |
|  | -132 |  | FR2b, 50MHz |
|  | -134 |  | FR2b, 100MHz |
|  | -138 |  | FR2b, 200MHz |
|  | -140 |  | FR2b, 400MHz |
| } |  |  |  |

Table 6.3.4.2.4.3-2: PUSCH-ConfigCommon (Test point 2) for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -108 |  | FR2a, 50MHz |
|  | -110 |  | FR2a, 100MHz |
|  | -114 |  | FR2a, 200MHz |
|  | -116 |  | FR2a, 400MHz |
|  | -110 |  | FR2b, 50MHz |
|  | -112 |  | FR2b, 100MHz |
|  | -116 |  | FR2b, 200MHz |
|  | -118 |  | FR2b, 400MHz |
| } |  |  |  |

Table 6.3.4.2.4.3-3: PUSCH-PowerControl (Test point 3) for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -98 |  | FR2a, 50MHz |
|  | -102 |  | FR2a, 100MHz |
|  | -104 |  | FR2a, 200MHz |
|  | -106 |  | FR2a, 400MHz |
|  | -100 |  | FR2b, 50MHz |
|  | -104 |  | FR2b, 100MHz |
|  | -106 |  | FR2b, 200MHz |
|  | -108 |  | FR2b, 400MHz |
| } |  |  |  |

Table 6.3.4.2.4.3-4: ServingCellConfigCommon

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1[5], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| ss-PBCH-BlockPower | 4 |  | SCS\_120kHz |
|  | 7 |  | SCS\_240kHz |
| } |  |  |  |

|  |  |
| --- | --- |
| **Condition** | **Explanation** |
| SCS\_120kHz | SCS=120kHz for SS/PBCH block |
| SCS\_240kHz | SCS=240kHz for SS/PBCH block |

Table 6.3.4.2.4.3-5: PUSCH-PowerControl

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-120 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-PowerControl ::= SEQUENCE { |  |  |  |
| tpc-Accumulation | disabled |  |  |
| p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE { | 1 entry |  |  |
| P0-PUSCH-AlphaSet[1] SEQUENCE { |  |  |  |
| alpha | alpha1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.4.2.5 Test requirement

The measured EIRP in step 5 and 7 shall not to exceed the values specified in Table 6.3.4.2.5-1 to 6.3.4.2.5-3.

Table 6.3.4.2.5-1: Absolute power tolerance: test point 1 for power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Frequency range | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | FR2a | -13.0 | -12.0 | -12.9 | -12.8 |
| power | FR2b | -13.0 | -12.0 | -12.9 | -12.8 |
| Power tolerance (Note 2) | | ± (14+TT)dB | | | |
| Note 1: The higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2.1.1.5.  Note 2: Do not test lower limit. | | | | | |

Table 6.3.4.2.5-2: Absolute power tolerance: test point 2 for power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Frequency range | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | FR2a | 11.0 | 12.0 | 11.1 | 11.2 |
| power | FR2b | 9.0 | 10.0 | 9.1 | 9.2 |
| Power tolerance (Note 2) | | ± (12+TT)dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3.2.5, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2.1.1.5.  Note 2: Do not test lower limit at CBW ≥ 200 MHz for FR2b | | | | | |

Table 6.3.4.2.5-3: Absolute power tolerance: test point 3 for power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Frequency range | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | FR2a | 21.0 | 20.0 | 21.1 | 21.2 |
| power | FR2b | 19.0 | 18.0 | 19.1 | 19.2 |
| Power tolerance | | ± (12+TT)dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3.2.5, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2.1.1.5. | | | | | |

Table 6.3.4.2.5-4: Test Tolerance for power class 1, 2, 4

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | Same as Table 6.3.1.5-3 | Same as Table 6.3.1.5-3 |

Table 6.3.4.2.5-5: Test Tolerance for power class 3

|  |  |  |
| --- | --- | --- |
| Test Metric | NTC testing | ETC testing |
| IFF (Max device size ≤ 30 cm) | ±8.16 dB | ±8.52 dB |

#### 6.3.4.3 Relative power tolerance

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

- MU and TT are TBD

- Starting power at ramp up/ramp down/alternating sub-test is TBD (6.3.4.3 MU dependent)

- Testability of test points needs further analysis, based on MU outcome

- This test case has a testability issue due to narrow range for 1 dB TPC step core requirement and therefore testing is not recommended.

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 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 20 ms.

6.3.4.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

6.3.4.3.3 Minimum conformance requirements

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 Pint as defined in sub-clause 6.3.4.2. The minimum requirements specified in Table 6.3.4.3.3-2 apply when the power of the target and reference sub-frames are within the power range bounded by Pint as defined in sub-clause 6.3.4.2 and the measured PUMAX as defined in sub-clause 6.2.4.

For a test pattern that is either a monotonically increasing or monotonically decreasing power sweep over the range specified for Tables 6.3.4.3.3-1and 6.3.4.3.3-2, 3 exceptions are allowed for each of the test patterns. For these exceptions, the power tolerance limit is a maximum of ±11.0 dB.

Table 6.3.4.3.3-1: Relative power tolerance, Pint ≥ P ≥ Pmin

|  |  |
| --- | --- |
| Power step ∆P (Up or down)  (dB) | All combinations of PUSCH and PUCCH, PUSCH/PUCCH and SRS transitions between sub-frames, PRACH (dB) |
| ΔP < 2 | ±5.0 |
| 2 ≤ ΔP < 3 | ±6.0 |
| 3 ≤ ΔP < 4 | ±7.0 |
| 4 ≤ ΔP < 10 | ±8.0 |
| 10 ≤ ΔP < 15 | ±10.0 |
| 15 ≤ ΔP | ±11.0 |
| NOTE: The requirements apply with *ue-BeamLockFunction* enabled. | |

Table 6.3.4.3.3-2: Relative power tolerance, PUMAX ≥ P > Pint

|  |  |
| --- | --- |
| Power step ∆P (Up or down)  (dB) | All combinations of PUSCH and PUCCH, PUSCH/PUCCH and SRS transitions between sub-frames, PRACH (dB) |
| ΔP < 2 | ±3.0 |
| 2 ≤ ΔP < 3 | ±4.0 |
| 3 ≤ ΔP < 4 | ±5.0 |
| 4 ≤ ΔP < 10 | ±6.0 |
| 10 ≤ ΔP < 15 | ±8.0 |
| 15 ≤ ΔP | ±9.0 |
| NOTE 1: The requirements apply with *ue-BeamLockFunction* enabled.  NOTE 2: For PUSCH to PUSCH transitions with the allocated resource blocks fixed in frequency and no transmission gaps other than those generated by downlink subframes, guard periods: for a power step ΔP = 1 dB, the relative power tolerance for transmission is ± 1.0 dB. | |

The normative reference for this requirement is TS 38.101-2 [3] 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, 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 subcarrier spacing, 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 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Low Range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | 100MHz | |
| Test SCS as specified in Table 5.3.5-1 | | | Highest | |
| Test Parameters | | | | |
| Ch BW | Downlink Configuration | | Uplink Configuration | |
|  | Modulation | RB Allocation | Modulation | RB allocation (NOTE 1) |
| 100MHz | - | | DFT-s-OFDM QPSK | See Table 6.3.4.3.5-1  See Table 6.3.4.3.5-2  See Table 6.3.4.3.5-3 |
| Note 1: The starting resource block shall be RB# 44. | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.3.4.3.4.1-1.

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 without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] 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 through Figure 6.3.4.3.4.2-3. The power patterns and corresponding sub frame numberings are derived from Table A.2.3-1.



Figure 6.3.4.3.4.2-1: TDD ramping up test power patterns, SCS 60kHz



Figure 6.3.4.3.4.2-2: TDD ramping down test power patterns, SCS 60kHz



Figure 6.3.4.3.4.2-3: Alternating Test Power patterns, SCS 60kHz

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.

1.2 Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

1.3 Send the appropriate TPC commands in the uplink scheduling information to UE until the UE EIRP 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 subclause 6.3.1.3.

- 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) + 5dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-2 [3], Table 6.3.4.3-1 and is 5dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

1.4 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

1.5 Schedule the UE's PUSCH data transmission as described in Figure 6.3.4.3.4.2-1 (TDD) pattern A: Uplink RB allocation as defined in Table 6.3.4.3.5-1. On the PDCCH format 0\_1 for the scheduling of the PUSCH the SS will transmit +1dB TPC commands over a sequence of 75 (NOTE 2) active uplink sub-frames to ensure that the UE reaches maximum power threshold. 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.

1.6 Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, to verify the UE relative power control meet test requirements in 6.3.4.3.5. EIRP test procedure is defined in Annex K.1.3. EIRP is calculated considering both polarizations, theta and phi. Measurement of the power is not required in sub-frame after the mean power has exceeded the maximum power threshold. For power transients between sub-frames, transient periods of 40us between sub-frames are excluded. For ON/OFF or OFF/ON transients, transient periods of 20 us at the beginning of the sub-frames are excluded.

1.7 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 to force different UE power steps at various points in the power range.

1.8 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

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. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2.2 Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

2.3 Send the appropriate TPC commands in the uplink scheduling information to UE until the UE EIRP 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 PUMAX, where:

- PUMAX is the maximum output power according to subclause 6.2.1.1.3.

- 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) + 1dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-2 [3], Table 6.3.4.3-2 and is 1dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

2.4 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

2.5. Schedule the UE's PUSCH data transmission as described in Figure 6.3.4.3.4.2-2 (TDD) pattern A: Uplink RB allocation as defined in Table 6.3.4.3.5-2. On the PDCCH format 0\_1 for the scheduling of the PUSCH the SS will transmit -1dB TPC commands over a sequence of 75 (NOTE 2) active uplink sub-frames to ensure that the UE reaches minimum power threshold. 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.

2.6. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, to verify the UE relative power control meet test requirements in 6.3.4.3.5. EIRP test procedure is defined in Annex K.1.3. EIRP is calculated considering both polarizations, theta and phi. Measurement of the power is not required in sub-frame after the mean power has exceeded the maximum power threshold. For power transients between sub-frame, transient periods of 40us between sub-frame are excluded. For ON/OFF or OFF/ON transients, transient periods of 20 us at the beginning of the sub-frame are excluded.

2.7. 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 to force different UE power steps at various points in the power range.

2.8 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

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. The initial uplink RB allocation is defined as the smaller uplink RB allocation value specified in Table 6.3.4.3.4.1-1. The power level and RB allocation are reset for each sub-test.

3.2 Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3.3 Send the appropriate TPC commands in the uplink scheduling information to UE until the UE EIRP 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 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 1.3.

Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3.4 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

3.5. Schedule the UE's PUSCH data transmission as described in Figure 6.3.5.2.4.2-3 for 5 frames with an uplink RB allocation alternating pattern as defined in Table 6.3.4.3.5-3 while transmitting 0dB TPC command for PUSCH via the PDCCH.

3.6. Measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, to verify the UE relative power control meet test requirements in 6.3.4.3.5. EIRP test procedure is defined in Annex K.1.3. EIRP is calculated considering both polarizations, theta and phi. Measurement of the power is not required in sub-frame after the mean power has exceeded the maximum power threshold. For power transients between sub-frames, transient periods of 40us between sub-frames are excluded. For ON/OFF or OFF/ON transients, transient periods of 20 us at the beginning of the sub-frame are excluded.

3.7 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: These numbers of TPC commands are given as examples. The actual number of TPC commands transmitted in these steps shall be enough to ensure that the UE reaches the relevant maximum or minimum power threshold in each step, as shown in Figure 6.3.4.3.4.2-1 through 6.3.4.3.4.2-3.

6.3.4.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

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 through 6.3.4.3.5-3.

For a test pattern that is either a monotonically increasing or monotonically decreasing power sweep over the range specified for Tables 6.3.4.3.3-1and 6.3.4.3.3-2, 3 exceptions are allowed for each of the test patterns. For these exceptions, the power tolerance limit is a maximum of ± (11.0 + 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 100MHz, SCS 60kHz, ramp up sub-test

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sub-test ID | Applicable sub-frames | Uplink RB allocation | TPC command | Expected power step size (Up) | Power step size range (Up) | PUSCH |
|  |  |  |  | ΔP [dB] | ΔP [dB] | [dB] |
|  | Sub-frames before RB change | 105RBs | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 1 | RB change | 105RBs to 128 RBs | TPC=+1dB | 1.86 | ΔP < 2dB | 1.86 +/- (5.0 + TT) (NOTE 1)  1.86 +/- (3.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 128 | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 90RBs | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 2 | RB change | 90RBs to 128 RBs | TPC=+1dB | 2.53 | 2dB ≤ ΔP < 3dB | 2.53 +/- (6.0 + TT) (NOTE 1)  2.53 +/- (4.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 128 | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 79RBs | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 3 | RB change | 79RBs to 128 RBs | TPC=+1dB | 3.10 | 3dB ≤ ΔP < 4dB | 3,10 +/- (7.0 + TT) (NOTE 1)  3,10 +/- (5.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 128RBs | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 32RBs | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 4 | RB change | 32RBs to 128 RBs | TPC=+1dB | 7.02 | 4dB ≤ ΔP < 10dB | 7.02 +/- (8.0 + TT) (NOTE 1)  7.02 +/- (6.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 128 | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 7RBs | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 5 | RB change | 7RBs to 128 RBs | TPC=+1dB | 13.62 | 10dB ≤ ΔP < 15dB | 13.62 +/- (10.0 + TT) (NOTE 1)  13.62 +/- (8.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 128RBs | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 1RB | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 6 | RB change | 1RB to 128 RBs | TPC=+1dB | 22.07 | 15dB < ΔP | 22.07 +/- (11.0 + TT) (NOTE 1)  22.07 +/- (9.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 128 | TPC=+1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| NOTE 1: Applicable if Pint ≥ P ≥ Pmin.  NOTE 2: Applicable if PUMAX ≥ P > Pint.  NOTE 3: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1. | | | | | | |

Table 6.3.4.3.5-2: Test Requirements Relative Power Tolerance for Transmission, channel BW 100MHz, SCS 60kHz, ramp down sub-test

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sub-test ID | Applicable sub-frames | Uplink RB allocation | TPC command | Expected power step size (Down) | Power step size range (Down) | PUSCH |
|  |  |  |  | ΔP [dB] | ΔP [dB] | [dB] |
|  | Sub-frames before RB change | 128RBs | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 1 | RB change | 128RBs to 105 RBs | TPC=-1dB | 1.86 | ΔP < 2dB | 1.86 +/- (5.0 + TT) (NOTE 1)  1.86 +/- (3.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 105 | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 128RBs | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 2 | RB change | 128RBs to 90 RBs | TPC=-1dB | 2.53 | 2dB ≤ ΔP < 3dB | 2.53 +/- (6.0 + TT) (NOTE 1)  2.53 +/- (4.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 90 | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 128RBs | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 3 | RB change | 128RBs to 79 RBs | TPC=-1dB | 3.10 | 3dB ≤ ΔP < 4dB | 3,10 +/- (7.0 + TT) (NOTE 1)  3,10 +/- (5.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 79RBs | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 128RBs | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 4 | RB change | 128RBs to 32 RBs | TPC=-1dB | 7.02 | 4dB ≤ ΔP < 10dB | 7.02 +/- (8.0 + TT) (NOTE 1)  7.02 +/- (6.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 32 | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 128RBs | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 5 | RB change | 128RBs to 7 RBs | TPC=-1dB | 13.62 | 10dB ≤ ΔP < 15dB | 13.62 +/- (10.0 + TT) (NOTE 1)  13.62 +/- (8.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 7RBs | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
|  | Sub-frames before RB change | 128RB | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| 6 | RB change | 128RB to 1 RBs | TPC=-1dB | 22.07 | 15dB < ΔP | 22.07 +/- (11.0 + TT) (NOTE 1)  22.07 +/- (9.0 + TT) (NOTE 2) |
|  | Sub-frames after RB change | Fixed = 1 | TPC=-1dB | 1 | ΔP ≤ 1 dB | 1 +/- (1.0 + TT) |
| NOTE 1: Applicable if Pint ≥ P ≥ Pmin.  NOTE 2: Applicable if PUMAX ≥ P > Pint.  NOTE 3: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1. | | | | | | |

Table 6.3.4.3.5-3: Test Requirements Relative Power Tolerance for Transmission, channel BW 100MHz, SCS 60kHz, alternating sub-test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sub-test ID | Uplink RB allocation | TPC command | Expected power step size (Up/Down) | Power step size range (Up/Down) | PUSCH |
|  |  |  | ΔP [dB] | ΔP [dB] | [dB] |
| 1 | Alternating 105 and 128 | TPC=0dB | 0.86 | ΔP < 2dB | 0.86 +/- (5.0 + TT) (NOTE 1)  0.86 +/- (3.0 + TT) (NOTE 2) |
| 2 | Alternating 79 and 128 | TPC=0dB | 2.10 | 2dB ≤ ΔP < 3dB | 2.10 +/- (6.0 + TT) (NOTE 1)  2.10 +/- (4.0 + TT) (NOTE 2) |
| 3 | Alternating 64 and 128 | TPC=0dB | 3.01 | 3dB ≤ ΔP < 4dB | 3.01 +/- (7.0 + TT) (NOTE 1)  3.01 +/- (5.0 + TT) (NOTE 2) |
| 4 | Alternating 32 and 128 | TPC=0dB | 6.02 | 4dB ≤ ΔP < 10dB | 6.02 +/- (8.0 + TT) (NOTE 1)  6.02 +/- (6.0 + TT) (NOTE 2) |
| 5 | Alternating 7 and 128 | TPC=0dB | 12.62 | 10dB ≤ ΔP < 15dB | 12.62 +/- (10.0 + TT) (NOTE 1)  12.62 +/- (8.0 + TT) (NOTE 2) |
| 6 | Alternating 1 and 128 | TPC=0dB | 21.07 | 15dB < ΔP | 21.07 +/- (11.0 + TT) (NOTE 1)  21.07 +/- (9.0 + TT) (NOTE 2) |
| NOTE 1: Applicable if Pint ≥ P ≥ Pmin.  NOTE 2: Applicable if PUMAX ≥ P > Pint.  NOTE 3: Applicable if PUMAX ≥ P ≥ Pmin. Pmin as defined in sub-clause 6.3.1. | | | | | |

#### 6.3.4.4 Aggregate power tolerance

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

- UE transmitted power for power class 1, 2 and 4 is FFS.

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 TS 38.213 [22] kept constant.

6.3.4.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

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 (1 ms) non-contiguous transmissions within 21ms in response to 0 dB TPC commands with respect to the first UE transmission and all other power control parameters as specified in TS 38.213 [22] kept constant.

The minimum requirements specified in Table 6.3.4.4.3-1 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 Pint as defined in sub-clause 6.3.4.2. The minimum requirements specified in Table 6.3.4.4.3-2 apply when the power of the target and reference sub-frames are within the power range bounded by Pint as defined in sub-clause 6.3.4.2 and the maximum output power as specified in sub-clause 6.2.1.

Table 6.3.4.4.3-1: Aggregate power tolerance, Pint ≥ P ≥ Pmin

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Aggregate power tolerance within 21ms |
| 0 dB | PUCCH | ± 5.5 dB |
| 0 dB | PUSCH | ± 5.5 dB |

Table 6.3.4.4.3-2: Aggregate power tolerance, Pmax ≥ P > Pint

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Aggregate power tolerance within 21ms |
| 0 dB | PUCCH | ± 3.5 dB |
| 0 dB | PUSCH | ± 3.5 dB |

The normative reference for this requirement is TS 38.101-2 [3] 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 subtest

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Mid range |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Lowest, Mid and Highest |
| Test SCS as specified in Table 5.3.5-1 | | | Highest |
| Test Parameters for Channel Bandwidths | | | |
| Test ID | Downlink Configuration | | Uplink Configuration |
|  | **Modulation** | **RB allocation** | PUCCH format = Format 1  Length in OFDM symbols = 14 |
| 1 | CP-OFDM 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 subtest

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Mid range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | Lowest, Mid and Highest | |
| Test SCS as specified in Table 5.3.5-1 | | Highest | |
| Test Parameters for Channel Bandwidths | | | |
| Test ID | Downlink Configuration | Uplink Configuration | |
|  | **-** | 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 for PC2, PC3, PC4 and PC7 or Table 6.1-2 for PC1. | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.

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

4. For PUCCH subtest, the UL and DL Reference Measurement Channels are set according to Table 6.3.4.4.4.1-1. For PUSCH subtest, the UL Reference Measurement Channel is set according to Table 6.3.4.4.4.1-2.

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

6. Ensure the UE is in State RRC\_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] 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 subtest:

1.1. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1.

1.2. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

1.3. 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 PW of the target power level specified in Table 6.3.4.4.4.2-1 according to the power class with power ID = 1. PW is the power window according to Table 6.3.4.4.4.2-2 for the carrier frequency f and the channel bandwidth BW.

1.4. Every 10 sub-frames (10ms) 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.

1.5. Measure the UE EIRP of 3 consecutive PUCCH transmissions in the Tx beam peak direction of in the measurement bandwidth specified in Table 6.3.1.5-1 and Table 6.3.1.5-2 to verify the UE transmitted PUCCH power is maintained within 21ms. EIRP test procedure is defined in Annex K. EIRP is calculated considering both polarizations, theta and phi. For TDD slots with transient periods are not under test.

1.6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

1.7. Repeat test steps 1.2 to 1.6 for measurement for power ID = 2 in Table 6.3.4.4.4.2-1.

2. PUSCH subtest:

2.1. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1.

2.2. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

2.3. 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 PW of the target power level specified in Table 6.3.4.4.4.2-1 according to the power class with power ID = 1. PW is the power window according to Table 6.3.4.4.4.2-2 for the carrier frequency f and the channel bandwidth BW.

2.4. Every 10 sub-frames (10ms) 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 6.3.4.4.4.2-1.

2.5. Measure the UE EIRP of 3 consecutive PUSCH transmissions in the Tx beam peak direction of in the measurement bandwidth specified in Table 6.3.1.5-1 and Table 6.3.1.5-2 to verify the UE transmitted PUSCH power is maintained within 21ms. EIRP test procedure is defined in Annex K. EIRP is calculated considering both polarizations, theta and phi. For TDD slots with transient periods are not under test.

2.6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

2.7. Repeat test steps 2.2 to 2.6 for measurement for power ID = 2 in Table 6.3.4.4.4.2-1.

Table 6.3.4.4.4.2-1: Parameters for Aggregate power tolerance

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Power ID | Unit | PC1 | PC2 | PC3 | PC4 |
| FR2a | 1 | dBm | TBD | TBD | 1 | TBD |
|  | 2 | dBm | TBD | TBD | 15 | TBD |
| FR2b | 1 | dBm | TBD | TBD | 6 | TBD |
|  | 2 | dBm | TBD | TBD | 15 | TBD |

Table 6.3.4.4.4.2-2: Power Window (dB) for Aggregate Power tolerance for PUSCH and PUCCH

|  |  |  |
| --- | --- | --- |
| Power ID | PUCCH | PUSCH |
| 1 | 7.4 | 7.4 |
| 2 | 5.4 | 3.4 |

6.3.4.4.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config and with following exception:

Table 6.3.4.4.4.3-1: Physical layer parameters for DCI format 1\_1 for PUCCH subtest

|  |  |  |
| --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 5.4.2.0-1 | | |
| Parameter | Value | Value in binary |
| PUCCH resource indicator | *PUCCH-ResourceId[8]* = 7 in pucch-ResourceSetID[1] as defined in TS 38.508-1 [10], Table 4.6.3-112 (Mapping as per Table 9.2.3-2 in TS 38.213 [22]) | ‘111’B |

6.3.4.4.5 Test requirement

The requirement for the power measurements made in step (1.5) and (2.5) of the test procedure shall not exceed the values specified in Table 6.3.4.4.5-1 and Table 6.3.4.4.5-2. The power measurement period shall be 1 sub-frame (1ms).

Table 6.3.4.4.5-1: Power control tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUCCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(5.5dB+TT) of the 1st measurement. |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(5.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3.4.4.5-3. | | |

Table 6.3.4.4.5-2: Power control tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUCCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(3.5dB+TT) of the 1st measurement. |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(3.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3.4.4.5-4. | | |

Table 6.3.4.4.5-3: Test Tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | 0.26 dB | 0.26 dB |

Table 6.3.4.4.5-4: Test Tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | 0.26 dB | 0.26 dB |

## 6.3A Output power dynamics for CA

### 6.3A.1 Minimum output power for CA

#### 6.3A.1.0 Minimum conformance requirements

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

The minimum output power is defined as the mean power in at least one subframe (1ms).

The minimum output power shall not exceed the values specified in Table 6.3A.1.0-1 and 6.3.A.1.0-2 for each operating band supported. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.3A.1.0-1: Minimum output power for CA for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | 4 | 47.58 |
| 100 | 4 | 95.16 |
| 200 | 4 | 190.20 |
| 400 | 4 | 380.28 |

Table 6.3A.1.0-2: Minimum output power for CA for power class 2, 3 and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | -13 | 47.58 |
| 100 | -13 | 95.16 |
| 200 | -13 | 190.20 |
| 400 | -13 | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3A.1.

#### 6.3A.1.1 Minimum output power for CA (2UL CA)

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

* Relaxation, Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 800MHz is FFS as test system complexity might increase.

6.3A.1.1.1 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 on each component carrier is set to a minimum value.

6.3A.1.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support intra-band contiguous 2UL CA.

6.3A.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.1.0.

6.3A.1.1.4 Test description

6.3A.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 CA configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, and are shown in Table 6.3A.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 6.3A.1.1.4.1-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: *“The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier”*. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.

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

4. The UL Reference Measurement Channel is set according to Table 6.3A.1.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.3A.1.1.4.3.

6.3A.1.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.3.0 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.3A.1.1.4.3

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.2).

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 6.3A.1.1.4.1-1 on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

6. Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power. If UE is disconnected, repeat the test case. Optionally, send continuously uplink power control “down” commands in every uplink scheduling information to the UE until the UE EIRP measured by the test system is at a level just before the UE was disconnected. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

8. Measure UE EIRP of each component carrier in the Tx beam peak direction in the measurement bandwidth specified in Table 6.3A.1.1.5-1 for the specific channel bandwidth under test. EIRP test procedure is defined in Annex K. The measuring duration is at least one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi. For TDD slots with transient periods are not under test.

9. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELEECT\_WAIT\_TIME default value is defined in Annex K.1.1.

6.3A.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with following exception.

Table 6.3A.1.1.4.3-1: *PUSCH-Config*

|  |
| --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-118 with condition TRANSFORM\_PRECODER\_ENABLED |

6.3A.1.1.5 Test requirement

For each component carrier, the minimum EIRP shall not exceed the values specified in Table 6.3A.1.1.5-1 and 6.3A.1.1.5-2.

Table 6.3A.1.1.5-1: Minimum output power for 2UL CA for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | 4+TBD+TT | 47.58 |
| 100 | 4+TBD+TT | 95.16 |
| 200 | 4+TBD+TT | 190.20 |
| 400 | 4+TBD+TT | 380.28 |

Table 6.3A.1.1.5-2: Minimum output power for 2UL CA for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n261 | 50 | -13+TT | 47.58 |
| 100 | -13+2.4+TT | 95.16 |
| 200 | -13+5.4+TT | 190.20 |
| 400 | -13+8.4+TT | 380.28 |
| n260 | 50 | -13+4.5+TT | 47.58 |
|  | 100 | -13+7.5+TT | 95.16 |
|  | 200 | -13+10.5+TT | 190.20 |
|  | 400 | -13+13.5+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.1.5-2a: Minimum output power for 2UL CA for power class 2 and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | -13+TBD+TT | 47.58 |
| 100 | -13+TBD+TT | 95.16 |
| 200 | -13+TBD+TT | 190.20 |
| 400 | -13+TBD+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.1.5-3: Test Tolerance for Minimum output power for 2UL CA for Power class 1, 2, 4

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

Table 6.3A.1.1.5-4: Test Tolerance for Minimum output power for 2UL CA for Power class 3

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | Same as in table 6.3.1.5-2 | Same as in table 6.3.1.5-2 |

#### 6.3A.1.2 Minimum output power for CA (3UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Relaxation, Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.
* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 800MHz is FFS as test system complexity might increase.

6.3A.1.2.1 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 on each component carrier is set to a minimum value.

6.3A.1.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.3A.1.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.1.0.

6.3A.1.2.4 Test description

Same as in clause 6.3A.1.1.4 with following exceptions:

- Instead of Table 6.3A.1.1.4.1-1 🡪 use Table 6.3A.1.2.4-1.

- Instead of Table 6.3A.1.1.5-1 and 6.3A.1.1.5-2 🡪 use Table 6.3A.1.2.5-1 and 6.3A.1.2.5-2.

Table 6.3A.1.2.4-1: Test Configuration Table for 3UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: *“The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier”*. | | | | | | |

6.3A.1.2.5 Test requirement

For each component carrier, the minimum EIRP shall not exceed the values specified in Table 6.3A.1.2.5-1 and 6.3A.1.2.5-2.

Table 6.3A.1.2.5-1: Minimum output power for 3UL CA for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n260, n261 | 50 | 4+TBD+TT | 47.58 |
| 100 | 4+TBD+TT | 95.16 |
| 200 | 4+TBD+TT | 190.20 |
| 400 | 4+TBD+TT | 380.28 |

Table 6.3A.1.2.5-2: Minimum output power for 3UL CA for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n261 | 50 | -13+TT | 47.58 |
| 100 | -13+2.4+TT | 95.16 |
| 200 | -13+5.4+TT | 190.20 |
| 400 | -13+8.4+TT | 380.28 |
| n260 | 50 | -13+4.5+TT | 47.58 |
|  | 100 | -13+7.5+TT | 95.16 |
|  | 200 | -13+10.5+TT | 190.20 |
|  | 400 | -13+13.5+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.2.5-2a: Minimum output power for 3UL CA for power class 2 and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | -13+TBD+TT | 47.58 |
| 100 | -13+TBD+TT | 95.16 |
| 200 | -13+TBD+TT | 190.20 |
| 400 | -13+TBD+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.2.5-3: Test Tolerance for Minimum output power for 3UL CA for Power class 1, 2, 4

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

Table 6.3A.1.2.5-4: Test Tolerance for Minimum output power for 3UL CA for Power class 3

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | Same as in table 6.3.1.5-2 | Same as in table 6.3.1.5-2 |

#### 6.3A.1.3 Minimum output power for CA (4UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Relaxation, Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 800MHz is FFS as test system complexity might increase.

6.3A.1.3.1 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 on each component carrier is set to a minimum value.

