**3GPP RAN4 Meeting #104-e *R4-2214883***

**Electronic meeting, August 15 - 26, 2022**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-2** | **CR** |  | **rev** |  | **Current version:** | **17.6.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Inc, Apple | | | | | | | | | |
| ***Source to TSG:*** | RAN4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_ext\_to\_71GHz-Core | | | | |  | ***Date:*** | | | 2022-08-22 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The definition of Tx requirements for the new band n263 motivates this CR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | There is an editorial error corrected in this n263 requirement:  6.2.1.3 UE maximum output power for power class 3  5.3.3 Minimum guard band: Brackets are removed  6.3.2 Transmit Off Power: Brackets are removed  The following requirements are introduced for FR2-2:  6.3.1 Minimum output power  6.4.2.1 Error vector magnitude  6.4.2.2 Carrier leakage  6.4.2.3 In-band emissions  6.4A.2.2 Carrier leakage  6.5A.2.1 SEM for CA  6.5A.2.3 ACLR for CA  6.6.4 Beam correspondence for power class 3 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Tx requirements for band FR2-2/n263 would not be defined. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **N** | Other core specifications | | | |  | | |
| ***affected:*** | | **Y** |  | Test specifications | | | | TS38.521-2 | | |
| ***(show related CRs)*** | |  | **N** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

begin changes

### 5.3.3 Minimum guardband and transmission bandwidth configuration

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

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SCS (kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| 60 | 1210 | 2450 | 4930 | N/A | N/A | N/A | N/A |
| 120 | 1900 | 2420 | 4900 | 9860 | N/A | N/A | N/A |
| 480 | N/A | N/A | N/A | 9680 | 42640 | 85520 | N/A |
| 960 | N/A | N/A | N/A | 9440 | 42400 | 85280 | 147040 |

NOTE: The minimum guardbands have been calculated using the following equation: (BWChannel x 1000 (kHz) - NRB x SCS x 12) / 2 - SCS/2, where NRB are from Table 5.3.2-1.

end changes

begin changes

#### 6.2.1.3 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 6.2.1.3-1. 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 6.2.1.3-1. The requirement for the UE which supports multiple FR2 bands is specified in both Table 6.2.1.3-1 and Table 6.2.1.3-4.

Table 6.2.1.3-1: 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 |
| n263 | 14.1 |
| 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 6.2.1.3-2. 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 6.2.1.3-2: UE maximum output power limits for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Max TRP (dBm) | Max EIRP (dBm) | Max EIRP  (dBm/MHz) | Notes |
| n257 | 23 | 43 |  |  |
| n258 | 23 | 43 |  |  |
| n259 | 23 | 43 |  |  |
| n260 | 23 | 43 |  |  |
| n261 | 23 | 43 |  |  |
| n262 | 23 | 43 |  |  |
| n263 | FFS | FFS |  | [Default for NS\_200] |
|  | 27 | 40 (NOTE1) | 23 | Applies when “NS\_204” is indicated in the cell  NOTE 1: it is max average EIRP |

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 6.2.1.3-3 below. The requirement is verified with the test metric of the total component of EIRP (Link=Beam peak search grids, Meas=Link angle). The requirement for the UE which supports a single FR2 band is specified in Table 6.2.1.3-3. The requirement for the UE which supports multiple FR2 bands is specified in both Table 6.2.1.3-3 and Table 6.2.1.3-4.

Table 6.2.1.3-3: UE spherical coverage 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 |
| n262 | 2.9 |
| n263 | 2.3 |
| 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 Annex E.2.1. | |

For the UEs that support multiple FR2 bands, minimum requirement for peak EIRP and EIRP spherical coverage in Tables 6.2.1.3-1 and 6.2.1.3-3 shall be decreased per band, respectively, by the peak EIRP relaxation parameter MBP,n and EIRP spherical coverage relaxation parameter MBS,n, as defined in Table 6.2.1.3-4..

Table 6.2.1.3-4: UE multi-band relaxation factors for power class 3

|  |  |  |
| --- | --- | --- |
| **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 |
| n263 | 1.0 | 1.0 |
| 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 | | |

end change

begin change

#### 6.2.2.1 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 6.2.2.1-1 and 6.2.2.1-2 for FR2-1 and in Tables 6.2.2.1-3 and 6.2.2.1-4 for FR2-2.

Table 6.2.2.1-1 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 6.2.2.1-2 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 |

Table 6.2.2.1-3 MPRWT for power class 1, BWchannel = 100 MHz in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPRWT (dB), BWchannel = 100 MHz | | |
|  | | Outer RB allocations | Inner RB allocations | |
|  | |  | Region 1 | Region 2 |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [5.5] | [0.0] | ≤ [3.5] |
|  | QPSK | ≤ [6.5] | [0.0] | ≤ [3.5] |
|  | 16 QAM | ≤ [7.0] | ≤ [2.5] | ≤ [2.5] |
|  | 64 QAM | ≤ [8.0] | ≤ [8.0] | ≤ [8.0] |
| CP-OFDM | QPSK | ≤ [8.0] | ≤ [1.5] | ≤ [3.5] |
|  | 16 QAM | ≤ [8.0] | ≤ [3.5] | ≤ [4.0] |
|  | 64 QAM | ≤ [9.5] | ≤ [9.5] | ≤ [9.5] |

Table 6.2.2.1-4 MPRWT for power class 1, BWchannel >= 400 MHz in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPRWT (dB), BWchannel = 400, 800, 1600, 2000 MHz | | |
|  | | Outer RB allocations | Inner RB allocations | |
|  | |  | Region 1 | Region 2 |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [6.0] | ≤ [1.0] | ≤ [3.5] |
|  | QPSK | ≤ [6.0] | ≤ [1.0] | ≤ [4.0] |
|  | 16 QAM | ≤ [4.5] | ≤ [3.0] | ≤ [3.0] |
|  | 64 QAM | ≤ [8.0] | ≤ [8.0] | ≤ [8.0] |
| CP-OFDM | QPSK | ≤ [6.0] | ≤ [1.5] | ≤ [3.5] |
|  | 16 QAM | ≤ [6.0] | ≤ [4.0] | ≤ [5.5] |
|  | 64 QAM | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] |

Where the following parameters are defined to specify valid RB allocation ranges for the RB allocations regions in Tables 6.2.2.1-1 , 6.2.2.1-2, 6.2.2.1-3, and 6.2.2.1-4:

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 6.2.2.1-1 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 6.2.2.1-2 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 clause 6.2.4 apply.

end change

begin change

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

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

MPR = max(MPRWT, MPRnarrow)

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 for FR2-1 in Table 6.2.2.3-1.