6.3A.1.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.3A.1.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.1.0.

6.3A.1.3.4 Test description

Same as in clause 6.3A.1.1.4 with following exceptions:

- Instead of Table 6.3A.1.1.4.1-1 🡪 use Table 6.3A.1.3.4-1.

- Instead of Table 6.3A.1.1.5-1 and 6.3A.1.1.5-2 🡪 use Table 6.3A.1.3.5-1 and 6.3A.1.3.5-2.

Table 6.3A.1.3.4-1: Test Configuration Table for 4UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.1.3.5 Test requirement

For each component carrier, the minimum EIRP shall not exceed the values specified in Table 6.3A.1.3.5-1 and 6.3A.1.3.5-2.

Table 6.3A.1.3.5-1: Minimum output power for 4UL CA for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n260, n261 | 50 | 4+TBD+TT | 47.58 |
| 100 | 4+TBD+TT | 95.16 |
| 200 | 4+TBD+TT | 190.20 |
| 400 | 4+TBD+TT | 380.28 |

Table 6.3A.1.3.5-2: Minimum output power for 4UL CA for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n261 | 50 | -13+TT | 47.58 |
| 100 | -13+2.4+TT | 95.16 |
| 200 | -13+5.4+TT | 190.20 |
| 400 | -13+8.4+TT | 380.28 |
| n260 | 50 | -13+4.5+TT | 47.58 |
|  | 100 | -13+7.5+TT | 95.16 |
|  | 200 | -13+10.5+TT | 190.20 |
|  | 400 | -13+13.5+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.3.5-2a: Minimum output power for 4UL CA for power class 2 and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | -13+TBD+TT | 47.58 |
| 100 | -13+TBD+TT | 95.16 |
| 200 | -13+TBD+TT | 190.20 |
| 400 | -13+TBD+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.3.5-3: Test Tolerance for Minimum output power for 4UL CA for Power class 1, 2, 4

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

Table 6.3A.1.3.5-4: Test Tolerance for Minimum output power for 4UL CA for Power class 3

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | Same as in table 6.3.1.5-2 | Same as in table 6.3.1.5-2 |

#### 6.3A.1.4 Minimum output power for CA (5UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Relaxation, Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 800MHz is FFS as test system complexity might increase.

6.3A.1.4.1 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 on each component carrier is set to a minimum value.

6.3A.1.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.3A.1.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.1.0.

6.3A.1.4.4 Test description

Same as in clause 6.3A.1.1.4 with following exceptions:

- Instead of Table 6.3A.1.1.4.1-1 🡪 use Table 6.3A.1.4.4-1.

- Instead of Table 6.3A.1.1.5-1 and 6.3A.1.1.5-2 🡪 use Table 6.3A.1.4.5-1 and 6.3A.1.4.5-2.

Table 6.3A.1.4.4-1: Test Configuration Table for 5UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC4 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.1.4.5 Test requirement

For each component carrier, the minimum EIRP shall not exceed the values specified in Table 6.3A.1.4.5-1 and 6.3A.1.4.5-2.

Table 6.3A.1.4.5-1: Minimum output power for 5UL CA for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n260, n261 | 50 | 4+TBD+TT | 47.58 |
| 100 | 4+TBD+TT | 95.16 |
| 200 | 4+TBD+TT | 190.20 |
| 400 | 4+TBD+TT | 380.28 |

Table 6.3A.1.4.5-2: Minimum output power for 5UL CA for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n261 | 50 | -13+TT | 47.58 |
| 100 | -13+2.4+TT | 95.16 |
| 200 | -13+5.4+TT | 190.20 |
| 400 | -13+8.4+TT | 380.28 |
| n260 | 50 | -13+4.5+TT | 47.58 |
|  | 100 | -13+7.5+TT | 95.16 |
|  | 200 | -13+10.5+TT | 190.20 |
|  | 400 | -13+13.5+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.4.5-2a: Minimum output power for 5UL CA for power class 2 and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | -13+TBD+TT | 47.58 |
| 100 | -13+TBD+TT | 95.16 |
| 200 | -13+TBD+TT | 190.20 |
| 400 | -13+TBD+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.4.5-3: Test Tolerance for Minimum output power for 5UL CA for Power class 1, 2, 4

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

Table 6.3A.1.4.5-4: Test Tolerance for Minimum output power for 5UL CA for Power class 3

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | Same as in table 6.3.1.5-2 | Same as in Table 6.3.1.5-2 |

#### 6.3A.1.5 Minimum output power for CA (6UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Relaxation, Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 800MHz is FFS as test system complexity might increase.

6.3A.1.5.1 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 on each component carrier is set to a minimum value.

6.3A.1.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.3A.1.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.1.0.

6.3A.1.5.4 Test description

Same as in clause 6.3A.1.1.4 with following exceptions:

- Instead of Table 6.3A.1.1.4.1-1 🡪 use Table 6.3A.1.5.4-1.

- Instead of Table 6.3A.1.1.5-1 and 6.3A.1.1.5-2 🡪 use Table 6.3A.1.5.5-1 and 6.3A.1.5.5-2.

Table 6.3A.1.5.4-1: Test Configuration Table for 6UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC4 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC5 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.1.5.5 Test requirement

For each component carrier, the minimum EIRP shall not exceed the values specified in Table 6.3A.1.5.5-1 and 6.3A.1.5.5-2.

Table 6.3A.1.5.5-1: Minimum output power for 6UL CA for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n260, n261 | 50 | 4+TBD+TT | 47.58 |
| 100 | 4+TBD+TT | 95.16 |
| 200 | 4+TBD+TT | 190.20 |
| 400 | 4+TBD+TT | 380.28 |

Table 6.3A.1.5.5-2: Minimum output power for 6UL CA for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n261 | 50 | -13+TT | 47.58 |
| 100 | -13+2.4+TT | 95.16 |
| 200 | -13+5.4+TT | 190.20 |
| 400 | -13+8.4+TT | 380.28 |
| n260 | 50 | -13+4.5+TT | 47.58 |
|  | 100 | -13+7.5+TT | 95.16 |
|  | 200 | -13+10.5+TT | 190.20 |
|  | 400 | -13+13.5+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.5.5-2a: Minimum output power for 6UL CA for power class 2 and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | -13+TBD+TT | 47.58 |
| 100 | -13+TBD+TT | 95.16 |
| 200 | -13+TBD+TT | 190.20 |
| 400 | -13+TBD+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.5.5-3: Test Tolerance for Minimum output power for 6UL CA for Power class 1, 2, 4

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

Table 6.3A.1.5.5-4: Test Tolerance for Minimum output power for 6UL CA for Power class 3

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | Same as in table 6.3.1.5-2 | Same as in table 6.3.1.5-2 |

#### 6.3A.1.6 Minimum output power for CA (7UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Relaxation, Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 800MHz is FFS as test system complexity might increase.

6.3A.1.6.1 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 on each component carrier is set to a minimum value.

6.3A.1.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.3A.1.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.1.0.

6.3A.1.6.4 Test description

Same as in clause 6.3A.1.1.4 with following exceptions:

- Instead of Table 6.3A.1.1.4.1-1 🡪 use Table 6.3A.1.6.4-1.

- Instead of Table 6.3A.1.1.5-1 and 6.3A.1.1.5-2 🡪 use Table 6.3A.1.6.5-1 and 6.3A.1.6.5-2.

Table 6.3A.1.6.4-1: Test Configuration Table for 7UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC4 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC5 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC6 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.1.6.5 Test requirement

For each component carrier, the minimum EIRP shall not exceed the values specified in Table 6.3A.1.6.5-1 and 6.3A.1.6.5-2.

Table 6.3A.1.6.5-1: Minimum output power for 7UL CA for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n260, n261 | 50 | 4+TBD+TT | 47.58 |
| 100 | 4+TBD+TT | 95.16 |
| 200 | 4+TBD+TT | 190.20 |
| 400 | 4+TBD+TT | 380.28 |

Table 6.3A.1.6.5-2: Minimum output power for 7UL CA for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n261 | 50 | -13+TT | 47.58 |
| 100 | -13+2.4+TT | 95.16 |
| 200 | -13+5.4+TT | 190.20 |
| 400 | -13+8.4+TT | 380.28 |
| n260 | 50 | -13+4.5+TT | 47.58 |
|  | 100 | -13+7.5+TT | 95.16 |
|  | 200 | -13+10.5+TT | 190.20 |
|  | 400 | -13+13.5+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.6.5-2a: Minimum output power for 7UL CA for power class 2 and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | -13+TBD+TT | 47.58 |
| 100 | -13+TBD+TT | 95.16 |
| 200 | -13+TBD+TT | 190.20 |
| 400 | -13+TBD+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.6.5-3: Test Tolerance for Minimum output power for 7UL CA for Power class 1, 2, 4

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

Table 6.3A.1.6.5-4: Test Tolerance for Minimum output power for 7UL CA for Power class 3

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | Same as in table 6.3.1.5-2 | Same as in table 6.3.1.5-2 |

#### 6.3A.1.7 Minimum output power for CA (8UL CA)

Editor’s note: The following aspects are either missing or not yet determined:

* Relaxation, Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

- Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 800MHz is FFS as test system complexity might increase.

6.3A.1.7.1 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 on each component carrier is set to a minimum value.

6.3A.1.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.3A.1.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.1.0.

6.3A.1.7.4 Test description

Same as in clause 6.3A.1.1.4 with following exceptions:

- Instead of Table 6.3A.1.1.4.1-1 🡪 use Table 6.3A.1.7.4-1.

- Instead of Table 6.3A.1.1.5-1 and 6.3A.1.1.5-2 🡪 use Table 6.3A.1.7.5-1 and 6.3A.1.7.5-2.

Table 6.3A.1.7.4-1: Test Configuration Table for 8UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC4 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC5 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC6 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC7 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.1.7.5 Test requirement

For each component carrier, the minimum EIRP shall not exceed the values specified in Table 6.3A.1.7.5-1 and 6.3A.1.7.5-2.

Table 6.3A.1.7.5-1: Minimum output power for 8UL CA for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n260, n261 | 50 | 4+TBD+TT | 47.58 |
| 100 | 4+TBD+TT | 95.16 |
| 200 | 4+TBD+TT | 190.20 |
| 400 | 4+TBD+TT | 380.28 |

Table 6.3A.1.7.5-2: Minimum output power for 8UL CA for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| **Operating band** | **Channel bandwidth**  **(MHz)** | **Minimum output power**  **(dBm)** | **Measurement bandwidth**  **(MHz)** |
| n257, n258, n261 | 50 | -13+TT | 47.58 |
| 100 | -13+2.4+TT | 95.16 |
| 200 | -13+5.4+TT | 190.20 |
| 400 | -13+8.4+TT | 380.28 |
| n260 | 50 | -13+4.5+TT | 47.58 |
|  | 100 | -13+7.5+TT | 95.16 |
|  | 200 | -13+10.5+TT | 190.20 |
|  | 400 | -13+13.5+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.7.5-2a: Minimum output power for 8UL CA for power class 2 and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | -13+TBD+TT | 47.58 |
| 100 | -13+TBD+TT | 95.16 |
| 200 | -13+TBD+TT | 190.20 |
| 400 | -13+TBD+TT | 380.28 |
| NOTE 1: n260 is not applied for power class 2. | | | |

Table 6.3A.1.7.5-3: Test Tolerance for Minimum output power for 8UL CA for Power class 1, 2, 4

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

Table 6.3A.1.7.5-4: Test Tolerance for Minimum output power for 8UL CA for Power class 3

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | Same as in table 6.3.1.5-2 | Same as in table 6.3.1.5-2 |

### 6.3A.2 Transmit OFF power for CA

#### 6.3A.2.0 Minimum conformance requirements

For intra-band contiguous carrier aggregation, the transmit OFF power is defined as the TRP in the channel bandwidth per component carrier when the transmitter is OFF. The transmitter is considered OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During DTX and measurements gaps, the transmitter is not considered OFF.

The transmit OFF power shall not exceed the values specified in Table 6.3A.2.0-1 for each operating band supported.

Table 6.3A.2.0-1: Transmit OFF power for CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n260, n261 | -35 | -35 | -35 | -35 |
| 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3A.2.

#### 6.3A.2.1 Void

#### 6.3A.2.2 Void

#### 6.3A.2.3 Void

### 6.3A.3 Transmit ON/OFF time mask for CA

#### 6.3A.3.0 Minimum conformance requirements

For intra-band contiguous carrier aggregation, the general output power ON/OFF time mask specified in subclause 6.3.3.2 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in subclause 6.3.3.2 shall only be applicable for each component carrier when all the component carriers are OFF.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3A.3.

#### 6.3A.3.1 General ON/OFF time mask for CA

##### 6.3A.3.1.1 General ON/OFF time mask for CA (2UL CA)

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

* Measurement Uncertainty and Test Tolerances are FFS.
* Test requirement of ON power is FFS.
* Testability of OFF power needs further study.
* The method of setting UE transmitted power is FFS.
* TP analysis is FFS
* Applicability of Beam peak of single UL is FFS.
* The UPLF test mode is applicable to UEs Release 16 and forward. This test case is incomplete for Release 15 until UE PHR method is used to prevent SCell drop.

6.3A.3.1.1.1 Test purpose

To verify that the general ON/OFF time mask for CA meets the requirements given in 6.3A.3.1.1.5. Transmission of the wrong power increases interference to other channels, or increases transmission errors in the uplink channel.

6.3A.3.1.1.2 Test applicability

The requirements of this test apply to all types of NR UE release 16 and forward supporting 2UL CA.

6.3A.3.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.3.0.

6.3A.3.1.1.4 Test description

6.3A.3.1.1.4.1 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, and CC combinations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration and subcarrier spacing, are shown in Table 6.3A.3.1.1.4.1-1. 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 6.3A.3.1.1.4.1-1: Intra-band Contiguous UL CA Test Configuration Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | FFS | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | | FFS | | |
| Test CC Combination setting (NRB\_agg) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | | FFS | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | FFS | | |
| Test Parameters | | | | | | | |
| Test ID | CC | Band | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation |
| Default Test Settings for a CA\_XG, CA\_nXO Configuration (Cumulative aggregated BWchannel < 400MHz) | | | | | | | |
| 1 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.3A.3.1.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.3A.3.1.1.4.3.

6.3A.3.1.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 and Annex C.3.0 for all downlink physical channels

2. The SS shall configure SCC as per TS 38.508-1 [10] subclause 5.5.1 Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in subclause 6.3A.3.1.1.4.3.

3. Apply the test step based on the 5G NR UE Release:

3a. For Release 16 and forward 5G NR UEs: SS applies a backoff on the PCell powerby activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using TOTAL NR AGGREGATED BANDWIDTH and PCELL NR bandwidth as per Test CC Combination setting. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

3b. For Release 15 5G NR UEs: Test Procedure updates to keep SCell active are FFS. Skip remaining steps.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 Table 6.3A.3.1.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slot 37 for 60kHz SCS and on slot 74 for 120kHz SCS.

6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

8. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction for each component carrier in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3A.3.1.1.5-1. EIRP test procedure is defined in Annex K. The period of the measurement shall be the slot prior to the PUSCH transmission, excluding a transient period of 5 µs in the end of the slot and any DL periods. EIRP is calculated considering both polarizations, theta and phi.

9. For UE transmission ON power, measure UE EIRP in the Tx beam peak direction for each component carrier in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3A.3.1.1.5-2. EIRP test procedure is defined in Annex K. The period of the measurement shall be one slot with PUSCH transmission. EIRP is calculated considering both polarizations, theta and phi. For TDD slots with transient periods are not under test.

10. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction for each component carrier in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3A.3.1.1.5-1. EIRP test procedure is defined in Annex K. The period of the measurement shall be the slot following the PUSCH transmission, excluding a transient period of 5 µs at the beginning of the slot and any DL periods. EIRP is calculated considering both polarizations, theta and phi.

11. SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

12. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.3A.3.1.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.3A.3.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] clause 4.6 with the following exceptions:

Table 6.3A.3.1.1.4.3-1: *PUSCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -106 |  |  |
| } |  |  |  |

6.3A.3.1.1.5 Test requirements

The requirement for the power measured in steps 7, 8 and 9 of the test procedure shall not exceed the values specified in Table 6.3A.3.1.1.5-1 and Table 6.3A.3.1.1.5-2.

Table 6.3A.3.1.1.5-1: Test requirement of OFF power of General ON/OFF time mask for 2UL CA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel bandwidth / minimum output power / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Transmit OFF power | ≤ -30+TT dBm | | | |
| Transmission OFF Measurement bandwidth | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |

Table 6.3A.3.1.1.5-2: Test requirement of ON power of General ON/OFF time mask for 2UL CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / minimum output power / measurement bandwidth | | | |
|  | [kHz] | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Transmission ON | 60 | FFS | FFS | FFS | FFS |
| Measured power for CP-OFDM | 120 | FFS | FFS | FFS | FFS |
| Expected Transmission ON | 60 | FFS | FFS | FFS | FFS |
| Measured power for DFT-s-OFDM | 120 | FFS | FFS | FFS | FFS |

Table 6.3A.3.1.1.5-3: Test Tolerance for OFF power

FFS

Table 6.3A.3.1.1.5-4: Test Tolerance for ON power

FFS

##### 6.3A.3.1.2 General ON/OFF time mask for CA (3UL CA)

FFS

##### 6.3A.3.1.3 General ON/OFF time mask for CA (4UL CA)

FFS

##### 6.3A.3.1.4 General ON/OFF time mask for CA (5UL CA)

FFS

##### 6.3A.3.1.5 General ON/OFF time mask for CA (6UL CA)

FFS

##### 6.3A.3.1.6 General ON/OFF time mask for CA (7UL CA)

FFS

##### 6.3A.3.1.7 General ON/OFF time mask for CA (8UL CA)

FFS

### 6.3A.4 Power control for CA

#### 6.3A.4.1 General

The requirements in this section apply to a UE when it has at least one of UL or DL configured for CA operation. The requirements on power control accuracy in CA operation apply under normal conditions and are defined as a directional requirement. The requirements are verified in beam locked mode on beam peak direction. The requirements apply for one single PUCCH, PUSCH or SRS transmission of contiguous PRB allocation per configured UL CC with power setting in accordance with Clause 7.1 of TS 38.213 [22].

#### 6.3A.4.2 Absolute power tolerance for CA

##### 6.3A.4.2.0 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 at the start of a contiguous transmission or non-contiguous transmission with a transmission gap on each active component carriers larger than 20 ms. For SRS switching, the absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap on component carriers (to which SRS switching occurs) larger than 20 ms. The requirement can be tested by time aligning any transmission gaps on the component carriers. For intra-band contiguous CA, the absolute power control tolerance per configured UL CC is given in Tables 6.3.4.2.3-1 and 6.3.4.2.3-2.

##### 6.3A.4.2.1 Absolute power tolerance for CA (2UL CA)

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

* Measurement Uncertainty and Test Tolerances are FFS.
* TP analysis is FFS.
* UE transmitted power for PC 1, 2 and 4 are FFS
* The UPLF test mode is applicable to UEs Release 16 and forward. This test case is incomplete for Release 15 until UE PHR method is used to prevent SCell drop.

6.3A.4.2.1.1 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.

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 20 ms.

6.3A.4.2.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 2UL CA.

6.3A.4.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.2.0.

6.3A.4.2.1.4 Test description

6.3A.4.2.1.4.1 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 bandwidth and subcarrier spacing based on NR CA configurations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA combination and subcarrier spacing, are shown in Table 6.3A.4.2.1.4.1-1. 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 6.3A.4.2.1.4.1-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.

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

4. The UL Reference Measurement Channel is set according to Table 6.3A.4.2.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.3A.4.2.1.4.3.

6.3A.4.2.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2, and C.3 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.3A.4.2.1.4.3.

3. Apply the test step based on the 5G NR UE Release:

3a. For Release 16 and forward 5G NR UEs: SS applies a backoff on the PCell powerby activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using TOTAL NR AGGREGATED BANDWIDTH and PCELL NR bandwidth as per Test CC Combination setting. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

3b. For Release 15 5G NR UEs: Test Procedure updates to keep SCell active are FFS. Skip remaining steps.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause9.2).

5. SS sends uplink scheduling information via PDCCH DCI format 0\_1 with TPC command 0dB for C\_RNTI to schedule the UL RMC according to Table 6.3A.4.2.1.4.1-1 on PCC and SCC(s). Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Configure the UE transmitted output power to test point 1 in section 6.3A.4.2.1.4.3. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

9. Measure UE EIRP of the first subframe of each component carrier in the Tx beam peak direction in the measurement bandwidth specified in Table 6.3A.4.2.1.5-1 through Table 6.3A.4.2.1.5-3 for the specific channel bandwidth under test. EIRP test procedure is defined in Annex K. The measuring duration is one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi. For TDD slots with transient periods are not under test.

10. SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

12. Repeat test steps 1~11 for measurement for test point 2~3. The timing of the execution between each test point shall be larger than 20ms.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3A.4.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config and with following exceptions:

Table 6.3A.4.2.1.4.3-1: PUSCH-ConfigCommon (Test point 1) for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -116 |  | 50MHz |
|  | -120 |  | 100MHz |
|  | -122 |  | 200MHz |
|  | -126 |  | 400MHz |
| } |  |  |  |

Table 6.3A.4.2.1.4.3-2: PUSCH-ConfigCommon (Test point 2) for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4. 6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -112 |  | 50MHz |
|  | -116 |  | 100MHz |
|  | -118 |  | 200MHz |
|  | -122 |  | 400MHz |
| } |  |  |  |

Table 6.3A.4.2.1.4.3-3: PUSCH-ConfigCommon (Test point 3) for power class 3

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4. 6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -102 |  | 50MHz |
|  | -106 |  | 100MHz |
|  | -108 |  | 200MHz |
|  | -112 |  | 400MHz |
| } |  |  |  |

Table 6.3A.4.2.1.4.3-5: ServingCellConfigCommon

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1[5], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| ss-PBCH-BlockPower | 4 |  | SCS\_120kHz |
|  | 7 |  | SCS\_240kHz |
| } |  |  |  |

|  |  |
| --- | --- |
| **Condition** | **Explanation** |
| SCS\_120kHz | SCS=120kHz for SS/PBCH block |
| SCS\_240kHz | SCS=240kHz for SS/PBCH block |

Table 6.3A.4.2.1.4.3-6: PUSCH-PowerControl

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-120 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-PowerControl ::= SEQUENCE { |  |  |  |
| tpc-Accumulation | disabled |  |  |
| p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE { | 1 entry |  |  |
| P0-PUSCH-AlphaSet[1] SEQUENCE { |  |  |  |
| alpha | alpha1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.3A.4.2.1.5 Test requirement

The measured EIRP in step 8 and 10 shall not to exceed the values specified in Table 6.3A.4.2.1.5-1 through 6.3A.4.2.1.5-3.

Table 6.3A.4.2.1.5-1: Test Requirements of Absolute power tolerance (Test point 1) for power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 8.1 | 7.1 | 8.1 | N/A |
| power | 120kHz | 8.1 | 7.1 | 8.1 | 7.1 |
| Power tolerance | | ± (14+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.1.5-4. | | | | | |

Table 6.3A.4.2.1.5-2: Test Requirements of Absolute power tolerance (Test point 2) for power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 12.1 | 11.1 | 12.1 | N/A |
| power | 120kHz | 12.1 | 11.1 | 12.1 | 11.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.1.5-5. | | | | | |

Table 6.3A.4.2.1.5-3: Test Requirements of Absolute power tolerance (Test point 3) for power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 22.1 | 21.1 | 22.1 | N/A |
| power | 120kHz | 22.1 | 21.1 | 22.1 | 21.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.1.5-5. | | | | | |

Table 6.3A.4.2.1.5-4: Test Tolerance (Test point 1) for power class 3

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

Table 6.3A.4.2.1.5-5: Test Tolerance (Test point 2 and Test point 3) for power class 3

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | [FFS] dB | [FFS] dB |

##### 6.3A.4.2.2 Absolute power tolerance for CA (3UL CA)

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

* Measurement Uncertainty and Test Tolerances are FFS.
* TP analysis is FFS.
* UE transmitted power for PC 1, 2 and 4 are FFS

6.3A.4.2.2.1 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.

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 20 ms.

6.3A.4.2.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 3UL CA.

6.3A.4.2.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.2.0.

6.3A.4.2.2.4 Test description

Same as in clause 6.3A.4.2.1.4with the following exceptions:

- Instead of Table 6.3A.4.2.1.4.1-1🡪 use Table 6.3A.4.2.2.4-1.

- Instead of Table 6.3A.4.2.1.5-1 through 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.2.5-1 and 6.3A.4.2.2.5-3.

Table 6.3A.4.2.2.4-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.2.2.5 Test requirement

Same as in clause 6.3A.4.2.1.5 with the following exceptions:

- Instead of Table 6.3A.4.2.1.5-1 🡪 use Table 6.3A.4.2.2.5-1.

- Instead of Table 6.3A.4.2.1.5-2 🡪 use Table 6.3A.4.2.2.5-2.

- Instead of Table 6.3A.4.2.1.5-3 🡪 use Table 6.3A.4.2.2.5-3.

- Instead of Table 6.3A.4.2.1.5-4 🡪 use Table 6.3A.4.2.2.5-4.

- Instead of Table 6.3A.4.2.1.5-5 🡪 use Table 6.3A.4.2.2.5-5.

Table 6.3A.4.2.2.5-1: Test Requirements of Absolute power tolerance (Test point 1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 8.1 | 7.1 | 8.1 | N/A |
| power | 120kHz | 8.1 | 7.1 | 8.1 | 7.1 |
| Power tolerance | | ± (14+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.2.5-4. | | | | | |

Table 6.3A.4.2.2.5-2: Test Requirements of Absolute power tolerance (Test point 2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 12.1 | 11.1 | 12.1 | N/A |
| power | 120kHz | 12.1 | 11.1 | 12.1 | 11.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.2.5-5. | | | | | |

Table 6.3A.4.2.2.5-3: Test Requirements of Absolute power tolerance (Test point 3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 22.1 | 21.1 | 22.1 | N/A |
| power | 120kHz | 22.1 | 21.1 | 22.1 | 21.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.2.5-5. | | | | | |

Table 6.3A.4.2.2.5-4: Test Tolerance (Test point 1)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

Table 6.3A.4.2.2.5-5: Test Tolerance (Test point 2 and Test point 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

##### 6.3A.4.2.3 Absolute power tolerance for CA (4UL CA)

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

* Measurement Uncertainty and Test Tolerances are FFS.
* TP analysis is FFS.
* UE transmitted power for PC 1, 2 and 4 are FFS

6.3A.4.2.3.1 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.

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 20 ms.

6.3A.4.2.3.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 4UL CA.

6.3A.4.2.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.2.0.

6.3A.4.2.3.4 Test description

Same as in clause 6.3A.4.2.1.4with the following exceptions:

- Instead of Table 6.3A.4.2.1.4.1-1🡪 use Table 6.3A.4.2.3.4-1.

- Instead of Table 6.3A.4.2.1.5-1 through 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.3.5-1 and 6.3A.4.2.3.5-3.

Table 6.3A.4.2.3.4-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation  (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.2.3.5 Test requirement

Same as in clause 6.3A.4.2.1.5 with the following exceptions:

- Instead of Table 6.3S.4.2.1.5-1🡪 use Table 6.3A.4.2.3.5-1.

- Instead of Table 6.3S.4.2.1.5-2🡪 use Table 6.3A.4.2.3.5-2.

- Instead of Table 6.3S.4.2.1.5-3🡪 use Table 6.3A.4.2.3.5-3.

- Instead of Table 6.3A.4.2.1.5-4🡪 use Table 6.3A.4.2.3.5-4.

- Instead of Table 6.3A.4.2.1.5-5 🡪 use Table 6.3A.4.2.3.5-5.

Table 6.3A.4.2.3.5-1: Test Requirements of Absolute power tolerance (Test point 1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 8.1 | 7.1 | 8.1 | N/A |
| power | 120kHz | 8.1 | 7.1 | 8.1 | 7.1 |
| Power tolerance | | ± (14+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.3.5-4. | | | | | |

Table 6.3A.4.2.3.5-2: Test Requirements of Absolute power tolerance (Test point 2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 12.1 | 11.1 | 12.1 | N/A |
| power | 120kHz | 12.1 | 11.1 | 12.1 | 11.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.3.5-5. | | | | | |

Table 6.3A.4.2.3.5-3: Test Requirements of Absolute power tolerance (Test point 3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 22.1 | 21.1 | 22.1 | N/A |
| power | 120kHz | 22.1 | 21.1 | 22.1 | 21.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.3.5-5. | | | | | |

Table 6.3A.4.2.3.5-4: Test Tolerance (Test point 1)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

Table 6.3A.4.2.3.5-5: Test Tolerance (Test point 2 and Test point 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

##### 6.3A.4.2.4 Absolute power tolerance for CA (5UL CA)

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

* Measurement Uncertainty and Test Tolerances are FFS.
* TP analysis is FFS.
* UE transmitted power for PC 1, 2 and 4 are FFS

6.3A.4.2.4.1 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.

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 20 ms.

6.3A.4.2.4.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 5UL CA.

6.3A.4.2.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.2.0.

6.3A.4.2.4.4 Test description

Same as in clause 6.3A.4.2.1.4 with the following exceptions:

- Instead of Table 6.3A.4.2.1.4.1-1🡪 use Table 6.3A.4.2.4.4-1.

- Instead of Table 6.3A.4.2.1.5-1 through 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.4.5-1 and 6.3A.4.2.4.5-3.

Table 6.3A.4.2.4.4-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation  (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC4 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.2.4.5 Test requirement

Same as in clause 6.3A.4.2.1.5 with the following exceptions:

- Instead of Table 6.3A.4.2.1.5-1🡪 use Table 6.3A.4.2.4.5-1.

- Instead of Table 6.3A.4.2.1.5-2🡪 use Table 6.3A.4.2.4.5-2.

- Instead of Table 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.4.5-3.

- Instead of Table 6.3A.4.2.1.5-4🡪 use Table 6.3A.4.2.4.5-4.

- Instead of Table 6.3A.4.2.1.5-5 🡪 use Table 6.3A.4.2.4.5-5.

Table 6.3A.4.2.4.5-1: Test Requirements of Absolute power tolerance (Test point 1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 8.1 | 7.1 | 8.1 | N/A |
| power | 120kHz | 8.1 | 7.1 | 8.1 | 7.1 |
| Power tolerance | | ± (14+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.4.5-4. | | | | | |

Table 6.3A.4.2.4.5-2: Test Requirements of Absolute power tolerance (Test point 2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 12.1 | 11.1 | 12.1 | N/A |
| power | 120kHz | 12.1 | 11.1 | 12.1 | 11.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.4.5-5. | | | | | |

Table 6.3A.4.2.4.5-3: Test Requirements of Absolute power tolerance (Test point 3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 22.1 | 21.1 | 22.1 | N/A |
| power | 120kHz | 22.1 | 21.1 | 22.1 | 21.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.4.5-5. | | | | | |

Table 6.3A.4.2.4.5-4: Test Tolerance (Test point 1)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

Table 6.3A.4.2.4.5-5: Test Tolerance (Test point 2 and Test point 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

##### 6.3A.4.2.5 Absolute power tolerance for CA (6UL CA)

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

* Measurement Uncertainty and Test Tolerances are FFS.
* TP analysis is FFS.
* UE transmitted power for PC 1, 2 and 4 are FFS

6.3A.4.2.5.1 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.

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 20 ms.

6.3A.4.2.5.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 6UL CA.

6.3A.4.2.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.2.0.

6.3A.4.2.5.4 Test description

Same as in clause 6.3A.4.2.1.4with the following exceptions:

- Instead of Table 6.3A.4.2.1.4.1-1🡪 use Table 6.3A.4.2.5.4-1.

- Instead of Table 6.3A.4.2.1.5-1 through 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.5.5-1 and 6.3A.4.2.5.5-3.

Table 6.3A.4.2.5.4-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation  (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC4 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC5 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.2.5.5 Test requirement

Same as in clause 6.3A.4.2.1.5 with the following exceptions:

- Instead of Table 6.3A.4.2.1.5-1🡪 use Table 6.3A.4.2.5.5-1.

- Instead of Table 6.3A.4.2.1.5-2🡪 use Table 6.3A.4.2.5.5-2.

- Instead of Table 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.5.5-3.

- Instead of Table 6.3A.4.2.1.5-4🡪 use Table 6.3A.4.2.5.5-4.

- Instead of Table 6.3A.4.2.1.5-5 🡪 use Table 6.3A.4.2.5.5-5.

Table 6.3A.4.2.5.5-1: Test Requirements of Absolute power tolerance (Test point 1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 8.1 | 7.1 | 8.1 | N/A |
| power | 120kHz | 8.1 | 7.1 | 8.1 | 7.1 |
| Power tolerance | | ± (14+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.5.5-4. | | | | | |

Table 6.3A.4.2.5.5-2: Test Requirements of Absolute power tolerance (Test point 2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 12.1 | 11.1 | 12.1 | N/A |
| power | 120kHz | 12.1 | 11.1 | 12.1 | 11.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.5.5-5. | | | | | |

Table 6.3A.4.2.5.5-3: Test Requirements of Absolute power tolerance (Test point 3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 22.1 | 21.1 | 22.1 | N/A |
| power | 120kHz | 22.1 | 21.1 | 22.1 | 21.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.5.5-5. | | | | | |

Table 6.3A.4.2.5.5-4: Test Tolerance (Test point 1 and Test point 2)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

Table 6.3A.4.2.5.5-5: Test Tolerance (Test point 2 and Test point 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

##### 6.3A.4.2.6 Absolute power tolerance for CA (7UL CA)

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

* Measurement Uncertainty and Test Tolerances are FFS.
* TP analysis is FFS.
* UE transmitted power for PC 1, 2 and 4 are FFS

6.3A.4.2.6.1 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.

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 20 ms.

6.3A.4.2.6.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 7UL CA.

6.3A.4.2.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.2.0.

6.3A.4.2.6.4 Test description

Same as in clause 6.3A.4.2.1.4 with the following exceptions:

- Instead of Table 6.3A.4.2.1.4.1-1🡪 use Table 6.3A.4.2.6.4-1.

- Instead of Table 6.3A.4.2.1.5-1 through 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.6.5-1 and 6.3A.4.2.6.5-3.

Table 6.3A.4.2.6.4-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation  (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC4 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC5 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC6 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.2.6.5 Test requirement

Same as in clause 6.3A.4.2.1.5 with the following exceptions:

- Instead of Table 6.3A.4.2.1.5-1🡪 use Table 6.3A.4.2.6.5-1.

- Instead of Table 6.3A.4.2.1.5-2🡪 use Table 6.3A.4.2.6.5-2.

- Instead of Table 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.6.5-3.

- Instead of Table 6.3A.4.2.1.5-4🡪 use Table 6.3A.4.2.6.5-4.

- Instead of Table 6.3A.4.2.1.5-5 🡪 use Table 6.3A.4.2.6.5-5.

Table 6.3A.4.2.6.5-1: Test Requirements of Absolute power tolerance (Test point 1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 7.1 | 8.1 | 7.1 | N/A |
| power | 120kHz | 7.1 | 8.1 | 7.1 | 8.1 |
| Power tolerance | | ± (14+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.6.5-4. | | | | | |

Table 6.3A.4.2.6.5-2: Test Requirements of Absolute power tolerance (Test point 2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 12.1 | 11.1 | 12.1 | N/A |
| power | 120kHz | 12.1 | 11.1 | 12.1 | 11.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.6.5-5. | | | | | |

Table 6.3A.4.2.6.5-3: Test Requirements of Absolute power tolerance (Test point 3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 22.1 | 21.1 | 22.1 | N/A |
| power | 120kHz | 22.1 | 21.1 | 22.1 | 21.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.6.5-5. | | | | | |

Table 6.3A.4.2.6.5-4: Test Tolerance (Test point 1)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

Table 6.3A.4.2.6.5-5: Test Tolerance (Test point 2 and Test point 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

##### 6.3A.4.2.7 Absolute power tolerance for CA (8UL CA)

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

* Measurement Uncertainty and Test Tolerances are FFS.
* TP analysis is FFS.
* UE transmitted power for PC 1, 2 and 4 are FFS

6.3A.4.2.7.1 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.

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 20 ms.

6.3A.4.2.7.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 8UL CA.

6.3A.4.2.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.2.0.

6.3A.4.2.7.4 Test description

Same as in clause 6.3A.4.2.1.4 with the following exceptions:

- Instead of Table 6.3A.4.2.1.4.1-1🡪 use Table 6.3A.4.2.7.4-1.

- Instead of Table 6.3A.4.2.1.5-1 through 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.7.5-1 and 6.3A.4.2.7.5-3.

Table 6.3A.4.2.7.4-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation  (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Outer\_Full |
| SCC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC2 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC3 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC4 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC5 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC6 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC7 | DFT-s-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.2.7.5 Test requirement

Same as in clause 6.3A.4.2.1.5 with the following exceptions:

- Instead of Table 6.3A.4.2.1.5-1🡪 use Table 6.3A.4.2.7.5-1.

- Instead of Table 6.3A.4.2.1.5-2🡪 use Table 6.3A.4.2.7.5-2.

- Instead of Table 6.3A.4.2.1.5-3🡪 use Table 6.3A.4.2.7.5-3.

- Instead of Table 6.3A.4.2.1.5-4🡪 use Table 6.3A.4.2.7.5-4.

- Instead of Table 6.3A.4.2.1.5-5 🡪 use Table 6.3A.4.2.7.5-5.

Table 6.3A.4.2.7.5-1: Test Requirements of Absolute power tolerance (Test point 1)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 8.1 | 7.1 | 8.1 | N/A |
| power | 120kHz | 8.1 | 7.1 | 8.1 | 7.1 |
| Power tolerance | | ± (14+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.7.5-4. | | | | | |

Table 6.3A.4.2.7.5-2: Test Requirements of Absolute power tolerance (Test point 2)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 12.1 | 11.1 | 12.1 | N/A |
| power | 120kHz | 12.1 | 11.1 | 12.1 | 11.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.7.5-5. | | | | | |

Table 6.3A.4.2.7.5-3: Test Requirements of Absolute power tolerance (Test point 3)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / expected output power (dBm) | | | |
|  |  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Measured | 60kHz | 22.1 | 21.1 | 22.1 | N/A |
| power | 120kHz | 22.1 | 21.1 | 22.1 | 21.1 |
| Power tolerance | | ± (12+TT) dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3A.1, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2A.1.  Note 2: TT for each frequency and channel bandwidth is specified in Table 6.3A.4.2.7.5-5. | | | | | |

Table 6.3A.4.2.7.5-4: Test Tolerance (Test point 1)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

Table 6.3A.4.2.7.5-5: Test Tolerance (Test point 2 and Test point 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Max device size ≤ 30 cm) | [FFS] dB | [FFS] dB |

#### 6.3A.4.3 Relative power tolerance for CA

##### 6.3A.4.3.0 Minimum conformance requirements

FFS

##### 6.3A.4.3.1 Relative power tolerance for CA (2UL CA)

FFS

##### 6.3A.4.3.2 Relative power tolerance for CA (3UL CA)

FFS

##### 6.3A.4.3.3 Relative power tolerance for CA (4UL CA)

FFS

##### 6.3A.4.3.4 Relative power tolerance for CA (5UL CA)

FFS

##### 6.3A.4.3.5 Relative power tolerance for CA (6UL CA)

FFS

##### 6.3A.4.3.6 Relative power tolerance for CA (7UL CA)

FFS

##### 6.3A.4.3.7 Relative power tolerance for CA (8UL CA)

FFS

#### 6.3A.4.4 Aggregate power tolerance for CA

##### 6.3A.4.4.0 Minimum conformance requirements

The aggregate power control tolerance is the ability of the UE transmitter to maintain its power during non-contiguous transmissions within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission and all other power control parameters as specified in TS 38.213 [22] kept constant.

For intra-band contiguous CA, the aggregate power tolerance per CC is given in Tables 6.3.4.4.3-1 and 6.3.4.4.3-2, with simultaneous PUSCH configured. The average PSDs over each assigned CC shall be aligned before the start of the test. The requirement can be tested with the transmission gaps time aligned between component carriers.

##### 6.3A.4.4.1 Aggregate power tolerance for CA (2UL CA)

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

- Measurement Uncertainty and Test Tolerances are FFS.

- UE transmitted power for PC 1, 2 and 4 are FFS.

- Power window is FFS.

- How to ensure equal PSD between component carriers is FFS.

- The UPLF test mode is applicable to UEs Release 16 and forward. This test case is incomplete for Release 15 until UE PHR method is used to prevent SCell drop.

6.3A.4.4.1.1 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 TS 38.213 [22] kept constant.

6.3A.4.4.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 2UL CA.

6.3A.4.4.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.4.0.

6.3A.4.4.1.4 Test description

6.3A.4.4.1.4.1 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 bandwidth and subcarrier spacing based on NR CA configurations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA combination and subcarrier spacing, are shown in Table 6.3A.4.4.1.4.1-1. 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 6.3A.4.4.1.4.1-1: Test Configuration Table: PUSCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Mid range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC | DFT-s-OFDM QPSK | Inner\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.

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

4. The UL Reference Measurement Channel is set according to Table 6.3A.4.4.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.3A.4.4.1.4.3.

6.3A.4.4.1.4.2 Test procedure

The procedure is only to verify PUSCH aggregate power control tolerance. The uplink transmission patterns are described in Figure 6.3.4.4.4.2-1.

1. Configure SCC according to Annex C.0, C.1, C.2, and C.3 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.3A.4.4.1.4.3.

3. Apply the test step based on the 5G NR UE Release:

3a. For Release 16 and forward 5G NR UEs: SS applies a backoff on the PCell powerby activating the UE Power Limit Function (UPLF). The ACTIVATE POWER LIMIT REQUEST procedure is performed as specified in TS 38.508-1 [10] clause 4.9.32 using TOTAL NR AGGREGATED BANDWIDTH and PCELL NR bandwidth as per Test CC Combination setting. UE shall transmit ACTIVATE POWER LIMIT RESPONSE to SS. Go to step 4.

3b. For Release 15 5G NR UEs: Test Procedure updates to keep SCell active are FFS. Skip remaining steps.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clause 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133 [25], clause 9.2).

5. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

6. The SS sends uplink scheduling information via PDCCH DCI format 0\_1 for C\_RNTI to schedule the PUSCH on PCC and SCC according to Table 6.3A.4.4.1.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. 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 PW of the target power level specified in Table 6.3.4.4.4.2-1 according to the power class with power ID = 1. PW is the power window according to Table 6.3.4.4.4.2-2 for the carrier frequency f and the channel bandwidth BW. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

8. Every 10 sub-frames (10ms) 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 6.3.4.4.4.2-1.

9. Measure the UE EIRP of 3 consecutive PUSCH transmissions on each component carrier in the Tx beam peak direction of in the measurement bandwidth specified in Table 6.3A.1.1.5-1 and Table 6.3A.1.1.5-2 to verify the UE transmitted PUSCH power is maintained within 21ms. EIRP test procedure is defined in Annex K. EIRP is calculated considering both polarizations, theta and phi. For TDD slots with transient periods are not under test.

10. SS deactivates the UE Power Limit Function (UPLF) by performing the DEACTIVATE POWER LIMIT REQUEST procedure as specified in TS 38.508-1 [10] clause 4.9.33.

11. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

12. Repeat test step 4 to 11 for measurement for power ID = 2 in Table 6.3.4.4.4.2-1.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3A.4.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.3A.4.4.1.5 Test requirement

The requirement for the power measurements made in step 8 of the test procedure shall not exceed the values specified in Table 6.3A.4.4.1.5-1 and Table 6.3A.4.4.1.5-2. The power measurement period shall be 1 sub-frame (1ms).

Table 6.3A.4.4.1.5-1: Power control tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(5.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.1.5-3. | | |

Table 6.3A.4.4.1.5-2: Power control tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(3.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.1.5-4. | | |

Table 6.3A.4.4.1.5-3: Test Tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

Table 6.3A.4.4.1.5-4: Test Tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

##### 6.3A.4.4.2 Aggregate power tolerance for CA (3UL CA)

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

Measurement Uncertainty and Test Tolerances are FFS.

UE transmitted power for PC 1, 2 and 4 are FFS.

Power window is FFS.

How to ensure equal PSD between component carriers is FFS.

6.3A.4.4.2.1 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 TS 38.213 [22] kept constant.

6.3A.4.4.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 3UL CA.

6.3A.4.4.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.4.0.

6.3A.4.4.2.4 Test description

Same as in clause 6.3A.4.4.1.4 with the following exceptions:

- Instead of Table 6.3A.4.4.1.4.1-1🡪 use Table 6.3A.4.4.2.4-1.

Table 6.3A.4.4.2.4-1: Test Configuration Table: PUSCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Mid range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC1 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC2 | DFT-s-OFDM QPSK | Inner\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier*". | | | | | | |

6.3A.4.4.2.5 Test requirement

The requirement for the power measurements made in step 8 of the test procedure shall not exceed the values specified in Table 6.3A.4.4.2.5-1 and Table 6.3A.4.4.2.5-2. The power measurement period shall be 1 sub-frame (1ms).

Table 6.3A.4.4.2.5-1: Power control tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(5.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.2.5-3. | | |

Table 6.3A.4.4.2.5-2: Power control tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(3.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.2.5-4. | | |

Table 6.3A.4.4.2.5-3: Test Tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

Table 6.3A.4.4.2.5-4: Test Tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

##### 6.3A.4.4.3 Aggregate power tolerance for CA (4UL CA)

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

Measurement Uncertainty and Test Tolerances are FFS.

UE transmitted power for PC 1, 2 and 4 are FFS.

Power window is FFS.

How to ensure equal PSD between component carriers is FFS.

6.3A.4.4.3.1 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 TS 38.213 [22] kept constant.

6.3A.4.4.3.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 4UL CA.

6.3A.4.4.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.4.0.

6.3A.4.4.3.4 Test description

Same as in clause 6.3A.4.4.1.4 with the following exceptions:

- Instead of Table 6.3A.4.4.1.4.1-1🡪 use Table 6.3A.4.4.3.4-1.

Table 6.3A.4.4.3.4-1: Test Configuration Table: PUSCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Mid range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC1 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC2 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC3 | DFT-s-OFDM QPSK | Inner\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier*". | | | | | | |

6.3A.4.4.3.5 Test requirement

The requirement for the power measurements made in step 8 of the test procedure shall not exceed the values specified in Table 6.3A.4.4.3.5-1 and Table 6.3A.4.4.3.5-2. The power measurement period shall be 1 sub-frame (1ms).

Table 6.3A.4.4.3.5-1: Power control tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(5.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.3.5-3. | | |

Table 6.3A.4.4.3.5-2: Power control tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(3.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.3.5-4. | | |

Table 6.3A.4.4.3.5-3: Test Tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

Table 6.3A.4.4.3.5-4: Test Tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

##### 6.3A.4.4.4 Aggregate power tolerance for CA (5UL CA)

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

Measurement Uncertainty and Test Tolerances are FFS.

UE transmitted power for PC 1, 2 and 4 are FFS.

Power window is FFS.

How to ensure equal PSD between component carriers is FFS.

6.3A.4.4.4.1 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 TS 38.213 [22] kept constant.

6.3A.4.4.4.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 5UL CA.

6.3A.4.4.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.4.0.

6.3A.4.4.4.4 Test description

Same as in clause 6.3A.4.4.1.4 with the following exceptions:

- Instead of Table 6.3A.4.4.1.4.1-1🡪 use Table 6.3A.4.4.4.4-1.

Table 6.3A.4.4.4.4-1: Test Configuration Table: PUSCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Mid range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC1 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC2 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC3 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC4 | DFT-s-OFDM QPSK | Inner\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.4.4.5 Test requirement

The requirement for the power measurements made in step 8 of the test procedure shall not exceed the values specified in Table 6.3A.4.4.4.5-1 and Table 6.3A.4.4.4.5-2. The power measurement period shall be 1 sub-frame (1ms).

Table 6.3A.4.4.4.5-1: Power control tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(5.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.4.5-3. | | |

Table 6.3A.4.4.4.5-2: Power control tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(3.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.4.5-4. | | |

Table 6.3A.4.4.4.5-3: Test Tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

Table 6.3A.4.4.4.5-4: Test Tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

##### 6.3A.4.4.5 Aggregate power tolerance for CA (6UL CA)

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

Measurement Uncertainty and Test Tolerances are FFS.

UE transmitted power for PC 1, 2 and 4 are FFS.

Power window is FFS.

How to ensure equal PSD between component carriers is FFS.

6.3A.4.4.5.1 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 TS 38.213 [22] kept constant.

6.3A.4.4.5.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 6UL CA.

6.3A.4.4.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.4.0.

6.3A.4.4.5.4 Test description

Same as in clause 6.3A.4.4.1.4 with the following exceptions:

- Instead of Table 6.3A.4.4.1.4.1-1🡪 use Table 6.3A.4.4.5.4-1.

Table 6.3A.4.4.5.4-1: Test Configuration Table: PUSCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Mid range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC1 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC2 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC3 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC4 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC5 | DFT-s-OFDM QPSK | Inner\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.4.5.5 Test requirement

The requirement for the power measurements made in step 8 of the test procedure shall not exceed the values specified in Table 6.3A.4.4.5.5-1 and Table 6.3A.4.4.5.5-2. The power measurement period shall be 1 sub-frame (1ms).

Table 6.3A.4.4.5.5-1: Power control tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(5.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.5.5-3. | | |

Table 6.3A.4.4.5.5-2: Power control tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(3.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.5.5-4. | | |

Table 6.3A.4.4.5.5-3: Test Tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

Table 6.3A.4.4.5.5-4: Test Tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

##### 6.3A.4.4.6 Aggregate power tolerance for CA (7UL CA)

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

Measurement Uncertainty and Test Tolerances are FFS.

UE transmitted power for PC 1, 2 and 4 are FFS.

Power window is FFS.

How to ensure equal PSD between component carriers is FFS.

6.3A.4.4.6.1 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 TS 38.213 [22] kept constant.

6.3A.4.4.6.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 7UL CA.

6.3A.4.4.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.4.0.

6.3A.4.4.6.4 Test description

Same as in clause 6.3A.4.4.1.4 with the following exceptions:

- Instead of Table 6.3A.4.4.1.4.1-1🡪 use Table 6.3A.4.4.6.4-1.

Table 6.3A.4.4.6.4-1: Test Configuration Table: PUSCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Mid range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC1 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC2 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC3 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC4 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC5 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC6 | DFT-s-OFDM QPSK | Inner\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.4.6.5 Test requirement

The requirement for the power measurements made in step 8 of the test procedure shall not exceed the values specified in Table 6.3A.4.4.6.5-1 and Table 6.3A.4.4.6.5-2. The power measurement period shall be 1 sub-frame (1ms).

Table 6.3A.4.4.6.5-1: Power control tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(5.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.6.5-3. | | |

Table 6.3A.4.4.6.5-2: Power control tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(3.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.6.5-4. | | |

Table 6.3A.4.4.6.5-3: Test Tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

Table 6.3A.4.4.6.5-4: Test Tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

##### 6.3A.4.4.7 Aggregate power tolerance for CA (8UL CA)

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

Measurement Uncertainty and Test Tolerances are FFS.

UE transmitted power for PC 1, 2 and 4 are FFS.

Power window is FFS.

How to ensure equal PSD between component carriers is FFS.

6.3A.4.4.7.1 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 TS 38.213 [22] kept constant.

6.3A.4.4.7.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that supports FR2 8UL CA.

6.3A.4.4.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.3A.4.4.0.

6.3A.4.4.7.4 Test description

Same as in clause 6.3A.4.4.1.4 with the following exceptions:

- Instead of Table 6.3A.4.4.1.4.1-1🡪 use Table 6.3A.4.4.7.4-1.

Table 6.3A.4.4.7.4-1: Test Configuration Table: PUSCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Mid range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Highest | | |
| Test Parameters | | | | | | |
| Test ID | CC | ChBw(MHz) | Test frequency | DL RB allocation | UL Modulation | UL RB allocation (Note 1) |
| 1 | PCC | Default | Default | - | DFT-s-OFDM QPSK | Inner\_Full |
| SCC1 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC2 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC3 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC4 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC5 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC6 | DFT-s-OFDM QPSK | Inner\_Full |
| SCC7 | DFT-s-OFDM QPSK | Inner\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.3A.4.4.7.5 Test requirement

The requirement for the power measurements made in step 8 of the test procedure shall not exceed the values specified in Table 6.3A.4.4.7.5-1 and Table 6.3A.4.4.7.5-2. The power measurement period shall be 1 sub-frame (1ms).

Table 6.3A.4.4.7.5-1: Power control tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(5.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.7.5-3. | | |

Table 6.3A.4.4.7.5-2: Power control tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| TPC command | UL channel | Test requirement measured power |
| 0 dB | PUSCH | Given 3 power measurements in the pattern, the 2nd, and later measurements shall be within ±(3.5dB+TT) of the 1st measurement. |
| Note 1: TT for each duplex, Sub-Carrier Spacing, frequency and channel bandwidth is specified in Table 6.3A.4.4.7.5-4. | | |

Table 6.3A.4.4.7.5-3: Test Tolerance (Pint ≥ P ≥ Pmin)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

Table 6.3A.4.4.7.5-4: Test Tolerance (Pmax ≥ P > Pint)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| IFF (Quiet Zone size ≤ 30 cm) | FFS | FFS |

## 6.3D Output power dynamics for UL MIMO

### 6.3D.0 General

The requirements in subclause 6.3D shall be met with configurations specified in sub-clause 6.2D.1.1.3.x, where ‘x’ depends on power class. Unless otherwise specified, the requirements shall be verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

### 6.3D.1 Minimum output power for UL MIMO

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

- Measurement Uncertainty and Test Tolerances are FFS for power classes other than 1, 3 and 5.

- The test case is incomplete for band n259.

6.3D.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.

6.3D.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.3D.1.3 Minimum conformance requirements

The minimum output power is defined as the mean power in at least one subframe (1ms). The minimum controlled output power is defined as the EIRP, i.e. the sum of the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the UE power is set to a minimum value.

6.3D.1.3.1 Minimum output power for UL MIMO for power class 1

For UE supporting UL MIMO, the minimum output power shall not exceed the sum of the values specified in Table 6.3.1.3.1-1 and the quantity 10\*log10(Number of Layers).

6.3D.1.3.2 Minimum output power for UL MIMO for power class 2, 3 and 4

For UE supporting UL MIMO, the minimum output power shall not exceed the values specified in Table 6.3.1.3.2-1 and the quantity 10\*log10(Number of Layers).

6.3D.1.3.3 Minimum output power for UL MIMO for power class 5 and 6

For UE supporting UL MIMO, the minimum controlled output power is defined as the EIRP, i.e. the sum of the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the UE power is set to a minimum value. The minimum output power shall not exceed the values specified in Table 6.3.1.3.3-1. The minimum power is verified in beam locked mode with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3D.1.

6.3D.1.4 Test description

6.3D.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 5.2-1. 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 6.3D.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 6.3D.1.4.1-1: Test Configuration Table

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 (NOTE 1) |
| 1 | CP-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] clause 4.4.3.

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

4. The UL Reference Measurement Channel is set according to Table 6.3D.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.3D.1.4.3.

6.3D.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 6.3D.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. The PDCCH DCI format 0\_1 is specified with the condition 2TX\_UL\_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

2. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power. If UE is disconnected, repeat the test case. Optionally, send continuously uplink power control “down” commands in every uplink scheduling information to the UE until the UE EIRP measured by the test system is at a level just before the UE was disconnected. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

5. Measure UE EIRP in the Tx beam peak direction in the measurement bandwidth specified in Table 6.3D.1.5-1 and Table 6.3D.1.5-2 for the specific channel bandwidth under test. EIRP test procedure is defined in Annex K. The measuring duration is at least one active uplink subframe. EIRP is calculated considering both polarizations, theta and phi. For TDD slots with transient periods are not under test.

6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3D.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO.

6.3D.1.5 Test requirement

The minimum EIRP, derived in step 5 shall not exceed the values specified in Table 6.3D.1.5-1 to Table 6.3D.1.5-3.

Table 6.3D.1.5-1: Minimum output power for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261 | 50 | 7+TT | 47.58 |
| 100 | 7+TT | 95.16 |
| 200 | 7+TT | 190.20 |
| 400 | 7+TT | 380.28 |

Table 6.3.1.5-1a: Test Tolerance Minimum output power for power class 1

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 3.79 dB | 4.09 dB |

Table 6.3D.1.5-2: Minimum output power for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Test Tolerance TT (dB) | Measurement bandwidth  (MHz) |
| n257, n258, n261 | 50 | -10+TT | 3.80 | 47.58 |
| 100 | -10+TT | 4.21 | 95.16 |
| 200 | -10+2.4+TT1 | 2.52 | 190.20 |
| 400 | -10+5.4+TT1 | 0.67 | 380.28 |
| n260 | 50 | -10+1.5+TT1 | 3.17 | 47.58 |
| 100 | -10+4.5+TT1 | 1.17 | 95.16 |
| 200 | -10+7.5+TT1 | 0 | 190.20 |
| 400 | -10+10.5+TT1 | 0 | 380.28 |
| n259 | 50 | -10+TBD+TT1 | TBD | 47.58 |
| 100 | -10+TBD+TT1 | TBD | 95.16 |
| 200 | -10+TBD+TT1 | TBD | 190.20 |
| 400 | -10+TBD+TT1 | TBD | 380.28 |
| NOTE 1: Core requirement cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement result = 1.0 dB (Minimum requirement + relaxation). | | | | |

Table 6.3D.1.5-2a: Minimum output power for power class 2 and 4

FFS

Table 6.3D.1.5-3: Minimum output power for power class 5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Test Tolerance TT (dB) | Measurement bandwidth  (MHz) |
| n257, n258 | 50 | -6+TT | 3.67 dB | 47.58 |
| 100 | -6+TT | 3.85 dB | 95.16 |
| 200 | -6+TT | 4.18 dB | 190.20 |
| 400 | -6+1.4+TT1 | 3.38 dB | 380.28 |
| NOTE 1: Core requirement cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement result = 1.0 dB (Minimum requirement + relaxation). | | | | |

**Table 6.3D.1.5-4: Minimum output power for power class 6**

FFS

### 6.3D.2 Transmit OFF power for UL MIMO

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

* Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2, 4, 5 and 6.
* The testability of this test case is pending further analysis on relaxation of the requirement for other than Band n257.
* Measurement grid for PC2/4 in Annex M.4 is TBD.

6.3D.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.

6.3D.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.3D.2.3 Minimum conformance requirements

For UE supporting UL MIMO, the transmit OFF power is defined as the TRP 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. During DTX and measurements gaps, the transmitter is not considered OFF. The minimum output power shall not exceed the values specified in Table 6.3.2.3-1. The requirement is verified with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3D.2.

6.3D.2.4 Test description

6.3D.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 6.3D.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 6.3D.2.4.1-1: Test Configuration Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Lowest | |
| 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 | **-** | **-** | **-** | **-** |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement Channels are set according to Table 6.3D.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 [10] clause 4.5. Message contents are defined in clause 6.3D.2.4.3.

6.3D.2.4.2 Test procedure

1. Set the UE in the Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE) for the UE Tx beam selection to complete.

2. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

3. Measure UE TRP for the assigned NR channel with a rectangular measurement filter with bandwidths according to Table 6.3D.2.5-1. Total radiated power is measured according to TRP measurement procedure defined in Annex K. TRP is calculated considering both polarizations, theta and phi.

NOTE: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3D.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO.

6.3D.2.5 Test requirement

The requirement for the transmit OFF power shall not exceed the values specified in Table 6.3D.2.5-1.

Table 6.3D.2.5-1: Transmit OFF power

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n2572 | -35+21.4 | -35+24.4 | -35+27.4 | -35+30.4 |
| 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| n258, n261 | -35+[21.4] | -35+[24.4] | -35+[27.4] | -35+[30.4] |
| 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| n260 | -35+[24.1] | -35+[27.1] | -35+[30.1] | -35+[33.1] |
| 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| NOTE 1: Core requirement cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement result = 1.0 dB (Minimum requirement + relaxation).  NOTE 2: Relaxed n257 test requirement is testable for PC3 and PC1. | | | | |

### 6.3D.3 Transmit ON/OFF time mask for UL MIMO

#### 6.3D.3.1 General ON/OFF time mask for UL MIMO

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

* Measurement Uncertainty and Test Tolerances are FFS.
* Test requirement of ON power is FFS.
* Testability of OFF power needs further study.
* OTA test procedure for UL-MIMO is still under investigation
* TP analysis is FFS.

6.3D.3.1.1 Test purpose

To verify that the general ON/OFF time mask meets the requirements given in 6.3D.3.1.5. Transmission of the wrong power increases interference to other channels, or increases transmission errors in the uplink channel.