Table 6.2.2.3-1 MPRWT for power class 3, BWchannel ≤ 200 MHz, FR2-1

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |

MPRWT is defined for FR2-2 in Table 6.2.2.3-1b.

Table 6.2.2.3-1b MPRWT for power class 3, BWchannel = 100 MHz, FR2-2

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel = 100 MHz | |
|  | | Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | 0.0 | ≤ [0.5] |
|  | QPSK | 0.0 | ≤ [0.5] |
|  | 16 QAM | ≤ [3.0] | ≤ [3.0] |
|  | 64 QAM | ≤ [8.5] | ≤ [8.5] |
| CP-OFDM | QPSK | ≤ [1.5] | ≤ [1.5] |
|  | 16 QAM | ≤ [4.0] | ≤ [4.0] |
|  | 64 QAM | ≤ [10.0] | ≤ [10.0] |

Where the following parameters are defined to specify valid RB allocation ranges for RB allocations in Table 6.2.2.3-1:

- 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 6.2.2.3-1 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 for FR2-1 in Table 6.2.2.3-2.

Table 6.2.2.3-2 MPRWT for power class 3, BWchannel = 400 MHz, FR2-1

|  |  |  |  |
| --- | --- | --- | --- |
| 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 |

MPRWT is defined for FR2-2 in Table 6.2.2.3-2b and 6.2.2.3-2c.

Table 6.2.2.3-2b MPRWT for power class 3, BWchannel = 400 MHz, FR2-2

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel = 400 MHz | |
|  | | Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [1.0] | ≤ 3.0 |
|  | QPSK | ≤ [1.0] | ≤ 3.0 |
|  | 16 QAM | ≤ 4.5 | ≤ 4.5 |
|  | 64 QAM | ≤ [9.5] | ≤ [9.0] |
| CP-OFDM | QPSK | ≤ 5.0 | ≤ 5.0 |
|  | 16 QAM | ≤ 6.5 | ≤ 6.5 |
|  | 64 QAM | ≤ 10.0 | ≤ 10.0 |

Table 6.2.2.3-2c MPRWT for power class 3, BWchannel >= 800 MHz, FR2-2

|  |  |  |  |
| --- | --- | --- | --- |
| Modulation | | MPRWT, BWchannel = 400 MHz | |
|  | | Inner RB allocations,  Region 1 | Edge RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ [1.0] | ≤ 4.0 |
|  | QPSK | ≤ [1.0] | ≤ 4.0 |
|  | 16 QAM | ≤ 6.0 | ≤ 6.0 |
|  | 64 QAM | ≤ [9.5] | ≤ [9.0] |
| CP-OFDM | QPSK | ≤ 6.5 | ≤ 6.5 |
|  | 16 QAM | ≤ 8.0 | ≤ 8.0 |
|  | 64 QAM | ≤ 10.5 | ≤ 10.5 |

Where the following parameters are defined to specify valid RB allocation ranges for RB allocations in Table 6.2.2.3-2:

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 6.2.2.3-2 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.

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

end change

begin change

#### 6.2A.2.2 Maximum output power reduction for power class 1

##### 6.2A.2.2.1 Maximum output power reduction for power class 1 intra-band contiguous UL CA

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 Tables 6.2A.2.2-1 and 6.2A.2.2-2.

Table 6.2A.2.2-1: Maximum power reduction (MPRWT\_C\_CA) for UE power class 1 in FR2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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 | ≤ 5.51 | 7.71 | 8.2 | ≤ 8.7 |
|  | QPSK | ≤ 6.51 | 8.71 | 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) | | | | | |

Table 6.2A.2.2-2: Maximum power reduction (MPRWT\_C\_CA) for UE power class 1 in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth | | | |
| < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2000 MHz |
| Pi/2 BPSK | ≤ [7.0] | ≤ [5.0] | ≤ [2.0] | ≤ [2.0] |
| QPSK | ≤ [8.0] | ≤ [6.0] | ≤ [3.0] | ≤ [3.0] |
| 16 QAM | ≤ [8.0] | ≤ [6.0] | ≤ [4.0] | ≤ [4.0] |
| 64 QAM | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] |

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 6.2.2.1-1 if CABW ≤ 200 MHz, from Table 6.2.2.1-2 if CABW > 200 MHz.

MPR2 shall be determined from Table 6.2.2.1-1 if UL BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.1-2 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 6.2.2.1-1 and Table 6.2.2.1-2:

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

end change

begin changes

##### 6.2A.2.4.1 Maximum output power reduction for power class 3 intra-band contiguous CA

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 Tables 6.2A.2.4-1 and 6.2A.2.4-2.

Table 6.2A.2.4-1: Maximum power reduction (MPRC\_CA) for UE power class 3 in FR2-1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | 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 | ≤ 5.01 | ≤ 7.71 | ≤ 8.2 | ≤ 8.7 |
|  | QPSK | ≤ 5.01 | ≤ 7.71 | ≤ 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). | | | | | |

Table 6.2A.2.4-2: Maximum power reduction (MPRWT\_C\_CA) for UE power class 3 in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth | | | |
| < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2000 MHz |
| Pi/2 BPSK | ≤ [1.0] | ≤ [1.0] | ≤ [1.0] | ≤ [1.0] |
| QPSK | ≤ [2.0] | ≤ [2.0] | ≤ [2.0] | ≤ [2.0] |
| 16 QAM | ≤ [4.0] | ≤ [4.0] | ≤ [4.0] | ≤ [4.0] |
| 64 QAM | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] | ≤ [10.0] |

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 6.2.2.3-1 if CABW ≤ 200 MHz, from Table 6.2.2.3-2 if CABW > 200 MHz.