6.3D.3.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward supporting UL MIMO.

6.3D.3.1.3 Minimum conformance requirements

For UE supporting UL MIMO, the ON/OFF time mask requirements in subclause 6.3.3 apply.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.3D.3.

6.3D.3.1.4 Test description

6.3D.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 6.3D.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 6.3D.3.1.4.1-1: Test Configuration Table

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 (NOTE 1) |
| 1 | CP-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement Channels are set according to Table 6.3D.3.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.3D.3.1.4.3.

6.3D.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 6.3D.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. The PDCCH DCI format 0\_1 is specified with the condition 2TX\_UL\_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

2. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE) for the UE Tx beam selection to complete.

3. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

4. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3D.3.1.5-1. EIRP test procedure is defined in Annex K. The period of the measurement shall be the slot prior to the PUSCH transmission, excluding a transient period of 5 µs in the end of the slot and any DL periods. EIRP is calculated considering both polarizations, theta and phi.

5. For UE transmission ON power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3D.3.1.5-2. EIRP test procedure is defined in Annex K. The period of the measurement shall be one slot with PUSCH transmission. EIRP is calculated considering both polarizations, theta and phi. For TDD slots with transient periods are not under test.

6. For UE transmission OFF power, measure UE EIRP in the Tx beam peak direction in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Table 6.3D.3.1.5-1. EIRP test procedure is defined in Annex K. The period of the measurement shall be the slot following the PUSCH transmission, excluding a transient period of 5 µs at the beginning of the slot and any DL periods. EIRP is calculated considering both polarizations, theta and phi.

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.3D.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO.

Table 6.3D.3.1.4.3-1: *PUSCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1[10], Table 4.6.3-119 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| p0-NominalWithGrant | -102 |  | 50MHz |
|  | -106 |  | 100MHz |
|  | -108 |  | 200MHz |
|  | -112 |  | 400MHz |
| } |  |  |  |

Table 6.3D.3.1.4.3-2: ServingCellConfigCommon

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.508-1[5], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| ss-PBCH-BlockPower | 4 |  | SCS\_120kHz |
|  | 7 |  | SCS\_240kHz |
| } |  |  |  |

|  |  |
| --- | --- |
| **Condition** | **Explanation** |
| SCS\_120kHz | SCS=120kHz for SS/PBCH block |
| SCS\_240kHz | SCS=240kHz for SS/PBCH block |

Table 6.3D.3.1.4.3-3: PUSCH-PowerControl

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-120 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUSCH-PowerControl ::= SEQUENCE { |  |  |  |
| tpc-Accumulation | disabled |  |  |
| p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF SEQUENCE { | 1 entry |  |  |
| P0-PUSCH-AlphaSet[1] SEQUENCE { |  |  |  |
| alpha | alpha1 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.3D.3.1.5 Test requirement

The requirement for the EIRP measured in steps 4, 5 and 6 of the test procedure shall not exceed the values specified in Table 6.3D.3.1.5-1 and 6.3D.3.1.5-2.

Table 6.3D.3.1.5-1: Test requirement of OFF power of General ON/OFF time mask for UL MIMO

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Channel bandwidth / minimum output power / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Transmit OFF power | ≤ -30+TT dBm | | | |
| Transmission OFF Measurement bandwidth | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |
| Note 1: Core requirements cannot be tested due to testability issue and test requirement includes relaxation to achieve impact from test system noise to measurement results = 1.0 dB (Minimum requirement + relaxation R).  Note 2: Relaxation R is specified in Table 6.3D.3.1.5-3. | | | | |

Table 6.3D.3.1.5-2: Test requirement of ON power of General ON/OFF time mask for UL MIMO

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | SCS | Channel bandwidth / measurement bandwidth | | | |
|  | [kHz] | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| Expected Transmission ON | 60 | 22.1 | 21.1 | 22.1 | N/A |
| power for DFT-s-OFDM | 120 | 22.1 | 21.1 | 22.1 | 21.1 |
| Power tolerance | | ± (14+TT)dB | | | |
| Note 1: The lower power limit shall not exceed the minimum output power requirements defined in sub-clause 6.3.2.3, and the higher power limit shall not exceed the Max EIRP defined in sub-clause 6.2.1.3. | | | | | |

Table 6.3D.3.1.5-3: Relaxation required for OFF power for PC3 UEs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n261 | [19.4] dB | [22.4] dB | [25.4] dB | [28.4] dB |
| n260 | [21.5] dB | [24.5] dB | [27.5] dB | [30.5] dB |

Table 6.3D.3.1.5-4: Test Tolerance for ON power

FFS

#### 6.3D.3.2 Void

#### 6.3D.3.3 Void

#### 6.3D.3.4 Void

## 6.4 Transmit signal quality

### 6.4.1 Frequency error

6.4.1.1 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.

6.4.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

6.4.1.3 Minimum conformance requirements

The UE basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of UE modulated carrier frequency shall be accurate to within ±0.1 PPM observed over a period of 1 msec of cumulated measurement intervals compared to the carrier frequency received from the NR gNB.

The frequency error is defined as a directional requirement. The requirement is verified in beam locked mode with the test metric of Frequency (Link=TX beam peak direction, Meas=Link angle).

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4.1

6.4.1.4 Test description

6.4.1.4.1 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 6.4.1.4.1-1. 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 6.4.1.4.1-1: Test Configuration Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | Mid range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The DL and UL Reference Measurement channels are set according to Table 6.4.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.4.1.4.3

6.4.1.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 6.4.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

3. 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 6.4.1.4.1-1. 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 UE in the Inband Tx beam peak direction and apply the associated polarization for the DL, both found with a 3D EIRP scan as performed in Annex K.1.1. Connect the SS (System Simulator) with the DUT through the measurement antenna with polarization reference PolLink to form the TX beam towards the TX beam peak direction and respective polarization. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. Send continuously uplink power control "up" commands to the UE in every uplink scheduling information to the UE so that the UE transmits at PUMAX level for the duration of the test. Allow at least 200ms starting from the first TPC Command for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

6. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

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

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with DFT-s-OFDM condition in Table 4.6.3-118 PUSCH-Config.

6.4.1.5 Test requirement

The 10 frequency error Δf results for the θ-polarization or the *10* frequency error Δf results for the φ-polarization must fulfil the test requirement:

|Δf| ≤ (0.1 PPM + 0.005 PPM),

### 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.

All the requirements in 6.4.2 are defined as directional requirement. The requirements are verified in beam locked mode on beam peak direction, with parameter *maxRank* (as defined in TS 38.331 [19]) set to 1. The requirements are applicable to UL transmission from each configurable antenna port (as defined in TS 38.331 [19]) of UE, enabled one at a time.

In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE (as defined in TS 38.331 [19]), 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

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

* Measurement Uncertainty and Test Tolerance are FFS except for PUSCH, PC1 in FR2a, PC3 in FR2a and FR2b.
* For a transition period until RAN#102 meeting (Dec 2023), the implementation of note 4 in Table 6.4.2.1.4.1-1 in test equipment is not applicable to avoid lack of test coverage until testcase 6.4.2.1\_1 is available.

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-clauses 6.4.2.4.3 and 6.4.2.5.3. 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 contain 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 UE release 15 and forward.

6.4.2.1.3 Minimum conformance requirements

The RMS average of the basic EVM measurements for the average EVM case, and 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 or Table 6.4.2.1.3-3 depending on UE power class. For EVM evaluation purposes, all 13 PRACH preamble formats and all 5 PUCCH formats are considered to have the same EVM requirement as QPSK modulated.

The measurement interval for the EVM determination is 10 subframes. The requirement is verified with the test metric of EVM (Link=TX beam peak direction, Meas=Link angle).

Table 6.4.2.1.3-1: Minimum requirements for error vector magnitude

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Average EVM level | Reference signal EVM level |
| Pi/2 BPSK | % | 30.0 | 30.0 |
| QPSK | % | 17.5 | 17.5 |
| 16 QAM | % | 12.5 | 12.5 |
| 64 QAM | % | 8.0 | 8.0 |

Table 6.4.2.1.3-2: Parameters for Error Vector Magnitude for power class 1

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| UE EIRP | dBm | ≥ 4 |
| UE EIRP for UL 16QAM | dBm | ≥ 7 |
| UE EIRP for UL 64QAM | dBm | ≥ 11 |
| Operating conditions |  | Normal conditions |

Table 6.4.2.1.3-3: Parameters for Error Vector Magnitude for power class 2, 3, and 4

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| UE EIRP | dBm | ≥ -13 |
| UE EIRP for UL 16QAM | dBm | ≥ -10 |
| UE EIRP for UL 64QAM | dBm | ≥ -6 |
| Operating conditions |  | Normal conditions |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4.2.1.

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 reference measurement channels (RMCs) are specified in Annex A.2. 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 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | Lowest, Highest | |
| Test SCS as specified in Table 5.3.5-1 | | Lowest, Highest | |
| Test Parameters | | | |
| Test ID | Downlink Configuration | Uplink Configuration | |
|  | - | Modulation | RB allocation (NOTE 1) |
| 1 |  | DFT-s-OFDM PI/2 BPSK | Inner\_Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| 2 |  | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| 3  (NOTE 4) |  | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| 4 |  | DFT-s-OFDM QPSK | Outer\_Full |
| 5 |  | DFT-s-OFDM 16 QAM | Inner\_Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| 6 |  | DFT-s-OFDM 16 QAM | Outer\_Full |
| 7 |  | DFT-s-OFDM 64 QAM | Inner\_Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| 8 |  | DFT-s-OFDM 64 QAM | Outer\_Full |
| 9 |  | CP-OFDM QPSK | Inner\_Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| 10 |  | CP-OFDM QPSK | Outer\_Full |
| 11 |  | CP-OFDM 16 QAM | Inner\_Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| 12 |  | CP-OFDM 16 QAM | Outer\_Full |
| 13 |  | CP-OFDM 64 QAM | Inner\_Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| 14 |  | CP-OFDM 64 QAM | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3, PC4 and PC7 or Table 6.1-2 for PC1.  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: The following test points are not testable for PC3 devices:  FR2a channel bandwidth 200MHz: test points 8, 13 and 14  FR2a channel bandwidth 400MHz: test points 7, 8, 11, 12, 13 and 14  FR2b channel bandwidth 50MHz: test points 13 and 14  FR2b channel bandwidth 100MHz: test points 7, 8, 13 and 14  FR2b channel bandwidth 200MHz: test points 7, 8, 13 and 14  FR2b channel bandwidth 400MHz: test points 5, 6, 7, 8, 11, 12, 13 and 14  NOTE 4: This test point shall be skipped if device supports mpr-PowerBoost-FR2-r16 UE capability. | | | |

Table 6.4.2.1.4.1-2: Test Configuration Table for PUCCH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | See Table 6.4.2.1.4.1-1 | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 |
| 1 | CP-OFDM QPSK | Full RB (Note 1) | CP-OFDM | PUCCH format = Format 1  Length in OFDM symbols = 14 |
| 2 | CP-OFDM QPSK | Full RB (Note 1) | DFT-s-OFDM | PUCCH format = Format 3  Length in OFDM symbols = 14 |
| 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. | | | | |

Table 6.4.2.1.4.1-3: Test Configuration for PRACH

|  |  |
| --- | --- |
| Initial Conditions | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | Normal |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | See Table 6.4.2.1.4.1-1 |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 |
| PRACH preamble format | |
| PRACH Configuration Index | 52 |
| SS/PBCH SSS EPRE setting (dBm/120kHz) | -96 |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

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. 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 [10] 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 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

1.2 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 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.

1.3 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.4 Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200 ms starting from the first TPC command in this step for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.5 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

1.6 Measure the EVMθ, EVMφ,  and using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. For TDD, only slots consisting of only UL symbols are under test. Calculate  and .

1.7 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4.2.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

Table 6.4.2.1.4.2-1: Void

Table 6.4.2.1.4.2-2: Void

Table 6.4.2.1.4.2-3: Void

Test procedure for PUCCH:

2.1 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2.2 PUCCH is set according to Table 6.4.2.1.4.1-2.

2.3 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.

2.4 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

2.5 SS send appropriate TPC commands for PUCCH to the UE until the UE transmit PUCCH at [PUMAX level]. Allow at least 200 ms starting from the first TPC command in this step for the UE to reach [PUMAX level]. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

2.6 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

2.7 Measure PUCCH EVMθ and PUCCH EVMφ using Global In-Channel Tx-Test (Annex E). Calculate .

2.8 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4.2.1.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

Test procedure for PRACH:

3.1 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

3.2 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1.

3.3 The SS shall set RS EPRE according to Table 6.4.2.1.4.1-3.

3.4 PRACH is set according to Table 6.4.2.1.4.1-3.

3.5 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.

3.6 The UE shall send the signalled preamble to the SS.

3.7 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.

3.8 The UE shall consider the random access response reception not successful then re-transmit the preamble with the calculated PRACH transmission power.

3.9 Repeat step 3.5 and 3.6 until the SS collect enough PRACH preambles (10 preambles for format A2). Measure the EVMθ and EVMφ in PRACH channel using Global In-Channel Tx-Test (Annex E). Calculate .

6.4.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with the following exceptions for PRACH test.

Table 6.4.2.1.4.3-1: *RACH-ConfigGeneric for PRACH test*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-130 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigGeneric ::= SEQUENCE { |  |  |  |
| preambleReceivedTargetPower | -60 |  |  |
| powerRampingStep | dB0 |  |  |
| } |  |  |  |

Table 6.4.2.1.4.3-2: *ServingCellConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| ss-PBCH-BlockPower | 18 |  |  |
| } |  |  |  |

Table 6.4.2.1.4.3-3: *ServingCellConfigCommonSIB*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-169 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommonSIB ::= SEQUENCE { |  |  |  |
| ss-PBCH-BlockPower | 18 |  |  |
| } |  |  |  |

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, 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.

The PUCCH EVM derived in Annex E.5.9.2 shall not exceed the values for QPSK in Table 6.4.2.1.5-1.

The PRACH EVM derived in Annex E.6.9.2 shall not exceed the values for QPSK in Table 6.4.2.1.5-1.

Table 6.4.2.1.5-1: Test requirements for Error Vector Magnitude

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

Table 6.4.2.1.5-2: Test Tolerance (TT) for PUSCH, PC3, FR2a

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test ID** | **Modulation** | **RB alloc.** | **50MHz** | **100MHz** | **200MHz** | **400MHz** |
| 1 | DFT-s-OFDM PI/2 BPSK | Inner\_Full | 0.00% | 0.00% | 0.00% | 0.00% |
| 2 | DFT-s-OFDM PI/2 BPSK | Outer\_Full | 0.00% | 0.00% | 0.00% | 0.00% |
| 3 | DFT-s-OFDM QPSK | Inner\_Full | 0.00% | 0.00% | 0.00% | 1.61% |
| 4 | DFT-s-OFDM QPSK | Outer\_Full | 0.00% | 0.00% | 0.00% | 2.18% |
| 5 | DFT-s-OFDM 16 QAM | Inner\_Full | 0.00% | 0.00% | 1.53% | 4.29% |
| 6 | DFT-s-OFDM 16 QAM | Outer\_Full | 0.00% | 0.00% | 1.67% | 4.29% |
| 7 | DFT-s-OFDM 64 QAM | Inner\_Full | 1.06% | 1.97% | 3.61% | NA |
| 8 | DFT-s-OFDM 64 QAM | Outer\_Full | 1.44% | 2.68% | NA | NA |
| 9 | CP-OFDM QPSK | Inner\_Full | 0.00% | 0.00% | 0.00% | 3.66% |
| 10 | CP-OFDM QPSK | Outer\_Full | 0.00% | 0.00% | 1.37% | 3.66% |
| 11 | CP-OFDM 16 QAM | Inner\_Full | 0.00% | 1.35% | 2.57% | NA |
| 12 | CP-OFDM 16 QAM | Outer\_Full | 0.00% | 1.35% | 2.57% | NA |
| 13 | CP-OFDM 64 QAM | Inner\_Full | 2.19% | 3.97% | NA | NA |
| 14 | CP-OFDM 64 QAM | Outer\_Full | 2.19% | 3.97% | NA | NA |
| NOTE 1: Test combinations without TT defined must be skipped as not testable. | | | | | | |

Table 6.4.2.1.5-3: Test Tolerance (TT) for PUSCH, PC3, FR2b

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test ID** | **Modulation** | **RB alloc.** | **50MHz** | **100MHz** | **200MHz** | **400MHz** |
| 1 | DFT-s-OFDM PI/2 BPSK | Inner\_Full | 0.00% | 0.00% | 0.00% | 0.00% |
| 2 | DFT-s-OFDM PI/2 BPSK | Outer\_Full | 0.00% | 0.00% | 0.00% | 2.50% |
| 3 | DFT-s-OFDM QPSK | Inner\_Full | 0.00% | 0.00% | 1.31% | 2.49% |
| 4 | DFT-s-OFDM QPSK | Outer\_Full | 0.00% | 0.00% | 1.79% | 4.01% |
| 5 | DFT-s-OFDM 16 QAM | Inner\_Full | 0.00% | 1.48% | 2.85% | NA |
| 6 | DFT-s-OFDM 16 QAM | Outer\_Full | 1.00% | 1.92% | 3.60% | NA |
| 7 | DFT-s-OFDM 64 QAM | Inner\_Full | 2.49% | NA | NA | NA |
| 8 | DFT-s-OFDM 64 QAM | Outer\_Full | 3.35% | NA | NA | NA |
| 9 | CP-OFDM QPSK | Inner\_Full | 0.00% | 1.42% | 2.73% | 8.42% |
| 10 | CP-OFDM QPSK | Outer\_Full | 0.00% | 1.58% | 3.04% | 8.42% |
| 11 | CP-OFDM 16 QAM | Inner\_Full | 1.72% | 3.25% | 5.92% | NA |
| 12 | CP-OFDM 16 QAM | Outer\_Full | 1.72% | 3.25% | 5.92% | NA |
| 13 | CP-OFDM 64 QAM | Inner\_Full | NA | NA | NA | NA |
| 14 | CP-OFDM 64 QAM | Outer\_Full | NA | NA | NA | NA |
| NOTE 1: Test combinations without TT defined must be skipped as not testable. | | | | | | |

Table 6.4.2.1.5-4: Test Tolerance (TT) for PUSCH, PC1, FR2a

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test ID | Modulation | 50MHz | 100MHz | 200MHz | 400MHz |
| 1-2 | PI/2 BPSK | 0.00% | 0.00% | 0.00% | 0.00% |
| 3-4, 9-10 | QPSK | 0.00% | 0.00% | 0.00% | 1.35% |
| 5-6, 11-12 | 16 QAM | 0.00% | 0.00% | 0.94% | 1.83% |
| 7-8, 13,14 | 64 QAM | 0.00% | 0.73% | 1.41% | 2.63% |
| NOTE 1: Test combinations without TT defined must be skipped as not testable. | | | | | |

#### 6.4.2.1\_1 Error vector magnitude with Power Boost

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

* Measurement Uncertainty and Test Tolerance are FFS except for PUSCH, PC3 in FR2a and FR2b.

6.4.2.1\_1.1 Test Purpose

Same as clause 6.4.2.1.1.

6.4.2.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward supporting *mpr-PowerBoost-FR2-r16* UE capability.

6.4.2.1\_1.3 Minimum conformance requirements

Same as clause 6.4.2.1.3.

6.4.2.1\_1.4 Test description

6.4.2.1.\_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 channel bandwidth and sub-carrier spacing, are shown in Table 6.4.2.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4.2.1.\_1.4.1-1: Test Configuration Table for PUSCH

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Low range, Mid Range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | | | Lowest, 100 MHz, Highest | |
| Test SCS as specified in Table 5.3.5-1 | | | | | 120 kHz | |
| Test Parameters | | | | | | |
| Test ID | ChBw | SCS | Downlink Configuration | Uplink Configuration | | |
|  |  | Default | - | Modulation | | RB allocation (NOTE 1) |
| 1 | 50 |  | DFT-s-OFDM QPSK | | Inner\_Full for PC2, PC3 |
| 2 | 100 |  |  |  | | and PC4 |
| 3 | 200 |  |  |  | | Inner\_Full\_Region1 for |
| 4 | 400 |  |  |  | | PC1 |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. | | | | | | |

Table 6.4.2.1.\_1.4.1-2: Test Configuration Table for PUCCH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | See Table 6.4.2.1.\_1.4.1-1 | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | See Table 6.4.2.1.\_1.4.1-1 | |
| Test SCS as specified in Table 5.3.5-1 | | | See Table 6.4.2.1.\_1.4.1-1 | |
| Test Parameters | | | | |
| ID | Downlink Configuration | | Uplink Configuration | |
|  | Modulation | RB allocation | Waveform | PUCCH format |
| 1 | CP-OFDM QPSK | Full RB (Note 1) | DFT-s-OFDM | PUCCH format = Format 3  Length in OFDM symbols = 14 |
| 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. | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

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. 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 [10] clause 4.5. Message contents are defined in clause 6.4.2.1.4.3

6.4.2.1\_1.4.2 Test procedure

Same as clause 6.4.2.1.4.2 for PUSCH and PUCCH with following exceptions:

- Instead of Table 6.4.2.1.4.1-1🡪 use Table 6.4.2.1.\_1.4.1-1.

- Instead of Table 6.4.2.1.4.1-2🡪 use Table 6.4.2.1.\_1.4.1-2.

6.4.2.1\_1.4.3 Message contents

Same as clause 6.2.4\_1.4.3.

6.4.2.1\_1.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4.2.1\_1.5-1.

The PUSCH, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4.2.1\_1.5-1 when embedded with data symbols of the respective modulation scheme.

The PUCCH EVM derived in Annex E.5.9.2 shall not exceed the values for QPSK in Table 6.4.2.1\_1.5-1.

The PRACH EVM derived in Annex E.6.9.2 shall not exceed the values for QPSK in Table 6.4.2.1\_1.5-1.

Table 6.4.2.1\_1.5-1: Test requirements for Error Vector Magnitude

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Average EVM Level | Reference Signal EVM Level |
| QPSK | % | 17.5+TT | 17.5+TT |

Table 6.4.2.1\_1.5-2: Test Tolerance (TT) for PUSCH, PC3, FR2a

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test ID** | **Modulation** | **RB alloc.** | **50MHz** | **100MHz** | **200MHz** | **400MHz** |
| 1, 2, 3, 4 | DFT-s-OFDM QPSK | Inner\_Full | 0.00% | 0.00% | 0.00% | 1.61% |

Table 6.4.2.1\_1.5-3: Test Tolerance (TT) for PUSCH, PC3, FR2b

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Test ID** | **Modulation** | **RB alloc.** | **50MHz** | **100MHz** | **200MHz** | **400MHz** |
| 1, 2, 3, 4 | DFT-s-OFDM QPSK | Inner\_Full | 0.00% | 0.00% | 1.31% | 2.49% |

#### 6.4.2.2 Carrier leakage

Editor’s note: The following aspects are either missing or not yet determined:

* Measurement Uncertainty and Test Tolerance are FFS for power class 1, 2, 4, 6 and 7.
* The test case is incomplete for band n259.

6.4.2.2.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal. Carrier leakage interferes with the sub carriers at its position (if allocated), especially, when their amplitude is small.

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 UE release 15 and forward.

6.4.2.2.3 Minimum conformance requirements

Carrier leakage is an additive sinusoid waveform. The carrier leakage requirement is defined for each component carrier. The measurement interval is one slot in the time domain. The relative carrier leakage power is a power ratio of the additive sinusoid waveform to the power in the modulated waveform.

The requirement is verified with the test metric of Carrier Leakage (Link=TX beam peak direction, Meas=Link angle).

When carrier leakage is contained inside the spectrum confined within the configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.3-1 for power class 1 UEs.

Table 6.4.2.2.3-1: Minimum requirements for relative carrier leakage power for power class 1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 17 dBm | -25 |
| 4 dBm ≤ EIRP ≤ 17 dBm | -20 |

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.3-2 for power class 2.

Table 6.4.2.2.3-2: Minimum requirements for relative carrier leakage power for power class 2

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 6 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 6 dBm | -20 |

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.3-3 for power class 3 UEs.

Table 6.4.2.2.3-3: Minimum requirements for relative carrier leakage power for power class 3

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 0 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 0 dBm | -20 |

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.3-4 for power class 4.

Table 6.4.2.2.3-4: Minimum requirements for relative carrier leakage power for power class 4

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 11 dBm | -25 |
| -13 dBm ≤ EIRP ≤11 dBm | -20 |

The normative reference for this requirement is TS 38.101-2[3] clause 6.4.2.2.

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.3-6 for power class 6.

Table 6.4.2.2.3-6: Minimum requirements for relative carrier leakage power for power class 6

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 7 dBm | -25 |
| -6 dBm ≤ EIRP ≤ 7 dBm | -20 |

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4.2.2.3-7 for power class 7.

Table 6.4.2.2.3-7: Minimum requirements for relative carrier leakage power for power class 7

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 0 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 0 dBm | -20 |

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 reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4.2.2.4.1-1: Test Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | Mid | |
| Test SCS as specified in Table 5.3.5-1 | | Highest | |
| Test Parameters | | | |
| Test ID | Downlink Configuration | Uplink Configuration | |
|  | - | Modulation | RB allocation (NOTE 1, 3) |
| 1 |  | DFT-s-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3,, PC4, PC6 and PC7  Inner\_Partial\_Left\_Region2 for PC1 |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3, PC4, PC6 and PC7 or Table 6.1-2 for PC1.  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 signalled DC carrier position is at Inner\_Partial\_Left for PC2, PC3, PC4, PC6 and PC7, use Inner\_Partial\_Right for UL RB allocation. When the signalled DC carrier position is in Inner\_Partial\_Left\_Region2 for PC1, use Inner\_Partial\_Right\_Region2 for UL RB allocation. | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

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. 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 [10] clause 4.5. Message contents are defined in clause 6.4.2.2.4.3.

7. 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. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

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 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.

3. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE EIRPTotal = EIRPθ + EIRPφ 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 Preq, where:

- Preq is the power level specified in Table 6.4.2.2.4.2-1 according to the power class.

- MU is the test system uplink absolute power measurement uncertainty and is specified in Table F.1.2-1 under carrier leakage sub-clause for the carrier frequency f and the channel bandwidth BW.

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

Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

5. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

6. Measure carrier leakage using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarization at the LO position obtained in step 1. For TDD, only slots consisting of only UL symbols are under test. Calculate CarrLeak = min(CarrLeakθ , CarrLeakφ).

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: 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 6.4.2.2.4.2-1: UE EIRP Preq (dBm) for carrier leakage

|  |  |
| --- | --- |
| Power Class | Preq (dBm) for step 3 |
| Power Class 1 | 17 |
| Power Class 2 | 6 |
| Power Class 3 | 0 |
| Power Class 4 | 11 |
| Power Class 6 | 7 |
| Power Class 7 | 0 |

Table 6.4.2.2.4.2-2: Void.

6.4.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.4.2.2.5 Test requirement

The test requirement below shall only be considered if UE output power measured in the test procedure step 4 ends within the Uplink power control window.

For each of the *n* carrier leakage results derived in Annex E.3.1 for θ- and φ-polarization the minimum is calculated according to

CarrLeak = min(CarrLeakθ , CarrLeakφ), where

.

Each of the *n* carrier leakage results CarrLeak shall not exceed the values in Table 6.4.2.2.5-1 to Table 6.4.2.2.5-4. Allocated RBs are not under test.

Table 6.4.2.2.5-1a: Test requirements for relative carrier leakage power for power class 1

|  |  |
| --- | --- |
| Parameter | Relative limit (dBc) |
| 17 dBm + MU < EIRP ≤ 17 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4.2.2.5-1b: Test Tolerance (carrier leakage for power class 1)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | TBD | TBD |

Table 6.4.2.2.5-2a: Test requirements for relative carrier leakage power for power class 2

|  |  |
| --- | --- |
| Parameter | Relative limit (dBc) |
| 6 dBm + MU < EIRP ≤ 6 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4.2.2.5-2b: Test Tolerance (carrier leakage for power class 2)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | TBD | TBD |

Table 6.4.2.2.5-3a: Test requirements for relative carrier leakage power for power class 3

|  |  |
| --- | --- |
| Parameter | Relative limit (dBc) |
| 0 dBm + MU < EIRP ≤ 0 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4.2.2.5-3b: Test Tolerance (carrier leakage for power class 3)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | 3.54 dB | 3.62 dB |

Table 6.4.2.2.5-4a: Test requirements for relative carrier Leakage Power for power class 4

|  |  |
| --- | --- |
| Parameter | Relative limit (dBc) |
| 11 dBm + MU < EIRP ≤ 11 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4.2.2.5-4b: Test Tolerance (carrier leakage for power class 4)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | TBD | TBD |

Table 6.4.2.2.5-5a: FFS

Table 6.4.2.2.5-5b: FFS

Table 6.4.2.2.5-6a: Test requirements for relative carrier Leakage Power for power class 6

|  |  |
| --- | --- |
| Parameter | Relative limit (dBc) |
| 7 dBm + MU < EIRP ≤ 7 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4.2.2.5-6b: Test Tolerance (carrier leakage for power class 6)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | TBD | TBD |

Table 6.4.2.2.5-7a: Test requirements for relative carrier leakage power for power class 7

|  |  |
| --- | --- |
| Parameter | Relative limit (dBc) |
| 0 dBm + MU < EIRP ≤ 0 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4.2.2.5-7b: Test Tolerance (carrier leakage for power class 7)

|  |  |  |
| --- | --- | --- |
| Test Metric | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS dB | FFS dB |

#### 6.4.2.3 In-band emissions

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

* Measurement Uncertainty and Test Tolerance are FFS.
* Testing of the general in-band emission requirement and if yes at which UE Tx power level and with which relaxation applied to the requirement is FFS.

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 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 UE release 15 and forward.

6.4.2.3.3 Minimum conformance requirements

The in-band emission is defined as the average 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 IBE requirement does not apply if UE declares support for *mpr-PowerBoost-FR2-r16*, UL transmission is QPSK, MPRf,c = 0 and when NS\_200 applies, and the network configures the UE to operate with *mpr-PowerBoost-FR2-r16*.

The basic in-band emissions measurement interval is identical to that of the EVM test.

The requirement is verified with the test metric of In-band emission (Link=TX beam peak direction, Meas=Link angle).

The relative in-band emission shall not exceed the values specified in Table 6.4.2.3.3-1 for power class 1 UEs.

The average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.3-1 for power class 1, Table 6.4.2.3.3-2 for power class 2, Table 6.4.2.3.3-3 for power class 3 and Table 6.4.2.3.3-4 for power class 4 UEs.

Table 6.4.2.3.3-1: Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB |  | | Any non-allocated (NOTE 2) |
| IQ Image | dB | -25 | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 27 dBm |
| Carrier leakage | dBc | -25 | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The relative in-band emission shall not exceed the values specified in Table 6.4.2.3.3-2 for power class 2.

Table 6.4.2.3.3-2: Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| **General** | dB |  | | Any non-allocated (NOTE 2) |
| **IQ Image** | dB | -25 | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 16 dBm |
| **Carrier leakage** | dBc | -25 | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The relative in-band emission shall not exceed the values specified in Table 6.4.2.3.3-3 for power class 3 UEs.

Table 6.4.2.3.3-3: Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB |  | | Any non-allocated (NOTE 2) |
| IQ Image | dB | -25 | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25 | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The relative in-band emission shall not exceed the values specified in Table 6.4.2.3.3-4 for power class 4 UEs.

Table 6.4.2.3.3-4: Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB |  | | Any non-allocated (NOTE 2) |
| IQ Image | dB | -25 | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 21 dBm |
| Carrier leakage | dBc | -25 | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4.2.3.

The average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.3-6 for power class 6 UEs.

Table 6.4.2.3.3-6: Requirements for in-band emissions for power class 6

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| **General** | dB |  | | Any non-allocated (NOTE 2) |
| **IQ Image** | dB | -25 | Output power > 17 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 17 dBm |
| **Carrier leakage** | dBc | -25 | Output power > 7 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -6 dBm ≤ Output power ≤ 7 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 (- 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. 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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Clause 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Clause 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB = 1 or RB = -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.3-7 for power class 7 UEs.

Table 6.4.2.3.3-7: Requirements for in-band emissions for power class 7

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB |  | | Any non-allocated (NOTE 2) |
| IQ Image | dB | -25 | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25 | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4.2.3.

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 reference measurement channels (RMCs) are specified in Annex A.2. 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 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 (NOTE 1) |
| 1 |  | DFT-s-OFDM PI/2 BPSK | Inner\_ Partial\_Left for PC2, PC3, PC4, PC6, PC7  Inner\_ Partial\_Left\_Region2 for PC1 |
| 2 |  | DFT-s-OFDM PI/2 BPSK | Inner\_ Partial\_Right for PC2, PC3, PC4, PC6, PC7  Inner\_ Partial\_Right\_Region2 for PC1 |
| 3 |  | CP-OFDM QPSK | Inner\_ Partial\_Left for PC2, PC3, PC4, PC6, PC7  Inner\_ Partial\_Left\_Region2 for PC1 |
| 4 |  | CP-OFDM QPSK | Inner\_ Partial\_Right for PC2, PC3, PC4, PC6, PC7  Inner\_ Partial\_Right\_Region2 for PC1 |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3, PC4, PC6 and PC7 or Table 6.1-2 for PC1.  NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. | | | |

Table 6.4.2.3.4.1-2: Test Configuration Table for PUCCH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | See Table 6.4.2.3.4.1-1 | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | See Table 6.4.2.3.4.1-1 | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 |
| 1 | CP-OFDM QPSK | Full RB (Note 1) | CP-OFDM | PUCCH format = Format 1  Length in OFDM symbols = 14 |
| 2 | CP-OFDM QPSK | Full RB (Note 1) | DFT-s-OFDM | PUCCH format = Format 3  Length in OFDM symbols = 14 |
| 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. | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

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 without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] 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 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

1.2 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 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.

1.3 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.4 Send the appropriate TPC commands in the uplink scheduling information to the UE until UE output power is Preq + PW ± PW, where Preq is the power level specified in Tables 6.4.2.3.4.2-1 according to the power class with power ID = 1. PW is the power window according to Table 6.4.2.3.4.2-2 for the carrier frequency f and the channel bandwidth BW. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.5 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

1.6 Measure In-band emission IEθ, IEφ using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. For TDD, only slots consisting of only UL symbols are under test. Calculate IE = IEθ + IEφ, where the calculation is based on linear power ratios.

1.7 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

1.8 Repeat steps 1.3 through 1.6 until In-band emissions have been measured for all power IDs in Table 6.4.2.3.4.2-1.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4.2.3.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

Table 6.4.2.3.4.2-1: Parameters for In-band emissions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Power ID | Unit | Level for power class 1 | Level for power class 2 | Level for power class 3 | Level for power class 4 | Level for power class 6 | Level for power class 7 |
| 1 | dBm | 27 | 16 | 10 | 21 | 17 | 10 |
| 2 | dBm | 17 | 6 | 0 | 11 | 7 | 0 |

Table 6.4.2.3.4.2-2: Power Window (dB) for In-band emissions PUSCH and PUCCH

TBD

Test procedure for PUCCH:

2.1 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2.2 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.

2.3 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

2.4 Send the appropriate TPC commands in the uplink scheduling information for PUCCH to the UE until UE output power is Preq + PW ± PW, where Preq is the power level specified in Tables 6.4.2.3.4.2-1 according to the power class with power ID = 1. PW is the power window according to Table 6.4.2.3.4.2-2 for the carrier frequency f and the channel bandwidth BW. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

2.5 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

2.6 Measure In-band emission IEθ, IEφ using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. Calculate IE = IEθ + IEφ, where the calculation is based on linear power ratios.

2.7 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

2.8 Repeat steps 2.3 through 2.6 until In-band emissions have been measured for all power IDs in Table 6.4.2.3.4.2-1.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.4.2.3.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.4.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.

6.4.2.3.5 Test requirement

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4.2.3.5-1 for power class 1 UEs.

Table 6.4.2.3.5-1: Test requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General  (NOTE 12) | dB | + TT | | Any non-allocated (NOTE 2) |
| IQ Image  (NOTE 12) | dB | -25+TT | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 27 dBm |
| Carrier leakage  (NOTE 12) | dBc | -25+TT | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction.  NOTE 12: In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4.2.3.5-2 for power class 2 UEs.

Table 6.4.2.3.5-2: Test requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| General  (NOTE 12) | dB | + TT | | Any non-allocated (NOTE 2) |
| IQ Image  (NOTE 12) | dB | -25 + TT | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20 + TT | Output power ≤ 16 dBm |
| Carrier leakage  (NOTE 12) | dBc | -25 + TT | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20 + TT | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency if NRB is odd, or in the two RBs immediately adjacent to the DC frequency if NRB is even but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction.  NOTE 12: In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4.2.3.5-3 for power class 3 UEs.

Table 6.4.2.3.5-3: Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General  (NOTE 12) | dB | + TT | | Any non-allocated (NOTE 2) |
| IQ Image  (NOTE 12) | dB | -25+TT | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 10 dBm |
| Carrier leakage  (NOTE 12) | dBc | -25+TT | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction.  NOTE 12: In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4.2.3.5-4 for power class 4 UEs.

Table 6.4.2.3.5-4: Test requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General  (NOTE 12) | dB | + TT | | Any non-allocated (NOTE 2) |
| IQ Image  (NOTE 12) | dB | -25 + TT | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20 + TT | Output power ≤ 21 dBm |
| Carrier leakage  (NOTE 12) | dBc | -25 + TT | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20 + TT | -13 dBm ≤ Output power ≤11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction.  NOTE 12: In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* 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

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

* Measurement Uncertainty and Test Tolerance are FFS.

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 UE release 15 and forward.

6.4.2.4.3 Minimum conformance requirements

For pi/2 BPSK modulation, the minimum requirements are defined in Clause 6.4.2.5.3.

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 requirements: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 (Table 6.4.2.4.3-1) must not be larger than 7 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 dB (see Figure 6.4.2.4.3-1).

The requirement is verified with the test metric of EVM SF (Link=TX beam peak direction, Meas=Link angle).

Table 6.4.2.4.3-1: Minimum requirements for EVM equalizer spectrum flatness (normal conditions)

|  |  |
| --- | --- |
| Frequency range | Maximum ripple (dB) |
| |FUL\_Meas – Fcenter| ≤ X MHz  (Range 1) | 6 (p-p) |
| |FUL\_Meas – Fcenter| > X MHz  (Range 2) | 9 (p-p) |
| NOTE 1: FUL\_Meas refers to the sub-carrier frequency for which the equalizer coefficient is evaluated  NOTE 2: Fcenter refers to the centre frequency of the CC  NOTE 3: X, in MHz, is equal to 30% of the CC bandwidth | |



Figure 6.4.2.4.3-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated under normal conditions

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4.2.4.

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 reference measurement channels (RMCs) are specified in Annex A.2. 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 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 (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 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  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. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

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. 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 [10] clause 4.5. Message contents are defined in clause 6.4.2.4.4.3

6.4.2.4.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

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 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

3. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

4. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200 ms for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

5. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

6. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. For TDD, only slots consisting of only UL symbols are under test.

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4.2.4.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.4.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [10] 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. The derived results shall not exceed the values in Figure 6.4.2.4.5-1: 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 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 requirements: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 (Table 6.4.2.4..5-1) must not be larger than 7 dB + TT, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 8 dB + TT (see Figure 6.4.2.4.5-1).

The UE passes the test when the derived results for at least one polarization fulfil the test requirements.

Table 6.4.2.4.5-1: Test requirements for EVM equalizer spectrum flatness (normal conditions)

|  |  |
| --- | --- |
| Frequency range | Maximum ripple (dB) |
| |FUL\_Meas – Fcenter| ≤ X MHz  (Range 1) | 6 +TT (p-p) |
| |FUL\_Meas – Fcenter| > X MHz  (Range 2) | 9 + TT (p-p) |
| NOTE 1: FUL\_Meas refers to the sub-carrier frequency for which the equalizer coefficient is evaluated  NOTE 2: Fcenter refers to the centre frequency of the CC  NOTE 3: X, in MHz, is equal to 30% of the CC bandwidth | |

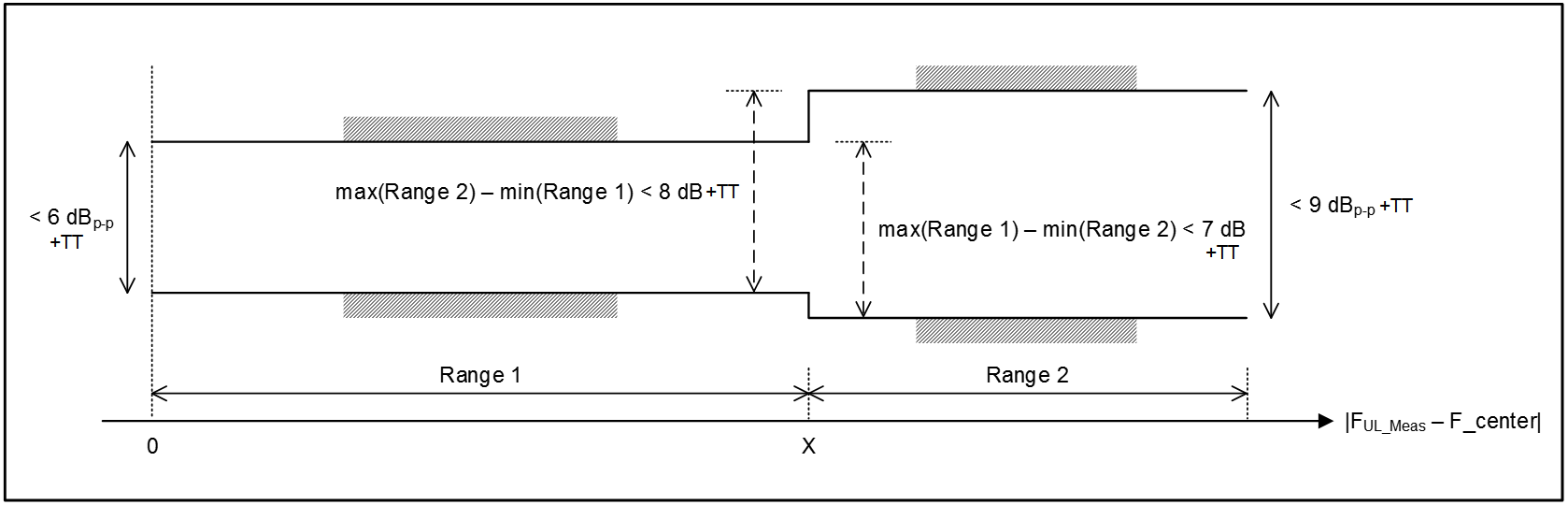


Figure 6.4.2.4.5-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated under normal conditions

#### 6.4.2.5 EVM spectral flatness for pi/2 BPSK modulation

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

* Measurement Uncertainty and Test Tolerance are FFS.
* Whether and, if yes, how to test the requirement on shaping filter is FFS.

6.4.2.5.1 Test purpose

Same test purpose as in clause 6.4.2.4.1.

6.4.2.5.2 Test applicability

This test case applies to all types of NR FR2 UE release 15 and forward supporting pi/2 BPSK modulation.

6.4.2.5.3 Minimum conformance requirements

These requirements are defined for pi/2 BPSK modulation. 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) |
| |FUL\_Meas – Fcenter| ≤ X MHz  (Range 1) | X1 | 6 (p-p) |
| |FUL\_Meas – Fcenter| > X MHz  (Range 2) | X2 | 14 (p-p) |
| NOTE 1: FUL\_Meas refers to the sub-carrier frequency for which the equalizer coefficient is evaluated.  NOTE 2: Fcenter refers to the centre 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 and X3. | | |



Figure 6.4.2.5.3-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation. Fcenter denotes the centre frequency of the allocated block of PRBs. F\_alloc denotes the bandwidth of the PRB allocation

This requirement does not apply to other modulation types. The UE shall be allowed to employ spectral shaping for pi/2 BPSK. The shaping filter shall be restricted so that the impulse response of the transmit chain shall meet

│*ãt*(*t*,0)│ ≥ │*ãt*(*t*, *τ*)│ ∀*τ* ≠ 0

20*log*10│*ãt*(*t*,*τ*)│< -15 dB 1< *τ* < M - 1,

Where:

│ãt(t,τ)│=IDFT{│ãt(t,f)│ejφ (t,f)} ,

f is the frequency of the M allocated subcarriers,

ã(t,f) and φ(t,f) are the amplitude and phase response, respectively of the transmit chain

0dB reference is defined as 20log10│ãt(t,0)│

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4.2.5.

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 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | Lowest, Mid, Highest | |
| Test SCS as specified in TS 38.508-1 [10] subclause 5.3.5-1 | | Lowest | |
| Test Parameters | | | |
| Test ID | Downlink Configuration | Uplink Configuration | |
|  | - | Modulation | RB allocation (NOTE 1) |
| 1 |  | DFT-s-OFDM pi/2-BPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  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. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

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 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

3. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200 ms for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

5. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

6. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. For TDD, only slots consisting of only UL symbols are under test.

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.4.2.5.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.4.2.5.5 Test requirement

Each of the *n* spectrum flatness functions, shall derive four ripple results in Annex E.4.4. The derived results shall not exceed the values in Table 6.4.2.5.5-1 and Figure 6.4.2.5.5-1:

Table 6.4.2.5.5-1: Test requirement for EVM equalizer coefficients for pi/2 BPSK (normal conditions)

|  |  |  |
| --- | --- | --- |
| Frequency range | Parameter | Maximum ripple (dB) |
| |FUL\_Meas – Fcenter| ≤ X MHz  (Range 1) | X1 | 6 + TT (p-p) |
| |FUL\_Meas – Fcenter| > X MHz  (Range 2) | X2 | 14 + TT (p-p) |
| NOTE 1: FUL\_Meas refers to the sub-carrier frequency for which the equalizer coefficient is evaluated.  NOTE 2: Fcenter refers to the centre 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 6.4.2.5.5-1 for description of X1, X2 and X3. | | |



Figure 6.4.2.5.5-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation. Fcenter denotes the centre frequency of the allocated block of PRBs

The UE passes the test when the derived results for at least one polarization fulfil the test requirements.

#### 6.4.2.6 Phase continuity requirements for DMRS bundling

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

- MU/TT analysis is pending

- PICS update is pending in TS 38.508-2

- Message Contents requires to be finalized

6.4.2.6.1 Test purpose

The objective of this test is to determine the maximum allowable phase difference for UEs that support DMRS bundling.

6.4.2.6.2 Test applicability

This test case applies to all types of NR FR2 UEs which are release 17 and forward supporting TDD, *dmrs-BundlingPUCCH-Rep-r17* and either *dmrs-BundlingPUSCH-multiSlot-r17 or dmrs-BundlingPUSCH-RepTypeA-r17 or dmrs-BundlingPUSCH-RepTypeB-r17.*

6.4.2.6.3 Minimum conformance requirements

For bands that UE indicates the support of DMRS bundling, the maximum allowable difference between the measured phase value in any slot *p-1* and slot *p* shall satisfy the requirements as listed in Table 6.4.2.6-1 for the measurement conditions defined in Table 6.4.2.6-2, within a measurement time window limited by the UE capability of maximum duration for DMRS bundling [maxDurationDMRS-Bundling-r17], and defined for each frequency band separately. The phase value for each slot is measured as shown in Annex F.8. These requirements apply to PUCCH and PUSCH transmissions with DFT-s-OFDM and CP-OFDM waveforms.

Table 6.4.2.6-1: Maximum allowable phase difference for DMRS bundling

|  |  |  |
| --- | --- | --- |
| **UL channel** | **Modulation order** | **Phase difference between any slot *p-1* and slot *p***  **(NOTE 2)** |
| PUSCH | Pi/2 BPSK, QPSK | [25] degrees |
| PUCCH | Pi/2 BPSK, BPSK, QPSK |
| NOTE 1: The UE capability of the length of maximum duration refers to the maximum time duration during which UE is able to meet the phase continuity requirements, assuming no phase consistency violating events defined in TS 38.214 in between.  NOTE 2: This requirement applies for TDD bands, for supported DMRS bundling configurations ≤ 8 slots. | | |

The above requirements are applicable when all the following conditions are met within the measurement time window.

- RB allocation in terms of length and frequency position does not change, and intra-slot and inter-slot frequency hopping is not activated.

- Modulation order does not change.

- No network commanded TA takes effect.

- The TPMI precoder does not change.

- There is no change in UE EIRP level, and no change in the level of P-MPR applied by the UE.

- UE is not scheduled with uplink transmission of other physical channel/signal in-between the PUSCH or PUCCH transmissions.

- For TDD, no downlink slot(s) or downlink symbol(s) or flexible symbol(s) with/without DL monitoring occasion configured in-between the PUSCH or PUCCH transmissions.

- No uplink beam switching occurs.

Table 6.4.2.6-2: Measurement conditions for the maximum allowable phase difference

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| UE EIRP | dBm | PUMAX,f,c in clause 6.2.4, P-MPR = 0 |
| UE downlink received power |  | Not change |
| Operating conditions |  | Normal conditions |
| Transmission bandwidth |  | Confined within FUL\_low + [4] MHz and FUL\_high – [4] MHz |
| DL signal frequency |  | Not change before and during the measurement window |
| DL signal timing |  | Maintained constant before and during the measurement window |
| UL slots for testing |  | Tested on consecutive UL slots |
| PUSCH waveform for testing |  | DFT-s-OFDM |

NOTE: Phase continuity requirements for DMRS bundling is defined only within FR2-1 in this release of the specification.

6.4.2.6.4 Test description

6.4.2.6.4.1 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 reference measurement channels (RMCs) are specified in Annex A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4.2.6.4.1-1: Test Configuration Table for PUSCH

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 (NOTE 1) |
| 1 |  | DFT-s-OFDM PI/2 BPSK | Inner\_Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| 2  (NOTE 4) |  | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3 and PC4  Inner\_Full\_Region1 for PC1 |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3, PC4 and PC7 or Table 6.1-2 for PC1.  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: The following test points are not testable for PC3 devices: FR2a channel bandwidth 200MHz: test points 8, 13 and 14 FR2a channel bandwidth 400MHz: test points 7, 8, 11, 12, 13 and 14 FR2b channel bandwidth 50MHz: test points 13 and 14 FR2b channel bandwidth 100MHz: test points 7, 8, 13 and 14 FR2b channel bandwidth 200MHz: test points 7, 8, 13 and 14 FR2b channel bandwidth 400MHz: test points 5, 6, 7, 8, 11, 12, 13 and 14  NOTE 4: This test point shall be skipped if device supports mpr-PowerBoost-FR2-r16 UE capability. | | | |

Table 6.4.2.6.4.1-2: Test Configuration Table for PUCCH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | See Table 6.4.2.6.4.1-1 | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | See Table 6.4.2.6.4.1-1 | |
| Test SCS as specified in Table 5.3.5-1 | | | See Table 6.4.2.6.4.1-1 | |
| Test Parameters | | | | |
| ID | Downlink Configuration | | Uplink Configuration | |
|  | Modulation | RB allocation | Waveform | PUCCH format |
| 1 | - | - | DFT-s-OFDM | PUCCH format = Format 3  Length in OFDM symbols = 14 |
| NOTE 1: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.4.2.6.4.1-1

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 [10] clause 4.5. Message contents are defined in clause 6.4.2.1.4.3

6.4.2.6.4.2 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. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.3. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200 ms starting from the first TPC command in this step for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

1.5. Measure the phase offset using the test measurement described in Annex E.6.11. For TDD, only slots consisting of only UL symbols are under test.

1.6. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4.2.6.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.1.1.

Test procedure for PUCCH:

2.1. PUCCH is set according to Table 6.4.2.6.4.1-2.

2.2 SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 6.4.2.6.4.1-2. 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. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

2.4. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits PUCCH at PUMAX level. Allow at least 200 ms starting from the first TPC command in this step for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

2.5 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

2.6. Measure the phase offset using test measurement described in Annex E.6.11.For TDD, only slots consisting of only UL symbols are under test.

2.7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.1.1.

6.4.2.6.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config. In addition, the following message contents shall be configured.

Table 6.4.2.6.4.3-1: *DMRS-BundlingPUCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [11], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-BundlingPUCCH-Config-r17::= CHOICE { |  |  |  |
| Setup SEQUENCE { |  |  |  |
| pucch-DMRS-Bundling-r17 | ENABLED |  |  |
| pucch-TimeDomainWindowLength-r17 | [2] |  |  |
| pucch-WindowRestart-r17 | TBD |  |  |
| pucch-FrequencyHoppingInterval-r17 | [s2] |  |  |
| } |  |  |  |

Table 6.4.2.6.4.3-2: *DMRS-BundlingPUSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [11], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-BundlingPUSCH-Config-r17::= CHOICE { |  |  |  |
| Setup SEQUENCE { |  |  |  |
| pucch-DMRS-Bundling-r17 | ENABLED |  |  |
| pucch-TimeDomainWindowLength-r17 | [2] |  |  |
| pucch-WindowRestart-r17 | TBD |  |  |
| pucch-FrequencyHoppingInterval-r17 | [s2] |  |  |
| } |  |  |  |

6.4.2.6.5 Test requirement

The maximum allowable phase difference for UEs supporting DMRS dbundling and as measured in Step [TBD} of test procedure should meet the following requirements.

Table 6.4.2.6.5-1: Test Requirements for Maximum allowable phase difference for DMRS bundling

|  |  |  |
| --- | --- | --- |
| **UL channel** | **Modulation order** | **Phase difference between any slot *p-1* and slot *p***  **(NOTE 2)** |
| PUSCH | Pi/2 BPSK, QPSK | [25+TT] degrees |
| PUCCH | Pi/2 BPSK, BPSK, QPSK |
| NOTE 1: The UE capability of the length of maximum duration refers to the maximum time duration during which UE is able to meet the phase continuity requirements, assuming no phase consistency violating events defined in TS 38.214 in between.  NOTE 2: This requirement applies for TDD bands, for supported DMRS bundling configurations ≤ 8 slots. | | |

Table 6.4.2.6.5-2: Test Tolerance for Maximum allowable phase difference for DMRS bundling

|  |  |  |
| --- | --- | --- |
| UL channel | Modulation order | TT |
| PUSCH | Pi/2 BPSK, QPSK | FFS |
| PUCCH | Pi/2 BPSK, BPSK, QPSK | FFS |

## 6.4A Transmit signal quality for CA

### 6.4A.1 Frequency error for CA

##### 6.4A.1.0 Minimum conformance requirements

The requirements in this clause apply to UEs of all power classes.

For intra-band contiguous carrier aggregation, the UE basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of UE modulated carrier frequencies per band shall be accurate to within ±0.1 PPM observed over a period of 1ms of cumulated measurement intervals compared to the carrier frequency of primary component carrier received from the gNB.

The frequency error is defined as a directional requirement. The requirement is verified in beam locked mode on beam peak direction.

##### 6.4A.1.1 Frequency error for CA (2UL CA)

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

* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz is TBD.
* Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

6.4A.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.

6.4A.1.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.4A.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.1.0.

6.4A.1.1.4 Test description

6.4A.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, and channel bandwidths based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.4A.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 6.4A.1.1.4.1-1: Test Configuration Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | | Mid range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest | | |
| Test Parameters | | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 4) | **CBW (MHz)** | **Modulation** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | Default | CP-OFDM QPSK | Full RB (NOTE 1) | | DFT-s-OFDM QPSK | REFSENS (NOTE 2) |
| SCC/CC2 | - | - | | - | - |
| 2 | PCC/CC1 | Default | CP-OFDM QPSK | Full RB (NOTE 1) | | - | - |
| SCC/CC2 | - | - | | 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.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.4A.1.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.4A.1.1.4.3

6.4A.1.1.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

3. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.4A.1.1.4.3.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

5. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 6.4A.1.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

6. 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 6.4A.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.

7. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. Send continuously uplink power control "up" commands to the UE in every uplink scheduling information to the UE so that the UE transmits at PUMAX level for the duration of the test. Allow at least 200ms starting from the first TPC Command for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

9. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition Tx only.

10. For every UE modulated carrier frequency, measure the Frequency Error using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarization. For TDD, only slots consisting of only UL symbols are under test.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.4A.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.4A.1.1.5 Test Requirements

The 10 frequency error Δf results for the θ-polarization or the 10 frequency error Δf results for the φ-polarization must fulfil the test requirement:

|Δf| ≤ (0.1 PPM + 0.005 PPM), (for Aggregated BW ≤ 400MHz)

##### 6.4A.1.2 Frequency error for CA (3UL CA)

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

* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz is TBD.
* Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

6.4A.1.2.1 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.

6.4A.1.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.4A.1.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.1.0.

6.4A.1.2.4 Test description

Same as in clause 6.4A.1.1.4 with following exceptions:

- Instead of Table 6.4A.1.1.4.1-1🡪 use Table 6.4A.1.2.4-1.

- Instead of Table 6.4A.1.1.5-1🡪 use Table 6.4A.1.2.5-1.

Table 6.4A.1.2.4-1: Test Configuration Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | | Mid range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest | | |
| Test Parameters | | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 4) | **CBW (MHz)** | **Modulation** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | default | CP-OFDM QPSK | Full RB (NOTE 1) | | DFT-s-OFDM QPSK | REFSENS (NOTE 2) |
| SCC/CC2 | - | - | | - | - |
| SCC/CC3 | - | - | | - | - |
| 2 | PCC/CC1 |  | CP-OFDM QPSK | Full RB (NOTE 1) | | - | - |
| SCC/CC2 | - | - | | DFT-s-OFDM QPSK | REFSENS (NOTE 2) |
| SCC/CC3 | - | - | | - | - |
| 3 | PCC/CC1 |  | CP-OFDM QPSK | Full RB (NOTE 1) | | - | - |
| SCC/CC2 | - | - | | - | - |
| SCC/CC3 | - | - | | 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.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | | |

6.4A.1.2.5 Test Requirements

The 10 frequency error Δf results for the θ-polarization or the 10 frequency error Δf results for the φ-polarization must fulfil the test requirement:

|Δf| ≤ (0.1 PPM + 0.005 PPM), (for Aggregated BW ≤ 400MHz)

##### 6.4A.1.3 Frequency error for CA (4UL CA)

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

* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA supporting aggregated BW > 400MHz is TBD.
* Measurement Uncertainties and Test Tolerances are FFS for power class 1, 2 and 4.

6.4A.1.3.1 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.

6.4A.1.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.4A.1.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.1.0.

6.4A.1.3.4 Test description

Same as in clause 6.4A.1.1.4 with following exceptions:

- Instead of Table 6.4A.1.1.4.1-1🡪 use Table 6.4A.1.3.4-1.

- Instead of Table 6.4A.1.1.5-1🡪 use Table 6.4A.1.3.5-1.

Table 6.4A.1.3.4-1: Test Configuration Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | | Normal, TL, TH | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | | Mid range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | | Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | | Lowest | | |
| Test Parameters | | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 4) | **CBW (MHz)** | **Modulation** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | Default | CP-OFDM QPSK | Full RB (NOTE 1) | | DFT-s-OFDM QPSK | REFSENS (NOTE 2) |
| SCC/CC2 | - | - | | - | - |
| SCC/CC3 | - | - | | - | - |
| SCC/CC4 | - | - | | - | - |
| 2 | PCC/CC1 | Default | CP-OFDM QPSK | Full RB (NOTE 1) | | - | - |
| SCC/CC2 | - | - | | DFT-s-OFDM QPSK | REFSENS (NOTE 2) |
| SCC/CC3 | - | - | | - | - |
| SCC/CC4 | - | - | | - | - |
| 3 | PCC/CC1 | Default | CP-OFDM QPSK | Full RB (NOTE 1) | | - | - |
| SCC/CC2 | - | - | | - | - |
| SCC/CC3 | - | - | | DFT-s-OFDM QPSK | REFSENS (NOTE 2) |
| SCC/CC4 | - | - | | - | - |
| 4 | PCC/CC1 | Default | CP-OFDM QPSK | Full RB (NOTE 1) | | - | - |
| SCC/CC2 | - | - | | - | - |
| SCC/CC3 | - | - | | - | - |
| SCC/CC4 | - | - | | 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.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | | |

6.4A.1.3.5 Test Requirements

The 10 frequency error Δf results for the θ-polarization or the 10 frequency error Δf results for the φ-polarization must fulfil the test requirement:

|Δf| ≤ (0.1 PPM + 0.005 PPM), (for Aggregated BW ≤ 400MHz)

##### 6.4A.1.4 Frequency error for CA (5UL CA)

FFS

##### 6.4A.1.5 Frequency error for CA (6UL CA)

FFS

##### 6.4A.1.6 Frequency error for CA (7UL CA)

FFS

##### 6.4A.1.7 Frequency error for CA (8UL CA)

FFS

### 6.4A.2 Transmit modulation quality for CA

#### 6.4A.2.0 General

For intra-band contiguous carrier aggregation, the requirements in subclauses 6.4A.2.1.0, 6.4A.2.2.0, and 6.4A.2.3.0.