MPR2 shall be determined from Table 6.2.2.3-1 if UL BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.3-2 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 6.2.2.3-1 and Table 6.2.2.3-2:

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

##### 6.2A.2.4.2 Maximum output power reduction for power class 3 intra-band non-contiguous CA

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.2.4.2-1

Table 6.2A.2.4.2-1: 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 |

end change

begin change

### 6.2A.4 Configured transmitted power for CA

#### 6.2A.4.1 Configured transmitted power for intra-band UL CA

A UE configured with carrier aggregation can configure its maximum output power for each uplink activated serving cell *c* and its total configured maximum 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 in subclause 6.2A.2, 6.2A.3 and 6.2.4, respectively. 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 clause 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.4.1-1 and Table 6.2A.4.1-2.

Table 6.2A.4.1-1: PUMAX tolerance for FR2-1

|  |  |  |
| --- | --- | --- |
| 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 lower bound, PPowerclass - P – T(P) = minimum output power specified in clause 6.3A.1 | | |

Table 6.2A.4.1-2: PUMAX tolerance for FR2-2

|  |  |  |
| --- | --- | --- |
| Operating Band | ∆P (dB) | Tolerance T(∆P)  (dB) |
| n263 | 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 clause 6.3A.1 | | |

end change

begin change

### 6.3.1 Minimum output power

#### 6.3.1.0 General

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 sub frame (1ms).

#### 6.3.1.1 Minimum output power for power class 1

For power class 1 UE, the minimum output power shall not exceed the values specified in Table 6.3.1.1-1 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 6.3.1.1-1: Minimum output power for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261, n262 | 50 | 4 | 47.58 |
| 100 | 4 | 95.16 |
| 200 | 4 | 190.20 |
| 400 | 4 | 380.28 |
| n263 | 100 | 4 | 95.16 |
| 400 | 4 | 381.12 |
| 800 | 4 | 715.20 |
| 1600 | 4 | 1429.44 |
| 2000 | 4 | 1705.92 |

#### 6.3.1.2 Minimum output power for power class 2, 3, and 4

The minimum output power shall not exceed the values specified in Table 6.3.1.2-1 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 6.3.1.2-1: Minimum output power for power class 2, 3, and 4

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261, n262 | 50 | -13 | 47.58 |
|  | 100 | -13 | 95.16 |
|  | 200 | -13 | 190.20 |
|  | 400 | -13 | 380.28 |
| n263 | 100 | -13 | 95.16 |
| 400 | -13 | 381.12 |
| 800 | -13 | 715.20 |
| 1600 | -13 | 1429.44 |
| 2000 | -13 | 1705.92 |
| NOTE 1: n260 is not applied for power class 2.  NOTE 2: n259 is not applied for power class 2 and 4.  NOTE 3: power class 4 is not applicable to n263 | | | |

#### 6.3.1.3 Minimum output power for power class 5 and 6

end change

begin changes

### 6.3.2 Transmit OFF power

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 Tables 6.3.2-1 and 6.3.2-2 for each operating band supported. The requirement is verified with the test metric of TRP (Link=TX beam peak direction, Meas=TRP grid).

Table 6.3.2-1: Transmit OFF power for FR2-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n259, n260, n261, n262 | -35 | -35 | -35 | -35 |
|  | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |

Table 6.3.2-2: Transmit OFF power for FR2-2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating band |  | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
|  | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| n263 | -35 | -35 | -35 | -35 | -35 |
|  | 95.16 MHz | 381.12 MHz | 715.20 | 1429.44 | 1705.92 |

For UE indicating [IE UL Gap], UE will meet OFF power requirement defined in this clause for the band for which UL transmission is stopped in the activated UL gap.

end change

begin changes

## 6.3A Output power dynamics for CA

### 6.3A.1 Minimum output power for CA

Table 6.3A.1-1: Void

#### 6.3A.1.0 General

For intra-band contiguous and non-contiguous carrier aggregation, the minimum controlled output power of the UE is defined as the transmit power of the UE per component carrier, i.e., 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 sub frame (1ms).

#### 6.3A.1.1 Minimum output power for power class 1

For intra-band contiguous and non-contiguous carrier aggregation, the minimum output power shall not exceed the values specified in Table 6.3A.1.1-1 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 6.3A.1.1-1: Minimum output power for power class 1

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n260, n261, n262 | 50 | 4 | 47.58 |
|  | 100 | 4 | 95.16 |
|  | 200 | 4 | 190.20 |
|  | 400 | 4 | 380.28 |
| n263 | 100 | 4 | 95.16 |
|  | 400 | 4 | 381.12 |
|  | 800 | 4 | 715.20 |
|  | 1600 | 4 | 1429.44 |
|  | 2000 | 4 | 1705.92 |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the minimum output power is defined per carrier and is specified in clause 6.3.1.1.

#### 6.3A.1.2 Minimum output power for power class 2, 3, and 4

For intra-band contiguous and non-contiguous carrier aggregation, the minimum output power shall not exceed the values specified in Table 6.3A.1.2-1 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 6.3A.1.2-1: 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, n259, n260, n261, n262 | 50 | -13 | 47.58 |
|  | 100 | -13 | 95.16 |
|  | 200 | -13 | 190.20 |
|  | 400 | -13 | 380.28 |
| n263 | 100 | -13 | 95.16 |
|  | 400 | -13 | 381.12 |
|  | 800 | -13 | 715.20 |
|  | 1600 | -13 | 1429.44 |
|  | 2000 | -13 | 1705.92 |
| NOTE 1: n260 is not applied for power class 2.  NOTE 2: n259 is not applied for power class 2 and 4. | | | |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the minimum output power is defined per carrier and is specified in clause 6.3.1.2.

#### 6.3A.1.3 Minimum output power for power class 5

For intra-band contiguous and non-contiguous carrier aggregation, the minimum output power shall not exceed the values specified in Table 6.3A.1.3-1 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 6.3A.1.2-1: Minimum output power for CA for power class 5

|  |  |  |  |
| --- | --- | --- | --- |
| Operating band | Channel bandwidth  (MHz) | Minimum output power  (dBm) | Measurement bandwidth  (MHz) |
| n257, n258, n259 | 50 | -6 | 47.52 |
| 100 | -6 | 95.04 |
| 200 | -6 | 190.08 |
| 400 | -6 | 380.16 |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the minimum output power is defined per carrier and is specified in clause 6.3.1.3.