All the parameters defined in subclause 6.4A.2 are defined using the measurement methodology specified in Annex E.

All the requirements in 6.4A.2 are defined as directional requirement. The requirements are verified in beam locked mode on beam peak direction, with both UL polarizations active.

The carrier leakage frequency is optionally indicated with IE *UplinkTxDirectCurrentList, UplinkTxDirectCurrentTwoCarrierList-r16* for CA with two component carriers configured for uplink *or* IE *UplinkTxDirectCurrentMoreCarrierList-r17* for any CA configuration.

If the UE does not indicate DC location parameters, the carrier leakage measurement requirement in clauses 6.4A.2.2 and 6.4A.2.3 shall be waived and the UE’s UL signal left uncorrected for carrier leakage. Any requirement relaxation to accommodate the IQ image shall be omitted.

If the UE indicates carrier leakage frequency as 3300 or 3301 with IE *UplinkTxDirectCurrentList or UplinkTxDirectCurrentTwoCarrierList-r16*, or if the carrier leakage frequency is outside the configured UL and DL carriers, the carrier leakage measurement requirement in clause 6.4A.2.2 and 6.4A.2.3 shall be waived and the UE’s UL signal left uncorrected for carrier leakage. Any requirement relaxation to accommodate the IQ image shall be omitted.

The UE is defined to be configured for CA operation when it has at least one of UL or DL configured for CA.

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the transmit modulation quality requirements are specified in clause 6.4.2 and are applicable for each CC with all CCs active with non-zero UL RB allocation.

#### 6.4A.2.1 Error vector magnitude for CA

Editor’s note: This test is incomplete due to lack of RRC framework for LO position retrieval.

##### 6.4A.2.1.0 Minimum conformance requirements

The requirements in this subclause apply to UEs of all power classes. For intra-band contiguous carrier aggregation, the Error Vector Magnitude requirement of section 6.4.2.1 is defined for each component carrier. Requirements only apply with PRB allocation in one of the component carriers. Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform.

##### 6.4A.2.1.1 Error vector magnitude for CA (2UL CA)

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

* Measurement Uncertainty and Test Tolerance are FFS.

6.4A.2.1.1.1 Test Purpose

For 2UL carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirement applies for the allocated component carrier, when all other component carriers are activated, but not allocated.

Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in section 6.4.2.1.

6.4A.2.1.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.4A.2.1.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.1.0

6.4A.2.1.1.4 Test description

6.4A.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 CA configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 6.4A.2.1.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4A.2.1.1.4.1-1: Test Configuration Table for 2UL CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | |
| Test SCS as specified in Table 5.3.5-1 | | | | Lowest, Highest | |
| Test Parameters | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 3) | **CBW (MHz)** | **RB allocation** | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | default | - | DFT-s-OFDM PI/2 BPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| 2 | PCC/CC1 | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| SCC/CC2 | - | - |
| 3 | PCC/CC1 | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| 4 | PCC/CC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| 5 | PCC/CC1 | DFT-s-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| 6 | PCC/CC1 | DFT-s-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| 7 | PCC/CC1 | DFT-s-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| 8 | PCC/CC1 | DFT-s-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| 9 | PCC/CC1 | CP-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| 10 | PCC/CC1 | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| 11 | PCC/CC1 | CP-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| 12 | PCC/CC1 | CP-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| 13 | PCC/CC1 | CP-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| 14 | PCC/CC1 | CP-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| 15 - 28 | PCC/CC1 | - | - |
| SCC/CC2 | **NOTE 4** | **NOTE 4** |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 4: Same Modulation and RB allocation of Test ID 1 – 14 are applied to Test ID 15 – 28 in sequence.  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

3. Downlink signals for PCC are initially set up according to Annex C, and uplink signals according to Annex G.

4. The UL Reference Measurement channels are set according to Table 6.4A.2.1.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.4A.2.1.1.4.3

6.4A.2.1.1.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2. Configure SCC according to Annex C.0, C.1, C.3 for all downlink physical channels.

3. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Message contents are defined in clause 6.4A.2.1.1.4.3.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause9.2).

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 Table 6.4A.2.1.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

7. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200ms starting from the first TPC command in this step for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

9. Measure the EVMθ, EVMφ,  and on PCC using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. For TDD, only slots consisting of only UL symbols are under test. Calculate  and .

10. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4A.2.1.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

Table 6.4A.2.1.1.4.2-1: Void

Table 6.4A.2.1.1.4.2-2: Void

Table 6.4A.2.1.1.4.2-3: Power Window (dB) for EVM PUSCH

FFS

6.4A.2.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.

6.4A.2.1.1.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4A.2.1.1.5-1.

The PUSCH, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4A.2.1.1.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4A.2.1.1.5-1: Test requirements for Error Vector Magnitude for CA

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

Table 6.4A.2.1.1.5-2: Test Tolerance for Error Vector Magnitude for CA

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

##### 6.4A.2.1.2 Error vector magnitude for CA (3UL CA)

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

* Measurement Uncertainty and Test Tolerance are FFS.

6.4A.2.1.2.1 Test Purpose

For 3UL carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirement applies for the allocated component carrier, when all other component carriers are activated, but not allocated.

Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in clause 6.4.2.1.

6.4A.2.1.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.4A.2.1.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.1.0

6.4A.2.1.2.4 Test description

Same as in clause 6.4A.2.1.1.4 with following exceptions:

- Instead of Table 6.4A.2.1.1.4.1-1 🡪 use Table 6.4A.2.1.2.4-1.

- Instead of Table 6.4A.2.1.1.5-1 🡪 use Table 6.4A.2.1.2.5-1.

Table 6.4A.2.1.2.4-1: Test Configuration Table for 3UL CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | |
| Test SCS as specified in Table 5.3.5-1 | | | | Lowest, Highest | |
| Test Parameters | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 3) | **CBW (MHz)** | **RB allocation** | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | default | - | DFT-s-OFDM PI/2 BPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 2 | PCC/CC1 | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 3 | PCC/CC1 | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 4 | PCC/CC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 5 | PCC/CC1 | DFT-s-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 6 | PCC/CC1 | DFT-s-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 7 | PCC/CC1 | DFT-s-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 8 | PCC/CC1 | DFT-s-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 9 | PCC/CC1 | CP-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 10 | PCC/CC1 | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 11 | PCC/CC1 | CP-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 12 | PCC/CC1 | CP-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 13 | PCC/CC1 | CP-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 14 | PCC/CC1 | CP-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| 15 - 28 | PCC/CC1 | - | - |
| SCC/CC2 | - | - |
| SCC/CC3 | **NOTE 4** | **NOTE 4** |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 4: Same Modulation and RB allocation of Test ID 1 – 14 are applied to Test ID 15 – 28 in sequence.  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | |

6.4A.2.1.2.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4A.2.1.2.5-1.

The PUSCH, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4A.2.1.2.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4A.2.1.2.5-1: Test requirements for Error Vector Magnitude

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

Table 6.4A.2.1.2.5-2: Test Tolerance for Error Vector Magnitude for CA

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

##### 6.4A.2.1.3 Error vector magnitude for CA (4UL CA)

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

* Measurement Uncertainty and Test Tolerance are FFS.

6.4A.2.1.3.1 Test Purpose

For 4UL carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirement applies for the allocated component carrier, when all other component carriers are activated, but not allocated.

Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in clause 6.4.2.1.

6.4A.2.1.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.4A.2.1.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.1.0

6.4A.2.1.3.4 Test description

Same as in clause 6.4A.2.1.1.4 with following exceptions:

- Instead of Table 6.4A.2.1.1.4.1-1 🡪 use Table 6.4A.2.1.3.4-1.

- Instead of Table 6.4A.2.1.1.5-1 🡪 use Table 6.4A.2.1.3.5-1.

Table 6.4A.2.1.3.4-1: Test Configuration Table for 4UL CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | |
| Test SCS as specified in Table 5.3.5-1 | | | | Lowest, Highest | |
| Test Parameters | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 3) | **CBW (MHz)** | **RB allocation** | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | default | - | DFT-s-OFDM PI/2 BPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 2 | PCC/CC1 | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 3 | PCC/CC1 | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 4 | PCC/CC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 5 | PCC/CC1 | DFT-s-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 6 | PCC/CC1 | DFT-s-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 7 | PCC/CC1 | DFT-s-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 |  |  |
| 8 | PCC/CC1 | DFT-s-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 9 | PCC/CC1 | CP-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 10 | PCC/CC1 | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 11 | PCC/CC1 | CP-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 12 | PCC/CC1 | CP-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 13 | PCC/CC1 | CP-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 14 | PCC/CC1 | CP-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| 15 - 28 | PCC/CC1 | - | - |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | **NOTE 4** | **NOTE 4** |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 4: Same Modulation and RB allocation of Test ID 1 – 14 are applied to Test ID 15 – 28 in sequence.  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | |

6.4A.2.1.3.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4A.2.1.3.5-1.

The PUSCH, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4A.2.1.3.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4A.2.1.3.5-1: Test requirements for Error Vector Magnitude

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

Table 6.4A.2.1.3.5-2: Test Tolerance for Error Vector Magnitude for CA

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

##### 6.4A.2.1.4 Error Vector magnitude for CA (5UL CA)

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

* Measurement Uncertainty and Test Tolerance are FFS.

6.4A.2.1.4.1 Test Purpose

For 5UL carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirement applies for the allocated component carrier, when all other component carriers are activated, but not allocated.

Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in clause 6.4.2.1.

6.4A.2.1.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.4A.2.1.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.1.0

6.4A.2.1.4.4 Test description

Same as in clause 6.4A.2.1.1.4 with following exceptions:

- Instead of Table 6.4A.2.1.1.4.1-1 🡪 use Table 6.4A.2.1.4.4-1.

- Instead of Table 6.4A.2.1.1.5-1 🡪 use Table 6.4A.2.1.4.5-1.

Table 6.4A.2.1.4.4-1: Test Configuration Table for 5UL CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | |
| Test SCS as specified in Table 5.3.5-1 | | | | Lowest, Highest | |
| Test Parameters | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 3) | **CBW (MHz)** | **RB allocation** | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | default | - | DFT-s-OFDM PI/2 BPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 2 | PCC/CC1 | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 3 | PCC/CC1 | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 4 | PCC/CC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 5 | PCC/CC1 | DFT-s-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 6 | PCC/CC1 | DFT-s-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 7 | PCC/CC1 | DFT-s-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 |  |  |
| SCC/CC5 | - | - |
| 8 | PCC/CC1 | DFT-s-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 9 | PCC/CC1 | CP-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 10 | PCC/CC1 | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 11 | PCC/CC1 | CP-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 12 | PCC/CC1 | CP-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 13 | PCC/CC1 | CP-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 14 | PCC/CC1 | CP-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| 15 - 28 | PCC/CC1 | - | - |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | **NOTE 4** | **NOTE 4** |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 4: Same Modulation and RB allocation of Test ID 1 – 14 are applied to Test ID 15 – 28 in sequence.  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | |

6.4A.2.1.4.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4A.2.1.4.5-1.

The PUSCH, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4A.2.1.4.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4A.2.1.4.5-1: Test requirements for Error Vector Magnitude for CA

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

Table 6.4A.2.1.4.5-2: Test Tolerance for Error Vector Magnitude for CA

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

##### 6.4A.2.1.5 Error Vector magnitude for CA (6UL CA)

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

* Measurement Uncertainty and Test Tolerance are FFS.

6.4A.2.1.5.1 Test Purpose

For 6UL carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirement applies for the allocated component carrier, when all other component carriers are activated, but not allocated.

Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in clause 6.4.2.1.

6.4A.2.1.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.4A.2.1.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.1.0

6.4A.2.1.5.4 Test description

Same as in clause 6.4A.2.1.1.4 with following exceptions:

- Instead of Table 6.4A.2.1.1.4.1-1 🡪 use Table 6.4A.2.1.5.4-1.

- Instead of Table 6.4A.2.1.1.5-1 🡪 use Table 6.4A.2.1.5.5-1.

Table 6.4A.2.1.5.4-1: Test Configuration Table for 6UL CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | |
| Test SCS as specified in Table 5.3.5-1 | | | | Lowest, Highest | |
| Test Parameters | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 3) | **CBW (MHz)** | **RB allocation** | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | default | - | DFT-s-OFDM PI/2 BPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 2 | PCC/CC1 | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 3 | PCC/CC1 | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 4 | PCC/CC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 5 | PCC/CC1 | DFT-s-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 6 | PCC/CC1 | DFT-s-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 7 | PCC/CC1 | DFT-s-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 |  |  |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 8 | PCC/CC1 | DFT-s-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 9 | PCC/CC1 | CP-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 10 | PCC/CC1 | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 11 | PCC/CC1 | CP-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 12 | PCC/CC1 | CP-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 13 | PCC/CC1 | CP-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 14 | PCC/CC1 | CP-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| 15 -28 | PCC/CC1 | - | - |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | **NOTE 4** | **NOTE 4** |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 4: Same Modulation and RB allocation of Test ID 1 – 14 are applied to Test ID 15 – 28 in sequence.  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | |

6.4A.2.1.5.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4A.2.1.5.5-1.

The PUSCH, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4A.2.1.5.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4A.2.1.5.5-1: Test requirements for Error Vector Magnitude for CA

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

Table 6.4A.2.1.5.5-2: Test Tolerance for Error Vector Magnitude for CA

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

##### 6.4A.2.1.6 Error vector magnitude for CA (7UL CA)

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

* Measurement Uncertainty and Test Tolerance are FFS.

6.4A.2.1.6.1 Test Purpose

For 7UL carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirement applies for the allocated component carrier, when all other component carriers are activated, but not allocated.

Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in sub-section 6.4.2.1.

6.4A.2.1.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.4A.2.1.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.1.0

6.4A.2.1.6.4 Test description

Same as in clause 6.4A.2.1.1.4 with following exceptions:

- Instead of Table 6.4A.2.1.1.4.1-1 🡪 use Table 6.4A.2.1.6.4-1.

- Instead of Table 6.4A.2.1.1.5-1 🡪 use Table 6.4A.2.1.6.5-1.

Table 6.4A.2.1.6.4-1: Test Configuration Table for 7UL CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | |
| Test SCS as specified in Table 5.3.5-1 | | | | Lowest, Highest | |
| Test Parameters | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 3) | **CBW (MHz)** | **RB allocation** | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | default | - | DFT-s-OFDM PI/2 BPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 2 | PCC/CC1 | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 3 | PCC/CC1 | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 4 | PCC/CC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 5 | PCC/CC1 | DFT-s-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 6 | PCC/CC1 | DFT-s-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 7 | PCC/CC1 | DFT-s-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 |  |  |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 8 | PCC/CC1 | DFT-s-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 9 | PCC/CC1 | CP-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 10 | PCC/CC1 | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 11 | PCC/CC1 | CP-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 12 | PCC/CC1 | CP-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 13 | PCC/CC1 | CP-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 14 | PCC/CC1 | CP-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| 15 - 28 | PCC/CC1 | - | - |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | **NOTE 4** | **NOTE 4** |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 4: Same Modulation and RB allocation of Test ID 1 – 14 are applied to Test ID 15 – 28 in sequence.  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | |

6.4A.2.1.6.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4A.2.1.6.5-1.

The PUSCH, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4A.2.1.6.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4A.2.1.6.5-1: Test requirements for Error Vector Magnitude for CA

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

Table 6.4A.2.1.6.5-2: Test Tolerance for Error Vector Magnitude for CA

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

##### 6.4A.2.1.7 Error vector magnitude for CA (8UL CA)

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

* Measurement Uncertainty and Test Tolerance are FFS.

6.4A.2.1.7.1 Test Purpose

For 8UL carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirement applies for the allocated component carrier, when all other component carriers are activated, but not allocated.

Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in sub-section 6.4.2.1.

6.4A.2.1.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.4A.2.1.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.1.0

6.4A.2.1.7.4 Test description

Same as in clause 6.4A.2.1.1.4 with following exceptions:

- Instead of Table 6.4A.2.1.1.4.1-1 🡪 use Table 6.4A.2.1.7.4-1.

- Instead of Table 6.4A.2.1.1.5-1 🡪 use Table 6.4A.2.1.7.5-1.

Table 6.4A.2.1.7.4-1: Test Configuration Table for 8UL CA

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | |
| Test SCS as specified in Table 5.3.5-1 | | | | Lowest, Highest | |
| Test Parameters | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 3) | **CBW (MHz)** | **RB allocation** | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | default | - | DFT-s-OFDM PI/2 BPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 2 | PCC/CC1 | DFT-s-OFDM PI/2 BPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 3 | PCC/CC1 | DFT-s-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 4 | PCC/CC1 | DFT-s-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 5 | PCC/CC1 | DFT-s-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 6 | PCC/CC1 | DFT-s-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 7 | PCC/CC1 | DFT-s-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 |  |  |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 8 | PCC/CC1 | DFT-s-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 9 | PCC/CC1 | CP-OFDM QPSK | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 10 | PCC/CC1 | CP-OFDM QPSK | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 11 | PCC/CC1 | CP-OFDM 16 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 12 | PCC/CC1 | CP-OFDM 16 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 13 | PCC/CC1 | CP-OFDM 64 QAM | Inner\_Full for PC2, PC3, PC4  Inner\_Full\_Region1 for PC1 |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 14 | PCC/CC1 | CP-OFDM 64 QAM | Outer\_Full |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | - | - |
| 15 -28 | PCC/CC1 | - | - |
| SCC/CC2 | - | - |
| SCC/CC3 | - | - |
| SCC/CC4 | - | - |
| SCC/CC5 | - | - |
| SCC/CC6 | - | - |
| SCC/CC7 | - | - |
| SCC/CC8 | **NOTE 4** | **NOTE 4** |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 4: Same Modulation and RB allocation of Test ID 1 – 14 are applied to Test ID 15 – 28 in sequence.  NOTE 5: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | |

6.4A.2.1.7.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4A.2.1.7.5-1.

The PUSCH, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4A.2.1.7.5-1 when embedded with data symbols of the respective modulation scheme.

Table 6.4A.2.1.7.5-1: Test requirements for Error Vector Magnitude for CA

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

Table 6.4A.2.1.7.5-2: Test Tolerance for Error Vector Magnitude for CA

|  |  |  |
| --- | --- | --- |
| **Test Metric** | FR2a | FR2b |
| Max device size ≤ 30 cm | FFS | FFS |

#### 6.4A.2.2 Carrier leakage for CA

Editor’s note: This test is incomplete due to lack of RRC framework for LO position retrieval.

##### 6.4A.2.2.0 Minimum conformance requirements

6.4A.2.2.0.1 General

Carrier leakage is an additive sinusoid waveform. The carrier leakage requirement is defined for each component carrier and is measured on the component carrier with PRBs allocated. The measurement interval is one slot in the time domain.

Note: When UE has DL configured for non-contiguous CA, carrier leakage may land outside the spectrum occupied by all configured UL and DL CC.

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The requirement is verified with the test metric of Carrier Leakage (Link=TX beam peak direction, Meas=Link angle).

6.4A.2.2.0.2 Carrier leakage for power class 1

When carrier leakage is contained inside the spectrum occupied by all configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4A.2.2.0.2-1 for power class 1 UEs.

Table 6.4A.2.2.0.2-1: Minimum requirements for relative carrier leakage for power class 1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 17 dBm | -25 |
| 4 dBm ≤ EIRP ≤ 17 dBm | -20 |

6.4A.2.2.0.3 Carrier leakage for power class 2

When carrier leakage is contained inside the spectrum occupied by all configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4A.2.2.0.3-1 for power class 2.

Table 6.4A.2.2.0.3-1: Minimum requirements for relative carrier leakage power class 2

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| EIRP > 6 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 6 dBm | -20 |

6.4A.2.2.0.4 Carrier leakage for power class 3

When carrier leakage is contained inside the spectrum occupied by all configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4A.2.2.0.4-1 for power class 3 UEs.

Table 6.4A.2.2.0.4-1: Minimum requirements for relative carrier leakage power class 3

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| Output power > 0 dBm | -25 |
| -13 dBm ≤ Output power EIRP ≤ 0 dBm | -20 |

6.4A.2.2.0.5 Carrier leakage for power class 4

When carrier leakage is contained inside the spectrum occupied by all configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4A.2.2.0.5-1 for power class 4 UEs.

Table 6.4A.2.2.0.5-1: Minimum requirements for relative carrier leakage power class 4

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| Output power > 11 dBm | -25 |
| -13 dBm ≤ Output power EIRP ≤ 11 dBm | -20 |

##### 6.4A.2.2.1 Carrier leakage for CA (2UL CA)

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

- This test is incomplete due to lack of RRC framework for LO position retrieval.

* Power window is TBD for power class 1, 2 and 4.
* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA is TBD.

6.4A.2.2.1.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal. Carrier leakage interferes with the sub carriers at its position (if allocated), especially, when their amplitude is small.

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

6.4A.2.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.4A.2.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.2.0.

6.4A.2.2.1.4 Test description

6.4A.2.2.1.4.1 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, and CC combinations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration and subcarrier spacing, are shown in Table 6.4A.2.2.1.4.1-1. 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 6.4A.2.2.1.4.1-1: Intra-band Contiguous CA Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | Highest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 5) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | Default | - | | DFT-s-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC/CC2 |  | |  |  |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: When the signalled DC carrier position is at Inner\_Partial\_Left for PC2, PC3, PC4, use Inner\_Partial\_Right for UL RB allocation. When the signalled DC carrier position is in Inner\_Partial\_Left\_Region2 for PC1, use Inner\_Partial\_Right\_Region2 for UL RB allocation.  NOTE 5: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 6: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.4A.2.2.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.4A.2.2.1.4.3

6.4A.2.2.1.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2. Configure PCC and SCC according to Annex C.0, C.1, C.2 and Annex C.3.0 for all downlink physical channels.

3. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1 Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in clause 6.4A.2.2.1.4.3.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 Table 6.4A.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.

6. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

7. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE EIRPTotal = EIRPθ + EIRPφ 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 Preq, where:

- Preq is the power level specified in Table 6.4.2.2.4.2-1 according to the power class.

- MU is the test system uplink absolute power measurement uncertainty and is specified in Table F.1.2-1 under carrier leakage sub-clause for the carrier frequency f and the channel bandwidth BW.

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

Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

9. Measure carrier leakage on PCC using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarization at the LO position obtained in step 1. For TDD, only slots consisting of only UL symbols are under test. Calculate CarrLeak = min(CarrLeakθ , CarrLeakφ).

10. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: 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 6.4A.2.2.1.4.2-1: UE EIRP Preq (dBm) for carrier leakage

|  |  |
| --- | --- |
| Power Class | Preq (dBm) for step 5 |
| Power Class 1 | 17 |
| Power Class 2 | 6 |
| Power Class 3 | 0 |
| Power Class 4 | 11 |

Table 6.4A.2.2.1.4.2-2: Void.

6.4A.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.4A.2.2.1.5 Test requirement

For each of the *n* carrier leakage results derived in Annex E.3.1 for θ- and φ-polarization the minimum is calculated according to

CarrLeak = min(CarrLeakθ , CarrLeakφ), where

.

Each of the *n* carrier leakage results CarrLeak shall not exceed the values in Table 6.4.2.2.5-1 for power class 1 Table 6.4.2.2.5-2 for power class 2, Table 6.4.2.2.5-3 for power class 3 and Table 6.4.2.2.5-4 for power class 4. Allocated RBs are not under test.

##### 6.4A.2.2.2 Carrier leakage for CA (3UL CA)

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

* This test is incomplete due to lack of RRC framework for LO position retrieval.
* Power window is TBD for power class 1, 2 and 4.
* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA is TBD.

6.4A.2.2.2.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal. Carrier leakage interferes with the sub carriers at its position (if allocated), especially, when their amplitude is small.

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

6.4A.2.2.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.4A.2.2.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.2.0.

6.4A.2.2.2.4 Test description

Same as in clause 6.4A.2.2.1.4 with the following exceptions:

- Instead of Table 6.4A.2.2.1.4.1-1→ use Table 6.4A.2.2.2.4-1.

Table 6.4A.2.2.2.4-1: Intra-band Contiguous CA Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1 | | | | Highest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 5) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | Default | - | | DFT-s-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC/CC2 |  | |  |  |
| SCC/CC3 |  | |  |  |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: When the signalled DC carrier position is at Inner\_Partial\_Left for PC2, PC3, PC4, use Inner\_Partial\_Right for UL RB allocation. When the signalled DC carrier position is in Inner\_16RB\_Left\_Region2 for PC1, use Inner\_16RB\_Right\_Region2 for UL RB allocation.  NOTE 5: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 6: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.2.2.5 Test requirement

For each of the *n* carrier leakage results derived in Annex E.3.1 for θ- and φ-polarization the minimum is calculated according to

CarrLeak = min(CarrLeakθ , CarrLeakφ), where

.

Each of the *n* carrier leakage results CarrLeak shall not exceed the values in Table 6.4.2.2.5-1 for power class 1, Table 6.4.2.2.5-2 for power class 2, Table 6.4.2.2.5-3 for power class 3 and Table 6.4.2.2.5-4 for power class 4. Allocated RBs are not under test.

##### 6.4A.2.2.3 Carrier leakage for CA (4UL CA)

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

- This test is incomplete due to lack of RRC framework for LO position retrieval.

* Power window is TBD for power class 1, 2 and 4.
* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA is TBD.

6.4A.2.2.3.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal. Carrier leakage interferes with the sub carriers at its position (if allocated), especially, when their amplitude is small.

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

6.4A.2.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.4A.2.2.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.2.0.

6.4A.2.2.3.4 Test description

Same as in clause 6.4A.2.2.1.4 with the following exceptions:

- Instead of Table 6.4A.2.2.1.4.1-1→ use Table 6.4A.2.2.3.4-1.

Table 6.4A.2.2.3.4-1: Intra-band Contiguous CA Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW | | |
| Test SCS as specified in Table 5.3.5-1 | | | | Highest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 5) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 50 | - | | DFT-s-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC/CC2 | 50 |  | | DFT-s-OFDM QPSK |  |
| SCC/CC3 | 50 |  | | DFT-s-OFDM QPSK |  |
| SCC/CC4 | 50 |  | | DFT-s-OFDM QPSK |  |
| NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: When the signalled DC carrier position is at Inner\_Partial\_Left for PC2, PC3, PC4, use Inner\_Partial\_Right for UL RB allocation. When the signalled DC carrier position is in Inner\_Partial\_Left\_Region2 for PC1, use Inner\_Partial\_Right\_Region2 for UL RB allocation.  NOTE 5: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS38.508-1 [10].  NOTE 6: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.2.3.5 Test requirement

For each of the *n* carrier leakage results derived in Annex E.3.1 for θ- and φ-polarization the minimum is calculated according to

CarrLeak = min(CarrLeakθ , CarrLeakφ), where

.

Each of the *n* total carrier leakage results CarrLeak shall not exceed the values in Table 6.4.2.2.5-1 for power class 1, Table 6.4.2.2.5-2 for power class 2, Table 6.4.2.2.5-3 for power class 3 and Table 6.4.2.2.5-4 for power class 4. Allocated RBs are not under test.

##### 6.4A.2.2.4 Carrier leakage for CA (5UL CA)

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

- This test is incomplete due to lack of RRC framework for LO position retrieval.

* Power window is TBD for power class 1, 2 and 4.
* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA is TBD.

6.4A.2.2.4.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal. Carrier leakage interferes with the sub carriers at its position (if allocated), especially, when their amplitude is small.

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

6.4A.2.2.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.4A.2.2.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.2.0.

6.4A.2.2.4.4 Test description

Same as in clause 6.4A.2.2.1.4 with the following exceptions:

- Instead of Table 6.4A.2.2.1.4.1-1→ use Table 6.4A.2.2.4.4-1.

Table 6.4A.2.2.4.4-1: Intra-band Contiguous CA Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW | | |
| Test SCS as specified in Table 5.3.5-1 | | | | Highest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 5) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 50 | - | | DFT-s-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC/CC2 | 50 |  | | - | - |
| SCC/CC3 | 50 |  | | - | - |
| SCC/CC4 | 50 |  | | - | - |
| SCC/CC5 | 50 |  | | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: When the signalled DC carrier position is at Inner\_Partial\_Left for PC2, PC3, PC4, use Inner\_Partial\_Right for UL RB allocation. When the signalled DC carrier position is in Inner\_Partial\_Left\_Region2 for PC1, use Inner\_Partial\_Right\_Region2 for UL RB allocation.  NOTE 5: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS 38.508-1 [10].  NOTE 6: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.2.4.5 Test requirement

For each of the *n* carrier leakage results derived in Annex E.3.1 for θ- and φ-polarization the minimum is calculated according to

CarrLeak = min(CarrLeakθ , CarrLeakφ), where

.

Each of the *n* carrier leakage results CarrLeak shall not exceed the values in Table 6.4.2.2.5-1 for power class 1, Table 6.4.2.2.5-2 for power class 2, Table 6.4.2.2.5-3 for power class 3 and Table 6.4.2.2.5-4 for power class 4. Allocated RBs are not under test.

##### 6.4A.2.2.5 Carrier leakage for CA (6UL CA)

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

* This test is incomplete due to lack of RRC framework for LO position retrieval.
* Power window is TBD for power class 1, 2 and 4.
* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA is TBD.

6.4A.2.2.5.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal. Carrier leakage interferes with the sub carriers at its position (if allocated), especially, when their amplitude is small.

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

6.4A.2.2.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.4A.2.2.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.2.0.

6.4A.2.2.5.4 Test description

Same as in clause 6.4A.2.2.1.4 with the following exceptions:

- Instead of Table 6.4A.2.2.1.4.1-1→ use Table 6.4A.2.2.5.4-1.

Table 6.4A.2.2.5.4-1: Intra-band Contiguous CA Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW | | |
| Test SCS as specified in Table 5.3.5-1 | | | | Highest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 5) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 50 | - | | DFT-s-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC/CC2 | 50 |  | | - | - |
| SCC/CC3 | 50 |  | | - | - |
| SCC/CC4 | 50 |  | | - | - |
| SCC/CC5 | 50 |  | | - | - |
| SCC/CC6 | 50 |  | | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: When the signalled DC carrier position is at Inner\_Partial\_Left for PC2, PC3, PC4, use Inner\_Partial\_Right for UL RB allocation. When the signalled DC carrier position is in Inner\_Partial\_Left\_Region2 for PC1, use Inner\_Partial\_Right\_Region2 for UL RB allocation.  NOTE 5: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS 38.508-1 [10].  NOTE 6: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.2.5.5 Test requirement

For each of the *n* carrier leakage results derived in Annex E.3.1 for θ- and φ-polarization the minimum is calculated according to

CarrLeak = min(CarrLeakθ , CarrLeakφ)., where

.