### 6.3A.2 Transmit OFF power for CA

For intra-band contiguous and non-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 on any of it sports.

The transmit OFF power shall not exceed the values specified in Table 6.3A.2-1 and Table 6.3A.2-2 for each operating band supported.

Table 6.3A.2-1: Transmit OFF power for CA for FR2-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
|  | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257, n258, n259, n260, n261, n262 | -35 | -35 | -35 | -35 |
|  | 47.58 MHz | 95.16 MHz | 190.20 MHz | 380.28 MHz |

Table 6.3A.2-2: Transmit OFF power for CA for FR2-2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Operating band |  | Channel bandwidth / Transmit OFF power (dBm) / measurement bandwidth | | | |
|  | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| n263 | -35 | -35 | -35 | -35 | -35 |
|  | 95.16 MHz | 381.12 MHz | 715.20 | 1429.44 | 1705.92 |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the transmit OFF power specified in clause 6.3.2.1 is applicable for each CC when the transmitter is OFF on all CCs. The transmitter is considered to be OFF when the UE is not allowed to transmit on any of its ports.

end changes

begin changes

#### 6.4.2.1 Error vector magnitude

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

The measured waveform is further equalised using the channel estimates subjected to the EVM equaliser spectrum flatness requirement specified in sub-clauses 6.4.2.4 and 6.4.2.5. 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 one slot for PUCCH and PUSCH in the time domain. The EVM measurement interval is reduced by any symbols that contains an allowable power transient in the measurement interval as as defined in clause 6.3.3.

The RMS average of the basic EVM measurements over 10 subframes for the average EVM case, and over 60 subframes for the reference signal EVM case, for the different modulation schemes shall not exceed the values specified in Table 6.4.2.1-1 for the parameters defined in Table 6.4.2.1-2 or 6.4.2.1-3, 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 requirement is verified with the test metric of EVM (Link=TX beam peak direction, Meas=Link angle).

Table 6.4.2.1-1: 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 6.4.2.1-2: Parameters for Error Vector Magnitude for power class 1 in FR2-1

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| UE EIRP | dBm | ≥ 4 |
| UE EIRP for UL 16 QAM | dBm | ≥ 7 |
| UE EIRP for UL 64 QAM | dBm | ≥ 11 |
| Operating conditions |  | Normal conditions |

**Table 6.4.2.1-2a: Parameters for Error Vector Magnitude for power class 1 in FR2-2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Level | | | | |
| Parameter | Unit | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| UE EIRP | dBm | ≥ 4 | ≥ [2] | ≥ [5] | ≥ [8] | ≥ [9] |
| UE EIRP for UL 16 QAM | dBm | ≥ 7 | ≥ [5] | ≥ [8] | ≥ [11] | ≥ [12] |
| UE EIRP for UL 64 QAM | dBm | ≥ 11 | ≥ [9] | ≥ [12] | ≥ [15] | ≥ [16] |
| Operating conditions | Normal Conditions | | | | | |
| NOTE 1: PTRS is configured for 16 QAM and 64 QAM | | | | | | |

Table 6.4.2.1-3: Parameters for Error Vector Magnitude for power class 2, 3, 4 and 7 in FR2-1

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| UE EIRP | dBm | ≥ -13 |
| UE EIRP for UL 16 QAM | dBm | ≥ -10 |
| UE EIRP for UL 64 QAM | dBm | ≥ -6 |
| Operating conditions |  | Normal conditions |

Table 6.4.2.1-3a: Parameters for Error Vector Magnitude for power class 3 in FR2-2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Level | | | | |
| Parameter | Unit | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| UE EIRP | dBm | ≥ -13 | [≥ -11] | [≥ -8] | [≥ -5] | [≥ -4] |
| UE EIRP for UL 16 QAM | dBm | ≥ -10 | [≥ -8] | [≥ -5] | [≥ -2] | [≥ -1] |
| UE EIRP for UL 64 QAM | dBm | ≥ -6 | [≥ -4] | [≥ -1] | [≥ 2] | [≥ 3] |
| Operating conditions | Normal Conditions | | | | | |
| NOTE 1: PTRS is configured for 16 QAM and 64 QAM | | | | | | |

**Table 6.4.2.1-3b: Parameters for Error Vector Magnitude for power class 2 in FR2-2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Level | | | | |
| Parameter | Unit | 100 MHz | 400 MHz | 800 MHz | 1600 MHz | 2000 MHz |
| UE EIRP | dBm | ≥ -13 | ≥ [-11] | ≥ [-8] | ≥ [-5] | ≥ [-4] |
| UE EIRP for UL 16 QAM | dBm | ≥ -10 | ≥ [-8] | ≥ [-5] | ≥ [-2] | ≥ [-1] |
| UE EIRP for UL 64 QAM | dBm | ≥ -6 | ≥ [-4] | ≥ [-1] | ≥ [2] | ≥ [3] |
| Operating conditions | Normal Conditions | | | | | |
| NOTE 1: PTRS is configured for 16 QAM and 64 QAM | | | | | | |

Table 6.4.2.1-4: Parameters for Error Vector Magnitude for power class 5

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Level |
| UE EIRP | dBm | ≥ -6 |
| UE EIRP for UL 16 QAM | dBm | ≥ -3 |
| UE EIRP for UL 64 QAM | dBm | ≥ 1 |
| Operating conditions |  | Normal conditions |

#### 6.4.2.2 Carrier leakage

##### 6.4.2.2.1 General

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).

##### 6.4.2.2.2 Carrier leakage for power class 1

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 6.4.2.2.2-1 and Table 6.4.2.2.2-2 for power class 1 UEs.