Each of the *n* carrier leakage results CarrLeak shall not exceed the values in Table 6.4.2.2.5-1 for power class 1, Table 6.4.2.2.5-2 for power class 2, Table 6.4.2.2.5-3 for power class 3 and Table 6.4.2.2.5-4 for power class 4. Allocated RBs are not under test.

##### 6.4A.2.2.6 Carrier leakage for CA (7UL CA)

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

- This test is incomplete due to lack of RRC framework for LO position retrieval.

* Power window is TBD for power class 1, 2 and 4.
* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA is TBD.

6.4A.2.2.6.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal. Carrier leakage interferes with the sub carriers at its position (if allocated), especially, when their amplitude is small.

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

6.4A.2.2.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.4A.2.2.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.2.0.

6.4A.2.2.6.4 Test description

Same as in clause 6.4A.2.2.1.4 with the following exceptions:

- Instead of Table 6.4A.2.2.1.4.1-1→ use Table 6.4A.2.2.6.4-1.

Table 6.4A.2.2.6.4-1: Intra-band Contiguous CA Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW | | |
| Test SCS as specified in Table 5.3.5-1 | | | | Highest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 5) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 50 | - | | DFT-s-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC/CC2 | 50 |  | | - | - |
| SCC/CC3 | 50 |  | | - | - |
| SCC/CC4 | 50 |  | | - | - |
| SCC/CC5 | 50 |  | | - | - |
| SCC/CC6 | 50 |  | | - | - |
| SCC/CC7 | 50 |  | | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: When the signalled DC carrier position is at Inner\_Partial\_Left for PC2, PC3, PC4, use Inner\_Partial\_Right for UL RB allocation. When the signalled DC carrier position is in Inner\_Partial\_Left\_Region2 for PC1, use Inner\_Partial\_Right\_Region2 for UL RB allocation.  NOTE 5: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS 38.508-1 [10].  NOTE 6: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.2.6.5 Test requirement

For each of the *n* carrier leakage results derived in Annex E.3.1 for θ- and φ-polarization the minimum is calculated according to

CarrLeak = min(CarrLeakθ , CarrLeakφ)., where

.

Each of the *n* carrier leakage results CarrLeak shall not exceed the values in Table 6.4.2.2.5-1 for power class 1, Table 6.4.2.2.5-2 for power class 2, Table 6.4.2.2.5-3 for power class 3 and Table 6.4.2.2.5-4 for power class 4. Allocated RBs are not under test.

##### 6.4A.2.2.7 Carrier leakage for CA (8UL CA)

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

* This test is incomplete due to lack of RRC framework for LO position retrieval.
* Power window is TBD for power class 1, 2 and 4.
* Measurement Uncertainties and Test Tolerances for intra-band contiguous CA is TBD.

6.4A.2.2.7.1 Test purpose

Carrier leakage expresses itself as unmodulated sine wave with the carrier frequency. It is an interference of approximately constant amplitude and independent of the amplitude of the wanted signal. Carrier leakage interferes with the sub carriers at its position (if allocated), especially, when their amplitude is small.

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

6.4A.2.2.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.4A.2.2.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.2.0.

6.4A.2.2.7.4 Test description

Same as in clause 6.4A.2.2.1.4 with the following exceptions:

- Instead of Table 6.4A.2.2.1.4.1-1→ use Table 6.4A.2.2.7.4-1.

Table 6.4A.2.2.7.4-1: Intra-band Contiguous CA Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes | | | | Low and High range | | |
| Test CC Combination setting (aggregated BW of the CA configuration) as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE | | | | Lowest aggregated BW | | |
| Test SCS as specified in Table 5.3.5-1 | | | | Highest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping (NOTE 5) | **CBW (MHz)** | **RB allocation** | | Modulation | RB allocation  (NOTE 1) |
| 1 | PCC/CC1 | 50 | - | | DFT-s-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC/CC2 | 50 |  | | - | - |
| SCC/CC3 | 50 |  | | - | - |
| SCC/CC4 | 50 |  | | - | - |
| SCC/CC5 | 50 |  | | - | - |
| SCC/CC6 | 50 |  | | - | - |
| SCC/CC7 | 50 |  | | - | - |
| SCC/CC8 | 50 |  | | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same cumulative aggregated BW, only the combination with the lowest PCC ChBW is tested.  NOTE 4: When the signalled DC carrier position is at Inner\_Partial\_Left for PC2, PC3, PC4, use Inner\_Partial\_Right for UL RB allocation. When the signalled DC carrier position is in Inner\_Partial\_Left\_Region2 for PC1, use Inner\_Partial\_Right\_Region2 for UL RB allocation.  NOTE 5: PCC/CCi and SCC/CCj means PCC is on component carrier CCi and SCC is on component carrier CCj, with CCi or CCj frequencies defined in TS 38.508-1 [10].  NOTE 6: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.2.7.5 Test requirement

For each of the *n* carrier leakage results derived in Annex E.3.1 for θ- and φ-polarization the minimum is calculated according to

CarrLeak = min(CarrLeakθ , CarrLeakφ), where

.

Each of the *n* carrier leakage results CarrLeak shall not exceed the values in Table 6.4.2.2.5-1 for power class 1, Table 6.4.2.2.5-2 for power class 2, Table 6.4.2.2.5-3 for power class 3 and Table 6.4.2.2.5-4 for power class 4. Allocated RBs are not under test.

#### 6.4A.2.3 In-band emissions for CA

Editor’s note: This test is incomplete due to lack of RRC framework for LO position retrieval

##### 6.4A.2.3.0 Minimum conformance requirements

6.4A.2.3.0.1 General

Inband emission requirement is defined over the spectrum occupied by all configured UL and DL CCs. The measurement interval is as defined in section 6.4.2.4. The requirement is verified with the test metric of In-band emission (Link=TX beam peak direction, Meas=Link angle).

For intra-band contiguous carrier aggregation, the requirements in this clause apply with all component carriers active and with one single contiguous PRB allocation in one of uplink component carriers. The inband emission is defined as the interference falling into the non-allocated resource blocks for all component carriers.

6.4A.2.3.0.2 In-band emissions for power class 1

The relative in-band emission shall not exceed the values specified in Table 6.4A.2.3.0.2-1 for power class 1 UEs.

Table 6.4A.2.3.0.2-1: Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB |  | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25 | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 27 dBm |
| Carrier leakage | dBc | -25 | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

6.4A.2.3.0.3 In-band emissions for power class 2

The relative in-band emission shall not exceed the values specified in Table 6.4A.2.3.0.3-1 for power class 2.

Table 6.4A.2.3.0.3-1: Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB |  | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25 | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 16 dBm |
| Carrier leakage | dBc | -25 | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

6.4A.2.3.0.4 In-band emissions for power class 3

The relative in-band emission shall not exceed the values specified in Table 6.4A.2.3.0.4-1 for power class 3 UEs.

Table 6.4A.2.3.0.4-1: Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB |  | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25 | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25 | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

6.4A.2.3.0.5 In-band emissions for power class 4

The relative in-band emission shall not exceed the values specified in Table 6.4A.2.3.0.5-1 for power class 4 UEs.

Table 6.4A.2.3.0.5-1: Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB |  | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25 | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 21 dBm |
| Carrier leakage | dBc | -25 | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤ 11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

##### 6.4A.2.3.1 In-band emissions for CA (2UL CA)

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

* The test procedure is incomplete due to that power window for CA is TBD
* Measurement Uncertainty and Test Tolerance are FFS.
* Testing of the general in-band emission requirement and if yes at which UE Tx power level and with which relaxation applied to the requirement is FFS.
* TP analysis is FFS

6.4A.2.3.1.1 Test purpose

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

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

6.4A.2.3.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 2UL CA.

6.4A.2.3.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.3.0.

6.4A.2.3.1.4 Test description

6.4A.2.3.1.4.1 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, and CC combinations based on NR operating bands specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each channel bandwidth and subcarrier spacing, are shown in Table 6.4A.2.3.1.4.1-1. 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 6.4A.2.3.1.4.1-1: Test Configuration Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Lowest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping | ChBw(MHz) | RB allocation | | Modulation | RB allocation (NOTE 1) |
| 1 | PCC | Default | - | | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| 2 | PCC | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| 3 | PCC | CP-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| 4 | PCC | CP-OFDM QPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

3. Downlink signals for PCC are initially set up according to Annex C, and uplink signals according to Annex G.

4. The UL Reference Measurement channels are set according to Table 6.4A.2.3.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.4A.2.3.1.4.3

6.4A.2.3.1.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2. Configure SCC according to Annex C.0, C.1 and C.3.0 for all downlink physical channels.

3. The SS shall configure SCC as per TS 38.508-1 [10] clause 5.5.1. Procedure to configure SCC(s) for NR RF CA testing. Message contents are defined in clause 6.4A.2.3.1.4.3.

4. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [28], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[25], clause 9.3).

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 Table 6.4A.2.3.1.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

7. Send the appropriate TPC commands in the uplink scheduling information to the UE until UE output power is Preq + PW ± PW, where Preq is the power level specified in Table 6.4A.2.3.1.4.2-1 according to the power class with power ID = 1. PW is the power window according to Table 6.4A.2.3.1.4.2-2 for the carrier frequency f and the channel bandwidth BW. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

8. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

9. Measure In-band emission IEθ, IEφ on PCC using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. Measure power spectral density on the SCC. For TDD, only slots consisting of only UL symbols are under test. Calculate IE = IEθ + IEφ, where the calculation is based on linear power ratios.

10. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

11. Repeat steps 6 through 10 until In-band emissions have been measured for all power IDs in Table 6.4A.2.3.1.4.2-1.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4A.2.3.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

Table 6.4A.2.3.1.4.2-1: Parameters for In-band emissions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Power ID | Unit | Level for power class 1 | Level for power class 2 | Level for power class 3 | Level for power class 4 |
| 1 | dBm | 27 | 16 | 10 | 21 |
| 2 | dBm | 17 | 6 | 0 | 11 |

Table 6.4A.2.3.1.4.2-2: Power Window (dB) for In-band emissions

FFS

6.4A.2.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6.

6.4A.2.3.1.5 Test requirement

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.1.5-1 for power class 1 UEs.

Table 6.4A.2.3.1.5-1: Test Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 27 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.1.5-2 for power class 2 UEs.

Table 6.4A.2.3.1.5-2: Test Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 16 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.1.5-3 for power class 3 UEs.

Table 6.4A.2.3.1.5-3: Test Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.1.5-4 for power class 4 UEs.

Table 6.4A.2.3.1.5-4: Test Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 21 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 8: is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. = 1 or = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

##### 6.4A.2.3.2 In-band emissions for CA (3UL CA)

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

* The test procedure is incomplete due to that power window for CA is TBD
* Measurement Uncertainty and Test Tolerance are FFS.
* Testing of the general in-band emission requirement and if yes at which UE Tx power level and with which relaxation applied to the requirement is FFS.
* TP analysis is FFS

6.4A.2.3.2.1 Test purpose

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

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

6.4A.2.3.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 3UL CA.

6.4A.2.3.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.3.0.

6.4A.2.3.2.4 Test description

Same as in clause 6.4A.2.3.1.4 with following exceptions:

- Instead of Table 6.4A.2.3.1.4.1-1 🡪 use Table 6.4A.2.3.2.4-1.

Table 6.4A.2.3.2.4-1: Test Configuration Table for 3UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Lowest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping | ChBw(MHz) | RB allocation | | Modulation | RB allocation (NOTE 1) |
| 1 | PCC | Default | - | | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| 2 | PCC | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| 3 | PCC | CP-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| 4 | PCC | CP-OFDM QPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.3.2.5 Test requirement

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.2.5-1 for power class 1 UEs.

Table 6.4A.2.3.2.5-1: Test Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 27 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.2.5-2 for power class 2 UEs.

Table 6.4A.2.3.2.5-2: Test Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 16 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: D*RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.2.5-3 for power class 3 UEs.

Table 6.4A.2.3.2.5-3: Test Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.2.5-4 for power class 4 UEs.

Table 6.4A.2.3.2.5-4: Test Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 21 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

##### 6.4A.2.3.3 In-band emissions for CA (4UL CA)

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

* The test procedure is incomplete due to that power window for CA is TBD
* Measurement Uncertainty and Test Tolerance are FFS.
* Testing of the general in-band emission requirement and if yes at which UE Tx power level and with which relaxation applied to the requirement is FFS.
* TP analysis is FFS

6.4A.2.3.3.1 Test purpose

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

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

6.4A.2.3.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 4UL CA.

6.4A.2.3.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.3.0.

6.4A.2.3.3.4 Test description

Same as in clause 6.4A.2.3.1.4 with following exceptions:

- Instead of Table 6.4A.2.3.1.4.1-1 🡪 use Table 6.4A.2.3.3.4-1.

Table 6.4A.2.3.3.4-1: Test Configuration Table for 4UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Lowest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping | ChBw(MHz) | RB allocation | | Modulation | RB allocation (NOTE 1) |
| 1 | PCC | Default | - | | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| 2 | PCC | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| 3 | PCC | CP-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| 4 | PCC | CP-OFDM QPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.3.3.5 Test requirement

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.3.5-1 for power class 1 UEs.

Table 6.4A.2.3.3.5-1: Test Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 27 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.3.5-2 for power class 2 UEs.

Table 6.4A.2.3.3.5-2: Test Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 16 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.3.5-3 for power class 3 UEs.

Table 6.4A.2.3.3.5-3: Test Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or RB = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.3.5-4 for power class 4 UEs.

Table 6.4A.2.3.3.5-4: Test Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 21 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

##### 6.4A.2.3.4 In-band emissions for CA (5UL CA)

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

* The test procedure is incomplete due to that power window for CA is TBD
* Measurement Uncertainty and Test Tolerance are FFS.
* Testing of the general in-band emission requirement and if yes at which UE Tx power level and with which relaxation applied to the requirement is FFS.
* TP analysis is FFS

6.4A.2.3.4.1 Test purpose

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

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

6.4A.2.3.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 5UL CA.

6.4A.2.3.4.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.3.0.

6.4A.2.3.4.4 Test description

Same as in clause 6.4A.2.3.1.4 with following exceptions:

- Instead of Table 6.4A.2.3.1.4.1-1 🡪 use Table 6.4A.2.3.4.4-1.

Table 6.4A.2.3.4.4-1: Test Configuration Table for 5UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Lowest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping | ChBw(MHz) | RB allocation | | Modulation | RB allocation (NOTE 1) |
| 1 | PCC | Default | - | | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| 2 | PCC | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| 3 | PCC | CP-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| 4 | PCC | CP-OFDM QPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.3.4.5 Test requirement

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.4.5-1 for power class 1 UEs.

Table 6.4A.2.3.4.5-1: Test Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 27 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.4.5-2 for power class 2 UEs.

Table 6.4A.2.3.4.5-2: Test Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 16 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.4.5-3 for power class 3 UEs.

Table 6.4A.2.3.4.5-3: Test Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.4.5-4 for power class 4 UEs.

Table 6.4A.2.3.4.5-4: Test Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 21 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: D*RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or D*RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

##### 6.4A.2.3.5 In-band emissions for CA (6UL CA)

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

* The test procedure is incomplete due to that power window for CA is TBD
* Measurement Uncertainty and Test Tolerance are FFS.
* Testing of the general in-band emission requirement and if yes at which UE Tx power level and with which relaxation applied to the requirement is FFS.
* TP analysis is FFS

6.4A.2.3.5.1 Test purpose

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

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

6.4A.2.3.5.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 6UL CA.

6.4A.2.3.5.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.3.0.

6.4A.2.3.5.4 Test description

Same as in clause 6.4A.2.3.1.4 with following exceptions:

- Instead of Table 6.4A.2.3.1.4.1-1 🡪 use Table 6.4A.2.3.5.4-1.

Table 6.4A.2.3.5.4-1: Test Configuration Table for 6UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Lowest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping | ChBw(MHz) | RB allocation | | Modulation | RB allocation (NOTE 1) |
| 1 | PCC | Default | - | | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| 2 | PCC | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| 3 | PCC | CP-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| 4 | PCC | CP-OFDM QPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.3.5.5 Test requirement

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.5.5-1 for power class 1 UEs.

Table 6.4A.2.3.5.5-1: Test Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 27 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.5.5-2 for power class 2 UEs.

Table 6.4A.2.3.5.5-2: Test Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 16 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.5.5-3 for power class 3 UEs.

Table 6.4A.2.3.5.5-3: Test Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.5.5-4 for power class 4 UEs.

Table 6.4A.2.3.5.5-4: Test Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 21 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

##### 6.4A.2.3.6 In-band emissions for CA (7UL CA)

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

* The test procedure is incomplete due to that power window for CA is TBD
* Measurement Uncertainty and Test Tolerance are FFS.
* Testing of the general in-band emission requirement and if yes at which UE Tx power level and with which relaxation applied to the requirement is FFS.
* TP analysis is FFS

6.4A.2.3.6.1 Test purpose

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

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

6.4A.2.3.6.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 7UL CA.

6.4A.2.3.6.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.3.0.

6.4A.2.3.6.4 Test description

Same as in clause 6.4A.2.3.1.4 with following exceptions:

- Instead of Table 6.4A.2.3.1.4.1-1 🡪 use Table 6.4A.2.3.6.4-1.

Table 6.4A.2.3.6.4-1: Test Configuration Table for 7UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Lowest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping | ChBw(MHz) | RB allocation | | Modulation | RB allocation (NOTE 1) |
| 1 | PCC | Default | - | | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| SCC6 | - | - |
| 2 | PCC | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| SCC6 | - | - |
| 3 | PCC | CP-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| SCC6 | - | - |
| 4 | PCC | CP-OFDM QPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| SCC6 | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.3.6.5 Test requirement

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.6.5-1 for power class 1 UEs.

Table 6.4A.2.3.6.5-1: Test Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 27 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.6.5-2 for power class 2 UEs.

Table 6.4A.2.3.6.5-2: Test Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 16 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.6.5-3 for power class 3 UEs.

Table 6.4A.2.3.6.5-3: Test Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.6.5-4 for power class 4 UEs.

Table 6.4A.2.3.6.5-4: Test Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 21 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

##### 6.4A.2.3.7 In-band emissions for CA (8UL CA)

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

* The test procedure is incomplete due to that power window for CA is TBD
* Measurement Uncertainty and Test Tolerance are FFS.
* Testing of the general in-band emission requirement and if yes at which UE Tx power level and with which relaxation applied to the requirement is FFS.
* TP analysis is FFS

6.4A.2.3.7.1 Test purpose

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

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

6.4A.2.3.7.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports FR2 8UL CA.

6.4A.2.3.7.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 6.4A.2.3.0.

6.4A.2.3.7.4 Test description

Same as in clause 6.4A.2.3.1.4 with following exceptions:

- Instead of Table 6.4A.2.3.1.4.1-1 🡪 use Table 6.4A.2.3.7.4-1.

Table 6.4A.2.3.7.4-1: Test Configuration Table for 8UL CA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Default Conditions | | | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | | Normal | | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for different CA bandwidth classes. | | | | Low and High range | | |
| Test CC combination setting as specified in TS 38.508-1 [10] subclause 4.3.1.2.3 for the CA Configuration across bandwidth combination sets supported by the UE. | | | | Lowest aggregated BW of the CA configuration  Highest aggregated BW of the CA configuration | | |
| Test SCS as specified in Table 5.3.5-1. | | | | Lowest | | |
| Test Parameters | | | | | | |
| CA Configuration / Aggregated BW | | | Downlink Configuration | | Uplink Configuration | |
| Test ID | CC & Mapping | ChBw(MHz) | RB allocation | | Modulation | RB allocation (NOTE 1) |
| 1 | PCC | Default | - | | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| SCC6 | - | - |
| SCC7 | - | - |
| 2 | PCC | DFT-s-OFDM PI/2 BPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| SCC6 | - | - |
| SCC7 | - | - |
| 3 | PCC | CP-OFDM QPSK | Inner\_Partial\_Left for PC2, PC3, PC4  Inner\_Partial\_Left\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| SCC6 | - | - |
| SCC7 | - | - |
| 4 | PCC | CP-OFDM QPSK | Inner\_Partial\_Right for PC2, PC3, PC4  Inner\_Partial\_Right\_Region2 for PC1 |
| SCC1 | - | - |
| SCC2 | - | - |
| SCC3 | - | - |
| SCC4 | - | - |
| SCC5 | - | - |
| SCC6 | - | - |
| SCC7 | - | - |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: CA Configuration Test cumulative aggregated BW settings are checked separately for each CA Configuration, which applicable aggregated channel bandwidths are specified in Table 5.5A.1-1.  NOTE 3: Number of DL CCs shall be configured the same as number of UL CCs. The requirements are appliable as per 5.3A.4: "*The requirements are applicable only when Uplink CCs are configured within the frequency range between lower edge of lowest downlink component carrier and upper edge of highest downlink component carrier"*. | | | | | | |

6.4A.2.3.7.5 Test requirement

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.7.5-1 for power class 1 UEs.

Table 6.4A.2.3.7.5-1: Test Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 27 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.7.5-2 for power class 2 UEs.

Table 6.4A.2.3.7.5-2: Test Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 16 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4A.2.3.7.5-3 for power class 3 UEs.

Table 6.4A.2.3.7.5-3: Test Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 10 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For Pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage Table 6.4A.2.3.7.5-4 for power class 4 UEs.

Table 6.4A.2.3.7.5-4: Test Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | Applicable Frequencies |
| General | dB | +TT | | Any non-allocated RB in allocated component carrier and not allocated component carriers  (NOTE 2) |
| IQ Image | dB | -25+TT | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 21 dBm |
| Carrier leakage | dBc | -25+TT | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* is defined in NOTE 9.  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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  NOTE 3: Image frequencies for UL CA are specified in relation to either UL or DL carrier frequency.  NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.  NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency, or in the two RBs immediately adjacent to the DC frequency but excluding any allocated RB.  NOTE 6: L*CRB* is the Transmission Bandwidth for kth allocated component carrier (see Figure 5.3.1-1).  NOTE 7: EVM is the limit for the modulation format used in the allocated RBs.  NOTE 8: *RB* is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. *RB* = 1 or *RB* = -1 for the first adjacent RB outside of the allocated bandwidth), and may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.  NOTE 9: *PRB* is the transmitted power per allocated RB, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | |

#### 6.4A.2.4 Void

#### 6.4A.2.5 Void

## 6.4D Transmit signal quality for UL MIMO

### 6.4D.0 General

For a UE supporting UL MIMO, the transmit modulation quality requirements in clause 6.4 apply but with all references to sub-clauses 6.3.1.3.x in clause 6.4 redirected to sub-clauses 6.3D.1.3.x, where ‘x’ depends on power class. The requirements apply when the UE is configured for 2-layer UL MIMO transmission as specified in Table 6.2D.1.0-1.

The requirement may alternatively be verified in each of the single layer UL MIMO configurations as specified in Table 6.4D.0-1. In this case, the transmit modulation quality requirements in clause 6.4 apply without modification.

Table 6.4D.0-1: Alternative UL MIMO configuration for transmit signal quality tests

|  |  |  |
| --- | --- | --- |
| Transmission scheme | DCI format | TPMI Index |
| Codebook based uplink | DCI format 0\_1 | 0 |
| Codebook based uplink | DCI format 0\_1 | 1 |

### 6.4D.1 Frequency error for UL MIMO

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

- OTA test procedure for UL MIMO is still under investigation.

- Test config table is still FFS.

- TP analysis is FFS.

- Measurement Uncertainty and Test Tolerances are FFS.

6.4D.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 for each layer from the results, gained by the receiver.

6.4D.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.1.3 Minimum conformance requirements

For a UE supporting UL MIMO, the UE basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of UE modulated carrier frequency at each layer shall be accurate to within ±0.1 PPM observed over a period of 1 msec of cumulated measurement intervals compared to the carrier frequency received from the NR gNB.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4D.1

6.4D.1.4 Test description

6.4D.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 6.4D.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 6.4D.1.4.1-1: Test Configuration Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Initial Conditions | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | Normal, TL, TH | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | FFS | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | FFS | |
| Test SCS as specified in Table 5.3.5-1. | | | FFS | |
| Test Parameters | | | | |
|  | Downlink Configuration | | Uplink Configuration | |
| Test ID | Modulation | RB allocation | Modulation | RB allocation |
| 1 | FFS | FFS | FFS | FFS |
|  | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The DL and UL Reference Measurement channels are set according to Table 6.4D.1.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.4D.1.4.3

6.4D.1.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 6.4D.1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

3. 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 6.4D.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. The PDCCH DCI format 0\_1 is specified with the condition 2Tx\_UL\_MIMO in 38.508-1[10] subclause 4.3.6.1.1.2.

5. Set the UE in the Inband Tx beam peak direction and apply the associated polarization for the DL, both found with a 3D EIRP scan as performed in Annex K.1.1. Connect the SS (System Simulator) with the DUT through the measurement antenna with polarization reference PolLink to form the TX beam towards the TX beam peak direction and respective polarization. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. Send continuously uplink power control "up" commands to the UE in every uplink scheduling information to the UE so that the UE transmits at PUMAX level for the duration of the test. Allow at least 200ms starting from the first TPC Command for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

6. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

7. Measure the Frequency Error using Global In-Channel Tx-Test (Annex E) at each layer for the θ- and φ-polarization of the UL. For TDD, only slots consisting of only UL symbols are under test.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.4D.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO.

6.4D.1.5 Test requirement

The 10 frequency error Δf results for the θ-polarization or the 10 frequency error Δf results for the φ-polarization must fulfil the test requirement:

|Δf| ≤ (0.1 PPM + 0.005 PPM)

### 6.4D.2 Transmit signal quality for UL MIMO

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

#### 6.4D.2.1 Error vector magnitude for UL MIMO

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

- OTA test procedure for UL MIMO is still under investigation.

- Test config table is FFS.

- TP analysis is FFS.

- Measurement Uncertainty and Test Tolerances are FFS.

6.4D.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.

6.4D.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.2.1.3 Minimum conformance requirements

For a UE supporting UL MIMO, the RMS average of the basic EVM measurements for the average EVM case, and for the reference signal EVM case, for the different modulation schemes shall not exceed the values specified in Table 6.4D.2.1.3-1 for the parameters defined in Table 6.4D.2.1.3-2 or Table 6.4D.2.1.3-3 depending on UE power class. For EVM evaluation purposes, all 13 PRACH preamble formats and all 5 PUCCH formats are considered to have the same EVM requirement as QPSK modulated.

The measurement interval for the EVM determination is 10 subframes. The requirement is verified with the test metric of EVM (Link=TX beam peak direction, Meas=Link angle).

Table 6.4D.2.1.3-1: Minimum requirements for error vector magnitude

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Average EVM level** | **Reference signal EVM level** |
| Pi/2 BPSK | % | 30.0 | 30.0 |
| QPSK | % | 17.5 | 17.5 |
| 16 QAM | % | 12.5 | 12.5 |
| 64 QAM | % | 8.0 | 8.0 |

Table 6.4D.2.1.3-2: Parameters for Error Vector Magnitude for power class 1

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Level** |
| UE EIRP | dBm | ≥ 4 |
| UE EIRP for UL 16QAM | dBm | ≥ 7 |
| UE EIRP for UL 64QAM | dBm | ≥ 11 |
| Operating conditions |  | Normal conditions |

Table 6.4D.2.1.3-3: Parameters for Error Vector Magnitude for power class 2, 3, and 4

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Level** |
| UE EIRP | dBm | ≥ -13 |
| UE EIRP for UL 16QAM | dBm | ≥ -10 |
| UE EIRP for UL 64QAM | dBm | ≥ -6 |
| Operating conditions |  | Normal conditions |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4D.2.

6.4D.2.1.4 Test description

6.4D.2.1.4.1 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 Tables 6.4D.2.1.4.1-1, 6.4D.2.1.4.1-1 and 6.4D.2.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4D.2.1.4.1-1: Test Configuration Table for PUSCH

|  |  |  |  |
| --- | --- | --- | --- |
| **Initial Conditions** | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | FFS | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | FFS | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | FFS | |
| Test SCS as specified in Table 5.3.5-1 | | FFS | |
| **Test Parameters** | | | |
| **Test ID** | **Downlink Configuration** | **Uplink Configuration** | |
|  | - | **Modulation** | **RB allocation (NOTE 1)** |
| 1 |  | FFS | FFS |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| 11 |  |  |  |
| 12 |  |  |  |
| 13 |  |  |  |
| 14 |  |  |  |
| NOTE 1:  NOTE 2: | | | |

Table 6.4D.2.1.4.1-2: Test Configuration Table for PUCCH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Initial Conditions** | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | FFS | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | | FFS / See Table 6.4D.2.1.4.1-1 | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | | FFS / See Table 6.4D.2.1.4.1-1 | |
| Test SCS as specified in Table 5.3.5-1 | | | FFS / See Table 6.4D.2.1.4.1-1 | |
| **Test Parameters** | | | | |
| **ID** | **Downlink Configuration** | | **Uplink Configuration** | |
|  | Modulation | RB allocation | **Waveform** | **PUCCH format** |
| 1 | FFS |  |  |  |
| 2 | FFS |  |  |  |
| NOTE 1:  NOTE 2: | | | | |

Table 6.4D.2.1.4.1-3: Test Configuration for PRACH

|  |  |
| --- | --- |
| **Initial Conditions** | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | FFS |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | FFS / See Table 6.4.2.1.4.1-1 |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | FFS / See Table 6.4.2.1.4.1-1 |
| Test SCS as specified in Table 5.3.5-1 | FFS / See Table 6.4.2.1.4.1-1 |
| **PRACH preamble format** | |
| PRACH Configuration Index | FFS |
| SS/PBCH SSS EPRE setting (dBm/120kHz) | FFS |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Tables 6.4D.2.1.4.1-1, 6.4D.2.1.4.1-1 and 6.4D.2.1.4.1-3.

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 [10] clause 4.5. Message contents are defined in clause 6.4D.2.1.4.3

6.4D.2.1.4.2 Test procedure

Test procedure for PUSCH:

1.1 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

1.2 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 6.4D.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.

1.3 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.4 Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200 ms starting from the first TPC command in this step for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.5 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

1.6 Measure the EVMθ, EVMφ,  and using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. For TDD, only slots consisting of only UL symbols are under test. Calculate  and .

1.7 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4D.2.1.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

Test procedure for PUCCH:

2.1 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2.2 PUCCH is set according to Table 6.4D.2.1.4.1-2.

2.3 SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 6.4D.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.

2.4 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

2.5 SS send appropriate TPC commands for PUCCH to the UE until the UE transmit PUCCH at [PUMAX level]. Allow at least 200 ms starting from the first TPC command in this step for the UE to reach [PUMAX level]. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

2.6 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

2.7 Measure PUCCH EVMθ and PUCCH EVMφ using Global In-Channel Tx-Test (Annex E). Calculate .

2.8 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4D.2.1.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

Test procedure for PRACH:

3.1 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

3.2 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1.

3.3 The SS shall set RS EPRE according to Table 6.4D.2.1.4.1-3.

3.4 PRACH is set according to Table 6.4D.2.1.4.1-3.

3.5 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.

3.6 The UE shall send the signalled preamble to the SS.

3.7 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.

3.8 The UE shall consider the random access response reception not successful then re-transmit the preamble with the calculated PRACH transmission power.

3.9 Repeat step 3.5 and 3.6 until the SS collect enough PRACH preambles ([2] preambles for format 0 and [10] preambles for format 4). Measure the EVMθ and EVMφ in PRACH channel using Global In-Channel Tx-Test (Annex E). Calculate .

6.4D.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO, with the following exceptions for PRACH test.

Table 6.4D.2.1.4.3-1: RACH-ConfigGeneric for PRACH test

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-130 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| RACH-ConfigGeneric ::= SEQUENCE { |  |  |  |
| preambleReceivedTargetPower | -60 |  |  |
| powerRampingStep | dB0 |  |  |
| } |  |  |  |

Table 6.4D.2.1.4.3-2: ServingCellConfigCommon

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-168 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| ss-PBCH-BlockPower | 18 |  |  |
| } |  |  |  |

Table 6.4D.2.1.4.3-3: ServingCellConfigCommonSIB

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [10], Table 4.6.3-169 | | | |
| **Information Element** | **Value/remark** | **Comment** | **Condition** |
| ServingCellConfigCommonSIB ::= SEQUENCE { |  |  |  |
| ss-PBCH-BlockPower | 18 |  |  |
| } |  |  |  |

6.4D.2.1.5 Test requirement

The PUSCH EVM, derived in Annex E.4.2, shall not exceed the values in Table 6.4D.2.1.5-1.

The PUSCH, derived in Annex E.4.6.2, shall not exceed the values in Table 6.4D.2.1.5-1 when embedded with data symbols of the respective modulation scheme.

The PUCCH EVM derived in Annex E.5.9.2 shall not exceed the values for QPSK in Table 6.4D.2.1.5-1.

The PRACH EVM derived in Annex E.6.9.2 shall not exceed the values for QPSK in Table 6.4D.2.1.5-1.

Table 6.4D.2.1.5-1: Test requirements for Error Vector Magnitude

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

#### 6.4D.2.2 Carrier leakage for UL MIMO

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

- OTA test procedure for UL MIMO is still under investigation.

- Test config table is FFS.

- TP analysis is FFS.

- Measurement Uncertainty and Test Tolerances are FFS.

6.4D.2.2.1 Test purpose

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

6.4D.2.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.2.2.3 Minimum conformance requirements

For a UE supporting UL MIMO, the Carrier leakage is an additive sinusoid waveform. The carrier leakage requirement is defined for each component carrier. The measurement interval is one slot in the time domain. The relative carrier leakage power is a power ratio of the additive sinusoid waveform to the power in the modulated waveform.

The requirement is verified with the test metric of Carrier Leakage (Link=TX beam peak direction, Meas=Link angle).

When carrier leakage is contained inside the spectrum confined within the configured UL and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4D.2.2.3-1 for power class 1 UEs.

Table 6.4D.2.2.3-1: Minimum requirements for relative carrier leakage power for power class 1

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 17 dBm | -25 |
| 4 dBm ≤ EIRP ≤ 17 dBm | -20 |

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4D.2.2.3-2 for power class 2.

Table 6.4D.2.2.3-2: Minimum requirements for relative carrier leakage power for power class 2

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 6 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 6 dBm | -20 |

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4D.2.2.3-3 for power class 3 UEs.

Table 6.4D.2.2.3-3: Minimum requirements for relative carrier leakage power for power class 3

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 0 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 0 dBm | -20 |

When carrier leakage is contained inside the spectrum occupied by the configured UL CCs and DL CCs, the relative carrier leakage power shall not exceed the values specified in Table 6.4D.2.2.3-4 for power class 4.

Table 6.4D.2.2.3-4: Minimum requirements for relative carrier leakage power for power class 4

|  |  |
| --- | --- |
| **Parameters** | **Relative Limit (dBc)** |
| EIRP > 11 dBm | -25 |
| -13 dBm ≤ EIRP ≤11 dBm | -20 |

The normative reference for this requirement is TS 38.101-2[3] clause 6.4D.2.

6.4D.2.2.4 Test description

6.4D.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 6.4D.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 6.4D.2.2.4.1-1: Test Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Initial Conditions** | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | FFS | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | FFS | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | FFS | |
| Test SCS as specified in Table 5.3.5-1 | |  | |
| **Test Parameters** | | | |
| **Test ID** | **Downlink Configuration** | **Uplink Configuration** | |
|  | - | **Modulation** | **RB allocation (NOTE 1, 3)** |
| 1 |  |  |  |
| NOTE 1:  NOTE 2:  NOTE 3: | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.4D.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 [10] clause 4.5. Message contents are defined in clause 6.4D.2.2.4.3.

7. 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.

6.4D.2.2.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

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 6.4D.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.

3. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE EIRPTotal = EIRPθ + EIRPφ 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 Preq, where:

- Preq is the power level specified in Table 6.4D.2.2.4.2-1 according to the power class.

- MU is the test system uplink absolute power measurement uncertainty and is specified in Table F.1.2-1 under carrier leakage sub-clause for the carrier frequency f and the channel bandwidth BW.

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

Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

5. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

6. Measure carrier leakage using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarization at the LO position obtained in step 1. For TDD, only slots consisting of only UL symbols are under test. Calculate CarrLeak = min(CarrLeakθ , CarrLeakφ).

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: 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 6.4.2.2.4.2-1: UE EIRP Preq (dBm) for carrier leakage

|  |  |
| --- | --- |
| **Power Class** | **Preq (dBm) for step 3** |
| Power Class 1 | 17 |
| Power Class 2 | 6 |
| Power Class 3 | 0 |
| Power Class 4 | 11 |

Table 6.4.2.2.4.2-2: Void

6.4D.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO and with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

6.4D.2.2.5 Test requirement

For each of the *n* carrier leakage results derived in Annex E.3.1 for θ- and φ-polarization the minimum is calculated according to

CarrLeak = min(CarrLeakθ , CarrLeakφ), where

.

Each of the *n* carrier leakage results CarrLeak shall not exceed the values in Table 6.4D.2.2.5-1 to Table 6.4D.2.2.5-4. Allocated RBs are not under test.

Table 6.4D.2.2.5-1a: Test requirements for relative carrier leakage power for power class 1

|  |  |
| --- | --- |
| **Parameter** | **Relative limit (dBc)** |
| 17 dBm + MU < EIRP ≤ 17 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4D.2.2.5-1b: Test Tolerance (carrier leakage for power class 1)

|  |  |  |
| --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** |
| Max device size ≤ 30 cm | TBD | TBD |

Table 6.4D.2.2.5-2a: Test requirements for relative carrier leakage power for power class 2

|  |  |
| --- | --- |
| **Parameter** | **Relative limit (dBc)** |
| 6 dBm + MU < EIRP ≤ 6 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4D.2.2.5-2b: Test Tolerance (carrier leakage for power class 2)

|  |  |  |
| --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** |
| Max device size ≤ 30 cm | TBD | TBD |

Table 6.4D.2.2.5-3a: Test requirements for relative carrier leakage power for power class 3

|  |  |
| --- | --- |
| **Parameter** | **Relative limit (dBc)** |
| 0 dBm + MU < EIRP ≤ 0 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4D.2.2.5-3b: Test Tolerance (carrier leakage for power class 3)

|  |  |  |
| --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** |
| Max device size ≤ 30 cm | TBD | TBD |

Table 6.4D.2.2.5-4a: Test requirements for relative carrier Leakage Power for power class 4

|  |  |
| --- | --- |
| **Parameter** | **Relative limit (dBc)** |
| 11 dBm + MU < EIRP ≤ 11 dBm + MU + Uplink power control window size | -25 + TT |

Table 6.4D.2.2.5-4b: Test Tolerance (carrier leakage for power class 4)

|  |  |  |
| --- | --- | --- |
| **Test Metric** | **FR2a** | **FR2b** |
| Max device size ≤ 30 cm | TBD | TBD |

#### 6.4D.2.3 In-band emissions for UL MIMO

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

- OTA test procedure for UL MIMO is still under investigation.

- Test config table is FFS.

- TP analysis is FFS.

- Measurement Uncertainty and Test Tolerances are FFS.

6.4D.2.3.1 Test purpose

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

6.4D.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.2.3.3 Minimum conformance requirements

For a UE supporting UL MIMO, the in-band emission is defined as the average 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 IBE requirement does not apply if UE declares support for *mpr-PowerBoost-FR2-r16*, UL transmission excluding Pi/2 BPSK is such that MPRf,c = 0 and when NS\_200 applies, and the network configures the UE to operate with *mpr-PowerBoost-FR2-r16*.

The basic in-band emissions measurement interval is identical to that of the EVM test.

The requirement is verified with the test metric of In-band emission (Link=TX beam peak direction, Meas=Link angle).

The relative in-band emission shall not exceed the values specified in Table 6.4D.2.3.3-1 for power class 1 UEs.

The average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4D.2.3.3-1 for power class 1, Table 6.4D.2.3.3-2 for power class 2, Table 6.4D.2.3.3-3 for power class 3 and Table 6.4D.2.3.3-4 for power class 4 UEs.

Table 6.4D.2.3.3-1: Requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| **General** | dB |  | | Any non-allocated (NOTE 2) |
| **IQ Image** | dB | -25 | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 27 dBm |
| **Carrier leakage** | dBc | -25 | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The relative in-band emission shall not exceed the values specified in Table 6.4D.2.3.3-2 for power class 2.

Table 6.4D.2.3.3-2: Requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| **General** | dB |  | | Any non-allocated (NOTE 2) |
| **IQ Image** | dB | -25 | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 16 dBm |
| **Carrier leakage** | dBc | -25 | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The relative in-band emission shall not exceed the values specified in Table 6.4D.2.3.3-3 for power class 3 UEs.

Table 6.4D.2.3.3-3: Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| **General** | dB |  | | Any non-allocated (NOTE 2) |
| **IQ Image** | dB | -25 | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 10 dBm |
| **Carrier leakage** | dBc | -25 | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The relative in-band emission shall not exceed the values specified in Table 6.4D.2.3.3-4 for power class 4 UEs.

Table 6.4D.2.3.3-4: Requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| **General** | dB |  | | Any non-allocated (NOTE 2) |
| **IQ Image** | dB | -25 | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20 | Output power ≤ 21 dBm |
| **Carrier leakage** | dBc | -25 | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20 | -13 dBm ≤ Output power ≤11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction. | | | | |

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4D.2.

6.4D.2.3.4 Test description

6.4D.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 6.4D.2.3.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4D.2.3.4.1-1: Test Configuration Table for PUSCH

|  |  |  |  |
| --- | --- | --- | --- |
| **Initial Conditions** | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | FFS | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | |  | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | |  | |
| Test SCS as specified in Table 5.3.5-1 | |  | |
| **Test Parameters** | | | |
| **Test ID** | **Downlink Configuration** | **Uplink Configuration** | |
|  | - | **Modulation** | **RB allocation (NOTE 1)** |
| 1 |  | FFS |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| NOTE 1: FFS  NOTE 2: FFS | | | |

Table 6.4D.2.3.4.1-2: Test Configuration Table for PUCCH

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Initial Conditions** | | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | | FFS | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | |  | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | |  | |
| Test SCS as specified in Table 5.3.5-1 | | |  | |
| **Test Parameters** | | | | |
| **ID** | **Downlink Configuration** | | **Uplink Configuration** | |
|  | **Modulation** | **RB allocation** | **Waveform** | **PUCCH format** |
| 1 |  |  | FFS |  |
| 2 |  |  |  |  |
| NOTE 1: FFS | | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.4D.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 without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.4D.2.3.4.3

6.4D.2.3.4.2 Test procedure

Test procedure for PUSCH:

1.1 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

1.2 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 6.4D.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.

1.3 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.4 Send the appropriate TPC commands in the uplink scheduling information to the UE until UE output power is Preq + PW ± PW, where Preq is the power level specified in Tables 6.4D.2.3.4.2-1 according to the power class with power ID = 1. PW is the power window according to Table 6.4D.2.3.4.2-2 for the carrier frequency f and the channel bandwidth BW. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

1.5 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

1.6 Measure In-band emission IEθ, IEφ using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. For TDD, only slots consisting of only UL symbols are under test. Calculate IE = IEθ + IEφ, where the calculation is based on linear power ratios.

1.7 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

1.8 Repeat steps 1.3 through 1.6 until In-band emissions have been measured for all power IDs in Table 6.4D.2.3.4.2-1.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4D.2.3.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

Table 6.4D.2.3.4.2-1: Parameters for In-band emissions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Power ID** | **Unit** | **Level for power class 1** | **Level for power class 2** | **Level for power class 3** | **Level for power class 4** |
| 1 | dBm | 27 | 16 | 10 | 21 |
| 2 | dBm | 17 | 6 | 0 | 11 |

Table 6.4D.2.3.4.2-2: Power Window (dB) for In-band emissions PUSCH and PUCCH

**TBD**

Test procedure for PUCCH:

2.1 Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

2.2 PUCCH is set according to Table 6.4D.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 6.4D.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.

2.3 Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

2.4 Send the appropriate TPC commands in the uplink scheduling information for PUCCH to the UE until UE output power is Preq + PW ± PW, where Preq is the power level specified in Tables 6.4D.2.3.4.2-1 according to the power class with power ID = 1. PW is the power window according to Table 6.4D.2.3.4.2-2 for the carrier frequency f and the channel bandwidth BW. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

2.5 SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

2.6 Measure In-band emission IEθ, IEφ using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. Calculate IE = IEθ + IEφ, where the calculation is based on linear power ratios.

2.7 SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

2.8 Repeat steps 2.3 through 2.6 until In-band emissions have been measured for all power IDs in Table 6.4D.2.3.4.2-1.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

NOTE 2: When switching to DFT-s-OFDM waveform, as specified in Table 6.4D.2.3.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

6.4.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO.

6.4.2.3.5 Test requirement

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4D.2.3.5-1 for power class 1 UEs.

Table 6.4D.2.3.5-1: Test requirements for in-band emissions for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| General  (NOTE 12) | dB | + TT | | Any non-allocated (NOTE 2) |
| IQ Image  (NOTE 12) | dB | -25+TT | Output power > 27 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 27 dBm |
| Carrier leakage  (NOTE 12) | dBc | -25+TT | Output power > 17 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | 4 dBm ≤ Output power ≤ 17 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction.  NOTE 12: In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4D.2.3.5-2 for power class 2 UEs.

Table 6.4D.2.3.5-2: Test requirements for in-band emissions for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| General  (NOTE 12) | dB | + TT | | Any non-allocated (NOTE 2) |
| IQ Image  (NOTE 12) | dB | -25 + TT | Output power > 16 dBm | Image frequencies (NOTES 2, 3) |
| -20 + TT | Output power ≤ 16 dBm |
| Carrier leakage  (NOTE 12) | dBc | -25 + TT | Output power > 6 dBm | Carrier frequency (NOTES 4, 5) |
| -20 + TT | -13 dBm ≤ Output power ≤ 6 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency if NRB is odd, or in the two RBs immediately adjacent to the DC frequency if NRB is even but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction.  NOTE 12: In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4D.2.3.5-3 for power class 3 UEs.

Table 6.4D.2.3.5-3: Requirements for in-band emissions for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| General  (NOTE 12) | dB | + TT | | Any non-allocated (NOTE 2) |
| IQ Image  (NOTE 12) | dB | -25+TT | Output power > 10 dBm | Image frequencies (NOTES 2, 3) |
| -20+TT | Output power ≤ 10 dBm |
| Carrier leakage  (NOTE 12) | dBc | -25+TT | Output power > 0 dBm | Carrier frequency (NOTES 4, 5) |
| -20+TT | -13 dBm ≤ Output power ≤ 0 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD.  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction.  NOTE 12: In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies. | | | | |

For power ID1 and ID2, the averaged in-band emissions result, derived in Annex E.4.3 shall not exceed the corresponding values for IQ Image and Carrier Leakage in Table 6.4D.2.3.5-4 for power class 4 UEs.

Table 6.4D.2.3.5-4: Test requirements for in-band emissions for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter description** | **Unit** | **Limit (NOTE 1)** | | **Applicable Frequencies** |
| General  (NOTE 12) | dB | + TT | | Any non-allocated (NOTE 2) |
| IQ Image  (NOTE 12) | dB | -25 + TT | Output power > 21 dBm | Image frequencies (NOTES 2, 3) |
| -20 + TT | Output power ≤ 21 dBm |
| Carrier leakage  (NOTE 12) | dBc | -25 + TT | Output power > 11 dBm | Carrier frequency (NOTES 4, 5) |
| -20 + TT | -13 dBm ≤ Output power ≤11 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 (*PRB* - 25 dB) and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. *PRB* 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. For pi/2 BPSK with Spectrum Shaping, the limit is expressed as a ratio of measured power in one non-allocated RB to the measured power in the allocated RB with highest PSD  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 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 *txDirectCurrentLocation* in *UplinkTxDirectCurrent* IE, and are those that are enclosed in the RBs containing the DC frequency but excluding any allocated RB.  NOTE 6: LCRB is the Transmission Bandwidth (see Section 5.3).  NOTE 7: NRB is the Transmission Bandwidth Configuration (see Section 5.3).  NOTE 8: EVM s the limit for the modulation format used in the allocated RBs.  NOTE 9: RB is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. RB= 1 or RB= -1 for the first adjacent RB outside of the allocated bandwidth).  NOTE 10: PRB is the transmitted power per allocated RB, measured in dBm.  NOTE 11: All powers are EIRP in beam peak direction.  NOTE 12: In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE, IQ Image and Carrier leakage limit do not apply and General limit applies for all non-allocated frequencies. | | | | |

#### 6.4D.2.4 EVM equalizer spectrum flatness for UL MIMO

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

- OTA test procedure for UL MIMO is still under investigation.

- Test config table is FFS.

- TP analysis is FFS.

- Measurement Uncertainty and Test Tolerances are FFS.

6.4D.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.

6.4D.2.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.2.4.3 Minimum conformance requirements

For pi/2 BPSK modulation, the minimum requirements are defined in Clause 6.4D.2.5.3.

For a UE supporting UL MIMO, 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 6.4D.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 requirements: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 (Table 6.4D.2.4.3-1) must not be larger than 7 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 dB (see Figure 6.4D.2.4.3-1).

The requirement is verified with the test metric of EVM SF (Link=TX beam peak direction, Meas=Link angle).

Table 6.4D.2.4.3-1: Minimum requirements for EVM equalizer spectrum flatness (normal conditions)

|  |  |
| --- | --- |
| **Frequency range** | **Maximum ripple (dB)** |
| |FUL\_Meas – Fcenter| ≤ X MHz  (Range 1) | 6 (p-p) |
| |FUL\_Meas – Fcenter| > X MHz  (Range 2) | 9 (p-p) |
| NOTE 1: FUL\_Meas refers to the sub-carrier frequency for which the equalizer coefficient is evaluated  NOTE 2: Fcenter refers to the centre frequency of the CC  NOTE 3: X, in MHz, is equal to 30% of the CC bandwidth | |



Figure 6.4D.2.4.3-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated under normal conditions

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4D.2.

6.4D.2.4.4 Test description

6.4D.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 6.4D.2.4.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.4D.2.4.4.1-1: Test Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Initial Conditions** | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | FFS | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | |  | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | |  | |
| Test SCS as specified in Table 5.3.5-1 | |  | |
| **Test Parameters** | | | |
| **Test ID** | **Downlink Configuration** | **Uplink Configuration** | |
|  | - | **Modulation** | **RB allocation (NOTE 1)** |
| 1 |  | FFS |  |
| 2 |  |  |  |
| NOTE 1: XXX | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A, in Figure A.3.3.1.1 for TE diagram and section A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement channels are set according to Table 6.4D.2.4.4.1-1.

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 [10] clause 4.5. Message contents are defined in clause 6.4D.2.4.4.3

6.4D.2.4.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

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 6.4D.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

3. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

4. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200 ms for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 2) for the UE Tx beam selection to complete.

5. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

6. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. For TDD, only slots consisting of only UL symbols are under test.

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE1: When switching to DFT-s-OFDM waveform, as specified in Table 6.4D.2.4.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [10] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM\_PRECODER\_ENABLED condition.

NOTE 2: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.4D.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO.

6.4D.2.4.5 Test requirement

Each of the *n* spectrum flatness functions, shall derive four ripple results in Annex E.4.4. The derived results shall not exceed the values in Figure 6.4D.2.4.5-1: 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 6.4D.2.4.5-1 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 requirements: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 (Table 6.4D.2.4..5-1) must not be larger than 7 dB + TT, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 8 dB + TT (see Figure 6.4D.2.4.5-1).

The UE passes the test when the derived results for at least one polarization fulfil the test requirements.

Table 6.4D.2.4.5-1: Test requirements for EVM equalizer spectrum flatness (normal conditions)

|  |  |
| --- | --- |
| **Frequency range** | **Maximum ripple (dB)** |
| |FUL\_Meas – Fcenter| ≤ X MHz  (Range 1) | 6 +TT (p-p) |
| |FUL\_Meas – Fcenter| > X MHz  (Range 2) | 9 + TT (p-p) |
| NOTE 1: FUL\_Meas refers to the sub-carrier frequency for which the equalizer coefficient is evaluated  NOTE 2: Fcenter refers to the centre frequency of the CC  NOTE 3: X, in MHz, is equal to 30% of the CC bandwidth | |

Diagram

Description automatically generated

Figure 6.4D.2.4.5-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated under normal conditions

6.4D.2.5 EVM spectral flatness for pi/2 BPSK modulation

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

- Measurement Uncertainty and Test Tolerance are FFS.

- Whether and, if yes, how to test the requirement on shaping filter is FFS.

- Test config table is FFS.

- TP analysis is FFS.

6.4D.2.5.1 Test purpose

Same test purpose as in clause 6.4D.2.4.1.

6.4D.2.5.2 Test applicability

This test case applies to all types of NR FR2 UE release 15 and forward that support pi/2 BPSK modulation and UL MIMO.

6.4D.2.5.3 Minimum conformance requirements

For a UE supporting UL MIMO, these requirements are defined for pi/2 BPSK modulation. The EVM equalizer coefficients across the allocated uplink block shall be modified to fit inside the mask specified in Table 6.4D.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 6.4D.2.5.3-1: Mask for EVM equalizer coefficients for pi/2 BPSK (normal conditions)

|  |  |  |
| --- | --- | --- |
| **Frequency range** | **Parameter** | **Maximum ripple (dB)** |
| |FUL\_Meas – Fcenter| ≤ X MHz  (Range 1) | X1 | 6 (p-p) |
| |FUL\_Meas – Fcenter| > X MHz  (Range 2) | X2 | 14 (p-p) |
| NOTE 1: FUL\_Meas refers to the sub-carrier frequency for which the equalizer coefficient is evaluated.  NOTE 2: Fcenter refers to the centre 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 6.4D.2.5.3-1 for description of X1, X2 and X3. | | |



Figure 6.4D.2.5.3-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation. Fcenter denotes the centre frequency of the allocated block of PRBs. F\_alloc denotes the bandwidth of the PRB allocation

This requirement does not apply to other modulation types. The UE shall be allowed to employ spectral shaping for pi/2 BPSK. The shaping filter shall be restricted so that the impulse response of the transmit chain shall meet

│*ãt*(*t*,0)│ ≥ │*ãt*(*t*, *τ*)│ ∀*τ* ≠ 0

20*log*10│*ãt*(*t*,*τ*)│< -15 dB 1< *τ* < M - 1,

Where:

│ãt(t,τ)│=IDFT{│ãt(t,f)│ejφ (t,f)} ,

f is the frequency of the M allocated subcarriers,

ã(t,f) and φ(t,f) are the amplitude and phase response, respectively of the transmit chain

0dB reference is defined as 20log10│ãt(t,0)│

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4.2.5.

6.4D.2.5.4 Test description

6.4D.2.5.4.1 Initial condition

Same initial conditions as in clause 6.4D.2.4.4.1 with following exceptions:

- Instead of Table 6.4D.2.4.4.1-1 🡪 use Table 6.4D.2.5.4.1-1

Table 6.4D.2.5.4.1-1: Test Configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Initial Conditions** | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Low range, Mid range, High range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] subclause 4.3.1 | | Lowest, Mid, Highest | |
| Test SCS as specified in TS 38.508-1 [10] subclause 5.3.5-1 | | Lowest | |
| **Test Parameters** | | | |
| **Test ID** | **Downlink Configuration** | **Uplink Configuration** | |
|  | - | **Modulation** | **RB allocation (NOTE 1)** |
| 1 |  | DFT-s-OFDM pi/2-BPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1.  NOTE 2: Test Channel Bandwidths are checked separately for each NR band, which applicable channel bandwidths are specified in Table 5.3.5-1. | | | |

6.4D.2.5.4.2 Test procedure

1. Retrieve the LO position from the parameter txDirectCurrentLocation in UplinkTxDirectCurrent IE.

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 6.4D.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.

3. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200 ms for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

5. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

6. Measure spectrum flatness using Global In-Channel Tx-Test (Annex E) for the θ- and φ-polarizations, respectively. For TDD, only slots consisting of only UL symbols are under test.

7. SS deactivates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.3.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.4D.2.5.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 with TRANSFORM\_PRECODER\_ENABLED condition in Table 4.6.3-118 PUSCH-Config and ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO.

6.4D.2.5.5 Test requirement

Each of the *n* spectrum flatness functions, shall derive four ripple results in Annex E.4.4. The derived results shall not exceed the values in Table 6.4D.2.5.5-1 and Figure 6.4D.2.5.5-1:

Table 6.4D.2.5.5-1: Test requirement for EVM equalizer coefficients for pi/2 BPSK (normal conditions)

|  |  |  |
| --- | --- | --- |
| **Frequency range** | **Parameter** | **Maximum ripple (dB)** |
| |FUL\_Meas – Fcenter| ≤ X MHz  (Range 1) | X1 | 6 + TT (p-p) |
| |FUL\_Meas – Fcenter| > X MHz  (Range 2) | X2 | 14 + TT (p-p) |
| NOTE 1: FUL\_Meas refers to the sub-carrier frequency for which the equalizer coefficient is evaluated.  NOTE 2: Fcenter refers to the centre 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 6.4D.2.5.5-1 for description of X1, X2 and X3. | | |



Figure 6.4D.2.5.5-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation. Fcenter denotes the centre frequency of the allocated block of PRBs

The UE passes the test when the derived results for at least one polarization fulfil the test requirements.

### 6.4D.3 Time alignment error for UL MIMO

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

- OTA test procedure for UL MIMO is still under investigation.

- Test tolerance is FFS

6.4D.3.1 Test purpose

To verify that the error of time alignment in UL MIMO does not exceed the range prescribed by the specified UL MIMO Time Alignment Error (TAE) and tolerance.

An excess time alignment error has the possibility to interfere to other channels or other systems and decrease UL MIMO performance because of the timing unsynchronization.

6.4D.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

6.4D.3.3 Minimum conformance requirements

For UE(s) with multiple physical antenna ports supporting UL MIMO, this requirement applies to frame timing differences between transmissions on multiple physical antenna ports in the codebook transmission scheme.

The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different physical antenna ports.

For UE(s) with multiple physical antenna ports, the Time Alignment Error (TAE) shall not exceed 130 ns.

The normative reference for this requirement is TS 38.101-2 [3] clause 6.4D.3.

6.4D.3.4 Test description

6.4D.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 test channel bandwidth and sub-carrier spacing, are shown in Table 6.4D.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 6.4D.3.4.1-1: Test Configuration Table

|  |  |  |  |
| --- | --- | --- | --- |
| Initial Conditions | | | |
| Test Environment as specified in TS 38.508-1 [10] subclause 4.1 | | Normal | |
| Test Frequencies as specified in TS 38.508-1 [10] subclause 4.3.1 | | Mid range | |
| Test Channel Bandwidths as specified in TS 38.508-1 [10] 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 (NOTE 1) |
| 1 | CP-OFDM QPSK | Outer\_Full |
| NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 for PC2, PC3 and PC4 or Table 6.1-2 for PC1. | | | |

1. Connection between SS and UE is shown in TS 38.508-1 [10] Annex A Figure A.3.3.1.1 for TE diagram and Figure A.3.4.1.1 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [10] subclause 4.4.3.

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

4. The UL Reference Measurement Channels are set according to Table 6.4D.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 without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [10] clause 4.5. Message contents are defined in clause 6.4D.3.4.3.

6.4D.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 6.4D.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 PDCCH DCI format 0\_1 is specified with the condition 2TX\_UL\_MIMO in 38.508-1 [10] subclause 4.3.6.1.1.2.

2. Set the UE in the Inband Tx beam peak direction found with a 3D EIRP scan as performed in Annex K.1.1. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

3. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE until the UE transmits at PUMAX level. Allow at least 200ms starting from the first TPC Command for the UE to reach PUMAX level. Allow at least BEAM\_SELECT\_WAIT\_TIME (NOTE 1) for the UE Tx beam selection to complete.

4. SS activates the UE Beamlock Function (UBF) by performing the procedure as specified in TS 38.508-1 [10] clause 4.9.2 using condition TxRx.

5. Measure the timing of one sub-frame at each physical antenna port.

NOTE 1: The BEAM\_SELECT\_WAIT\_TIME default value is defined in Annex K.

6.4D.3.4.3 Message contents

Message contents are according to TS 38.508-1 [10] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX\_UL\_MIMO.

6.4D.3.5 Test requirement

For UE(s) with multiple physical antenna ports, the Time Alignment Error (TAE) shall not exceed 130 + TT ns.

Table 6.4D.3.5-1: Test Tolerance (Time alignment error for UL MIMO)

|  |
| --- |
| Test Tolerance |
| FFS |