Table 6.4.2.2.2-1: Minimum requirements for relative carrier leakage power for power class 1 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 17 dBm | -25 |
| 4 dBm ≤ EIRP ≤ 17 dBm | -20 |

Table 6.4.2.2.2-2: Minimum requirements for relative carrier leakage power for power class 1 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 13.4 dBm | -25 |
| 0.4 dBm ≤ EIRP ≤ 13.4 dBm | -20 |

##### 6.4.2.2.3 Carrier leakage for power class 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 6.4.2.2.3-1 and Table 6.4.2.2.3-2 for power class 2.

Table 6.4.2.2.3-1: Minimum requirements for relative carrier leakage power for power class 2 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 6 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 6 dBm | -20 |

Table 6.4.2.2.3-2: Minimum requirements for relative carrier leakage power for power class 2 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 5.8 dBm | -25 |
| -13.2 dBm ≤ EIRP ≤ 5.8 dBm | -20 |

##### 6.4.2.2.4 Carrier leakage for power class 3

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 6.4.2.2.4-1 and Table 6.4.2.2.4-2 for power class 3 UEs.

Table 6.4.2.2.4-1: Minimum requirements for relative carrier leakage power for power class 3 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 0 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 0 dBm | -20 |

Table 6.4.2.2.4-2: Minimum requirements for relative carrier leakage power for power class 3 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > -1.9 dBm | -25 |
| -14.9 dBm ≤ EIRP ≤ -1.9 dBm | -20 |

##### 6.4.2.2.5 Carrier leakage for power class 4

end changes

begin changes

#### 6.4.2.3 In-band emissions

##### 6.4.2.3.1 General

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).

##### 6.4.2.3.2 In-band emissions for power class 1

The average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.2-1 for power class 1 UEs.

Table 6.4.2.3.2-1: Requirements for in-band emissions for power class 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | | Applicable Frequencies |
| General | dB |  | | | Any non-allocated (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | > 27 dBm | > 23.4 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | ≤ 27 dBm | ≤ 23.4 dBm |  |
| Carrier leakage | dBc | -25 | > 17 dBm | > 13.4 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | 4 dBm ≤ Output power ≤ 17 dBm | 0.4 dBm ≤ Output power ≤ 13.4 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. | | | | | |

##### 6.4.2.3.3 In-band emissions for power class 2

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 2.

Table 6.4.2.3.3-1: 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) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | Output power > 16 dBm | Output power > 15.8 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | Output power ≤ 16 dBm | Output power ≤ 15.8 dBm |  |
| Carrier leakage | dBc | -25 | Output power > 6 dBm | Output power > 5.8 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 6 dBm | -13.2 dBm ≤ Output power ≤ 5.8 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 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 5.3.3-1).  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: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | | |

Table 6.4.2.3.3-2: Void

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | |  |
|  |  |  | |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  | | | | |

##### 6.4.2.3.4 In-band emissions for power class 3

The average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4.2.3.4-1 for power class 3 UEs.

Table 6.4.2.3.4-1: Requirements for in-band emissions for power class 3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter description | Unit | Limit (NOTE 1) | | | Applicable Frequencies |
| General | dB |  | | | Any non-allocated (NOTE 2) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | > 10 dBm | > 8.1 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | ≤ 10 dBm | ≤ 8.1 dBm |  |
| Carrier leakage | dBc | -25 | > 0 dBm | > -1.9dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 0 dBm | -14.9 dBm ≤ Output power ≤ -1.9 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. | | | | | |

##### 6.4.2.3.5 In-band emissions for power class 4

end changes

begin changes

#### 6.4A.2.2 Carrier leakage

##### 6.4A.2.2.1 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 intra-band 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.2.2.2 Carrier leakage for power class 1

For intra-band contiguous and non-contiguous carrier aggregation, 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.2.2.2-1 and Table 6.4A.2.2.2-2 for power class 1 UEs.

Table 6.4A.2.2.2-1: Minimum requirements for relative carrier leakage for power class 1 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 17 dBm | -25 |
| 4 dBm ≤ EIRP ≤ 17 dBm | -20 |

Table 6.4A.2.2.2-2: Minimum requirements for relative carrier leakage for power class 1 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative Limit (dBc) |
| EIRP > 13.4 dBm | -25 |
| 0.4 dBm ≤ EIRP ≤ 13.4 dBm | -20 |
| NOTE: Not applicable for Intraband non-contiguous carrier aggregation | |

##### 6.4A.2.2.3 Carrier leakage for power class 2

For intra-band contiguous and non-contiguous carrier aggregation, 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.2.2.3-1 and Table 6.4A.2.2.3-2 for power class 2.

Table 6.4A.2.2.3-1: Minimum requirements for relative carrier leakage power class 2 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| EIRP > 6 dBm | -25 |
| -13 dBm ≤ EIRP ≤ 6 dBm | -20 |

Table 6.4A.2.2.3-2: Minimum requirements for relative carrier leakage power class 2 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| EIRP > 5.8 dBm | -25 |
| -13.2 dBm ≤ EIRP ≤ 5.8 dBm | -20 |
| NOTE: Not applicable for Intraband non-contiguous carrier aggregation | |

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the carrier leakage requirements are specified in clause 6.4.2.2.3 and are applicable for each CC with all CCs active with non-zero UL RB allocation.

##### 6.4A.2.2.4 Carrier leakage for power class 3

For intra-band contiguous and non-contiguous carrier aggregation, 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.2.2.4-1 and Table 6.4A.2.2.4-2 for power class 3 UEs.

Table 6.4A.2.2.4-1: Minimum requirements for relative carrier leakage power class 3 in FR2-1

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| Output power > 0 dBm | -25 |
| -13 dBm ≤ Output power EIRP ≤ 0 dBm | -20 |

Table 6.4A.2.2.4-2: Minimum requirements for relative carrier leakage power class 3 in FR2-2

|  |  |
| --- | --- |
| Parameters | Relative limit (dBc) |
| Output power > -1.9 dBm | -25 |
| -14.9 dBm ≤ Output power EIRP ≤ -1.9 dBm | -20 |
| NOTE: Not applicable for Intraband non-contiguous carrier aggregation | |

##### 6.4A.2.2.5 Carrier leakage for power class 4

end changes

begin changes

#### 6.4A.2.3 Inband emissions

##### 6.4A.2.3.1 General

For intra-band contiguous and non-contiguous carrier aggregation, the Inband emission requirement is defined over the spectrum occupied by all configured UL and DL CCs. The measurement interval is as defined in clause 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 and non-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.

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the in-band emissions requirements are applicable for each CC with all CCs active with non-zero UL RB allocation.

##### 6.4A.2.3.2 Inband emissions for power class 1

For intra-band contiguous and non-contiguous carrier aggregation, the average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4A.2.3.2-1 for power class 1 UEs.

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the in-band emissions requirements are specified in clause 6.4.2.3.2 and are applicable for each CC with all CCs active with non-zero UL RB allocation.

Table 6.4A.2.3.2-1: Requirements for in-band emissionsfor 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) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | Output power > 27 dBm | > 23.4 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | Output power ≤ 27 dBm | ≤ 23.4 dBm |  |
| Carrier leakage | dBc | -25 | Output power > 17 dBm | > 13.4 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | 4 dBm ≤ Output power ≤ 17 dBm | 0.4 dBm ≤ Output power ≤ 13.4 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 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 5.3.3-1).  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: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | | |

end changes

begin changes

##### 6.4A.2.3.3 Inband emissions for power class 2

For intra-band contiguous and non-contiguous carrier aggregation, the average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4A.2.3.3-1 for power class 2.

For inter-band carrier aggregation with uplink assigned to two NR bands, and each UL band is configured with a single CC, the in-band emissions requirements are specified in clause 6.4.2.3.3 and are applicable for each CC with all CCs active with non-zero UL RB allocation.

Table 6.4A.2.3.3-1: 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) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | Output power > 16 dBm | Output power > 15.8 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | Output power ≤ 16 dBm | Output power ≤ 15.8 dBm |  |
| Carrier leakage | dBc | -25 | Output power > 6 dBm | Output power > 5.8 dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 6 dBm | -13.2 dBm ≤ Output power ≤ 5.8 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 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 5.3.3-1).  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: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | | |

end changes

begin changes

##### 6.4A.2.3.4 Inband emissions for power class 3

For intra-band contiguous and non-contiguous carrier aggregation, the average of the in-band emission measurement over 10 sub-frames shall not exceed the values specified in Table 6.4A.2.3.4-1 for power class 3 UEs.

Table 6.4A.2.3.4-1: 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) |
|  |  |  | Output power for FR2-1 | Output Power for FR2-2 |  |
| IQ Image | dB | -25 | Output power > 10 dBm | > 8.1 dBm | Image frequencies (NOTES 2, 3) |
|  |  | -20 | Output power ≤ 10 dBm | ≤ 8.1 dBm |  |
| Carrier leakage | dBc | -25 | Output power > 0 dBm | > -1.9dBm | Carrier frequency (NOTES 4, 5) |
|  |  | -20 | -13 dBm ≤ Output power ≤ 0 dBm | -14.9 dBm ≤ Output power ≤ -1.9 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 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 5.3.3-1).  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: is an average of the transmitted power over 10 sub-frames normalized by the number of allocated RBs, measured in dBm.  NOTE 10: All powers are EIRP in beam peak direction. | | | | | |

end changes

begin changes

### 6.5A.2 Out of band emissions

#### 6.5A.2.1 Spectrum emission mask for CA

##### 6.5A.2.1.0 General

For intra-band CA, the requirements specified in this clause shall apply if the UE has at least one of UL or DL configured for CA or if the UE is configured for single CC operation with different channel bandwidths in UL and DL carriers. In case the CA configuration consists of a single UL CC, spectrum emission mask defined in subclause 6.5.2.1 applies. Spectral emission mask requirements do not apply at any frequency where IBE requirements of clause 6.4A.2.3 apply.

The requirement is verified in beam locked mode with the test metric of TRP (Link=TX beam peak direction).

##### 6.5A.2.1.1 Spectrum emission mask for intra-band contiguous UL CA

For intra-band contiguous UL carrier aggregation, the spectrum emission mask of the UE applies to frequencies (ΔfOOB) starting from the ± edge of the UL aggregated channel bandwidth (Table 5.3A.5-1). For any bandwidth class defined in Table 5.3A.5-1, the UE emission shall not exceed the levels specified in Table 6.5A.2.1-1.

Table 6.5A.2.1.1-1: General NR spectrum emission mask for intra-band contiguous CA in FR2-1 and FR2-2

|  |  |  |
| --- | --- | --- |
| ΔfOOB  (MHz) | Any carrier aggregation bandwidth class | Measurement bandwidth |
| ± 0-0.1\*BWChannel\_CA | -5 | 1 MHz |
| ± 0.1\*BWChannel\_CA -2\*BWChannel\_CA | -13 | 1 MHz |
| NOTE 1: (void) | | |

end changes

begin changes

#### 6.5A.2.3 Adjacent channel leakage ratio for CA

##### 6.5A.2.3.1 Adjacent channel leakage ratio for CA intra-band contiguous UL CA

In case the CA configuration consists of a single UL CC, the adjacent channel leakage ratio defined in subclause 6.5.2.3 applies. For intra-band contiguous UL carrier aggregation, the carrier aggregation NR adjacent channel leakage power ratio (CA NRACLR) is the ratio of the filtered mean power centred on the UL aggregated channel bandwidth to the filtered mean power centred on an adjacent UL aggregated channel bandwidth at spacing equal to the UL aggregated channel bandwidth. The assigned UL aggregated channel bandwidth power and adjacent UL aggregated channel bandwidth power are measured with rectangular filters with measurement bandwidths specified in Table 6.5A.2.3.1-1. If the measured adjacent channel power is greater than -35 dBm then the CA NRACLR shall be higher than the value specified in Table 6.5A.2.3.1-1.

Table 6.5A.2.3.1-1: General requirements for contiguous UL CA NRACLR

|  |  |
| --- | --- |
|  | CA bandwidth class / CA NRACLR / Measurement bandwidth |
|  | Any CA bandwidth class |
| CA NRACLR for band n257, n258, n261 | 17 dB |
| CA NRACLR for band n259, n260, n262 | 16 dB |
| CA NRACLR for band n263 | 15 dB |
| NR channel measurement bandwidth1 | BWChannel\_CA – 2\*BWGB |
| Adjacent channel centre frequency offset (in MHz) | + BWChannel\_CA  /  - BWChannel\_CA |
| NOTE 1: BWGB is defined in clause 5.3A.2. | |

##### 6.5A.2.3.2 Adjacent channel leakage ratio for CA intra-band non-contiguous UL CA

For intra-band non-contiguous carrier aggregation, adjacent channel leakage power ratio (CA NRACLR) is the ratio of the sum of the filtered mean powers centred on each sub-block bandwidth to the filtered mean power centred on an adjacent sub-block frequency at nominal spacing equal to the sub-block bandwidth. The power in the configured UL CCs and power in the sub-block bandwidth adjacent to each sub-block of configured UL CCs are measured with rectangular filters with measurement bandwidths specified in Table 6.5A.2.3.1-2. In case a sub-block consists of a single component carrier, the measurement bandwidths and adjacent frequency offset from subclause 6.5.2.3 shall be used. If the measured adjacent sub-block power is greater than -35 dBm then the CA NRACLR shall be higher than the value specified in Table 6.5A.2.3.1-2.

No requirement applies in the gap between neighbouring sub-blocks if the frequency span between the lowest edge of the upper sub-block and the highest edge of the lower sub-block is smaller than the bandwidth of either sub-block.

Table 6.5A.2.3.1-2: General requirements for NC UL CA NRACLR

|  |  |
| --- | --- |
|  | CA bandwidth class / CA NRACLR / Measurement bandwidth |
|  | Any CA bandwidth class |
| CA NRACLR for band n257, n258, n261 | 17 dB |
| CA NRACLR for band n260 | 16 dB |
| CA NRACLR for band n263 | 15 dB |
| NR channel measurement bandwidth1 | Σ(BWChannel,block) |
| Adjacent sub-block centre frequency offset (in MHz) | + BWChannel,block  /  - BWChannel\_block |
| NOTE 1: BWChannel\_block is defined in clause 5.3A.2.  NOTE 2: ‘Adjacent sub-block centre frequency offset’ is defined for each sub-block in the UL CA configuration | |

end changes

begin changes

### 6.6.4 Beam correspondence for power class 3

#### 6.6.4.1 General

The beam correspondence requirement for power class 3 UEs consists of three components: UE minimum peak EIRP (as defined in Clause 6.2.1.3), UE spherical coverage (as defined in Clause 6.2.1.3), and beam correspondence tolerance (as defined in Clause 6.6.4.2). The beam correspondence requirement is fulfilled if the UE satisfies one of the following conditions, depending on the UE's beam correspondence capability IE *beamCorrespondenceWithoutUL-BeamSweeping*, as defined in TS 38.306 [14]:

UEs supporting FR2-2 shall support *beamCorrespondenceWithoutUL-BeamSweeping.*

- If *beamCorrespondenceWithoutUL-BeamSweeping* is supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 with its autonomously chosen UL beams and without uplink beam sweeping. Such a UE is considered to have met the beam correspondence tolerance requirement.

- If *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceSSB-based-r16* are supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 using the side conditions for SSB based enhanced beam correspondence requirements as defined in Clause 6.6.4.3.2.

- If *beamCorrespondenceWithoutUL-BeamSweeping* and *beamCorrespondenceCSI-RS-based-r16* are supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 using the side conditions for CSI-RS based enhanced beam correspondence requirements as defined in Clause 6.6.4.3.3.

- If *beamCorrespondenceWithoutUL-BeamSweeping* is not present, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 with uplink beam sweeping. Such a UE shall meet the beam correspondence tolerance requirement defined in Clause 6.6.4.2 and shall support uplink beam management, as defined in TS 38.306 [14].

- If *beamCorrespondenceWithoutUL-BeamSweeping* is not present and *beamCorrespondenceSSB-based-r16* is supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 with uplink beam sweeping using the side conditions for SSB based enhanced beam correspondence requirements as defined in Clause 6.6.4.3.2. Such a UE shall meet the beam correspondence tolerance requirement defined in Clause 6.6.4.2 and shall support uplink beam management, as defined in TS 38.306 [14].

- If *beamCorrespondenceWithoutUL-BeamSweeping* is not present and *beamCorrespondenceCSI-RS-based-r16* is supported, the UE shall meet the minimum peak EIRP requirement according to Table 6.2.1.3-1 and spherical coverage requirement according to Table 6.2.1.3-3 with uplink beam sweeping using the side conditions for CSI-RS based enhanced beam correspondence requirements as defined in Clause 6.6.4.3.3. Such a UE shall meet the beam correspondence tolerance requirement defined in Clause 6.6.4.2 and shall support uplink beam management, as defined in TS 38.306 [14].

#### 6.6.4.2 Beam correspondence tolerance for power class 3

The beam correspondence tolerance requirement ∆EIRPBC for power class 3 UEs is defined based on a percentile of the distribution of ∆EIRPBC, defined as ∆EIRPBC = EIRP2 - EIRP1 over the link angles spanning a subset of the spherical coverage grid points, such that

- EIRP1 is the total EIRP in dBm calculated based on the beam the UE chooses autonomously (corresponding beam) to transmit in the direction of the incoming DL signal, which is based on beam correspondence without relying on UL beam sweeping.

- EIRP2 is the best total EIRP (beam yielding highest EIRP in a given direction) in dBm which is based on beam correspondence with relying on UL beam sweeping.

- The link angles are the ones corresponding to the top Nth percentile of the EIRP2 measurement over the whole sphere, where the value of N is according to the test point of EIRP spherical coverage requirement for power class 3, i.e. N = 50.

For power class 3 UEs, the requirement is fulfilled if the UE's corresponding UL beams satisfy the maximum limit in Table 6.6.4.2-1.

Table 6.6.4.2-1: UE beam correspondence tolerance for power class 3

|  |  |
| --- | --- |
| Operating band | Max ∆EIRPBC at 85th %-tile ∆EIRPBC CDF (dB) |
| n257 | 3.0 |
| n258 | 3.0 |
| n259 | 3.2 |
| n260 | 3.2 |
| n261 | 3.0 |
| n262 | 3.2 |
|  |  |
| NOTE: The requirements in this table are verified only under normal temperature conditions as defined in Annex E.2.1 | |

#### 6.6.4.3 Side Conditions

##### 6.6.4.3.1 Side Condition for beam correspondence based on SSB and CSI-RS

The beam correspondence requirements are only applied under the following side conditions:

- The downlink reference signals including both SSB and CSI-RS are provided and Type D QCL shall be maintained between SSB and CSI-RS.

- The reference measurement channel for beam correspondence are fulfilled according to the CSI-RS configuration in Annex A.3.

- For beam correspondence, conditions for L1-RSRP measurements are fulfilled according to Table 6.6.4.3.1-1 and Table 6.6.4.3.1-2.

Table 6.6.4.3.1-1: Conditions for SSB based L1-RSRP measurements for beam correspondence

|  |  |  |  |
| --- | --- | --- | --- |
| Angle of arrival | NR operating bands | Minimum SSB\_RP Note 2 | SSB Ês/Iot |
|  |  | dBm / SCSSSB | dB |
|  |  | SCSSSB = 120 kHz |  |
| All angles **Note 1** | n257 | -96.2 | ≥6 |
|  | n258 | -96.2 |  |
|  | n259 | -90.7 |  |
|  | n260 | -91.9 |  |
|  | n261 | -96.2 |  |
|  | n262 | -88.5 |  |
|  |  |  |  |
| NOTE 1: For UEs that support multiple FR2 bands, the Minimum SSB\_RP values for all angles are increased by MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1.  NOTE 2: Values specified at the radiated requirements reference point to give minimum SSB Ês/Iot, with no applied noise. | | | |

Table 6.6.4.3.1-2: Conditions for CSI-RS based L1-RSRP measurements for beam correspondence

|  |  |  |  |
| --- | --- | --- | --- |
| Angle of arrival | NR operating bands | Minimum CSI-RS\_RP Note 2 | CSI-RS Ês/Iot |
|  |  | dBm / SCSCSI-RS | dB |
|  |  | SCSCSI-RS = 120 kHz |  |
| All angles **Note 1** | n257 | -96.2 | ≥6 |
|  | n258 | -96.2 |  |
|  | n259 | -90.7 |  |
|  | n260 | -91.9 |  |
|  | n261 | -96.2 |  |
|  | n262 | -88.5 |  |
|  |  |  |  |
| NOTE 1: For UEs that support multiple FR2 bands, the Minimum SSB\_RP values for all angles are increased by MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1.  NOTE 2: Values specified at the radiated requirements reference point to give minimum CSI-RS Ês/Iot, with no applied noise. | | | |

##### 6.6.4.3.2 Side Condition for SSB based enhanced Beam Correspondence requirements

The beam correspondence requirements for beam correspondence based on SSB are only applied under the following side conditions:

- The downlink reference signal SSB is provided and CSI-RS is not provided.

- For beam correspondence, conditions for L1-RSRP measurements are fulfilled according to Table 6.6.4.3.1-1.

##### 6.6.4.3.3 Side Condition for CSI-RS based enhanced Beam Correspondence requirements

The beam correspondence requirements for beam correspondence based on CSI-RS are only applied under the following side conditions:

- The downlink reference signals including both SSB and CSI-RS are provided.

- The reference measurement channel for beam correspondence are fulfilled according to the CSI-RS configuration in Annex A.3.

- For beam correspondence, conditions for L1-RSRP measurements are fulfilled according to Table 6.6.4.3.1-2 and SSB signal is provided according to Table 6.6.4.3.3-1.

Table 6.6.4.3.3-1: SSB signal conditions for CSI-RS based beam correspondence requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Angle of arrival | NR operating bands | Minimum SSB\_RP Note 2 | SSB Ês/Iot |
|  |  | dBm / SCSSSB | dB |
|  |  | SCSSSB = 120 kHz |  |
| All angles **Note 1** | n257 | -101,4 | ≥1 |
|  | n258 | -101,4 |  |
|  | n259 | -97,1 |  |
|  | n260 | -97,1 |  |
|  | n261 | -101,4 |  |
|  | n262 | -93,5 |  |
|  |  |  |  |
| NOTE 1: For UEs that support multiple FR2 bands, the Minimum SSB\_RP values for all angles are increased by MBS,n, the UE multi-band relaxation factor in dB specified in clause 6.2.1.  NOTE 2: Values specified at the radiated requirements reference point to give minimum SSB Ês/Iot, with no applied noise. | | | |

#### 6.6.4.4 Applicability

For UEs supporting more than one type of beam correspondence, the following applicability rules apply:

- If a UE meets enhanced beam correspondence requirements either based on SSB or based on CSI-RS, it is considered to have met the beam correspondence requirements based on SSB and CSI-RS.

- For a UE supporting either SSB based or CSI-RS based enhanced beam correspondence, the UE shall meet the supported enhanced beam correspondence requirements.

- For a UE supporting both SSB based and CSI-RS based enhanced beam correspondence, the UE shall meet both SSB based and CSI-RS based enhanced beam correspondence requirements and the following applicability rules for verifying the requirements apply:

- The enhanced beam correspondence requirements shall be verified with the SSB based enhanced beam correspondence side conditions in clause 6.6.4.3.2. If the UE meets the SSB based enhanced beam correspondence requirements using the side conditions in clause 6.6.4.3.2 and meets the minimum peak EIRP requirement as defined in clasue 6.2.1.3 using the CSI-RS based side conditions in clause 6.6.4.3.3, where the link direction is determined in the SSB based enhanced beam correspondence test, the UE is considered to have met both the SSB based and CSI-RS based enhanced beam correspondence requirements.

- Otherwise, if UE does not meet the minimum peak EIRP requirement as defined in clasue 6.2.1.3 using the CSI-RS based side conditions in clause 6.6.4.3.3, the enhanced beam correspondence requirements shall be further verified for the UE with the CSI-RS based enhanced beam correspondence side conditions in clause 6.6.4.3.3.

### 6.6.5 (Void)

end changes