**3GPP TSG-RAN4 WG4 Meeting # 97-e *R4-2016530***

**Electronic meeting, Nov. 2- 13, 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-2** | **CR** |  | **rev** | **-** | **Current version:** | **16.5.0** |  |
|  | | | | | | | | |
| *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:*** | Draft CR for FR2 FWA RF requirements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_FR2\_FWA\_Bn257\_Bn258-Core | | | | |  | ***Date:*** | | | 2020-10-23 |
|  |  | | | |  | |  | | |  |
| ***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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Power class 5 is introduced in Rel-17 for FWA usage. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | RF requirements for power class 5 is added. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No RF requirement for power class 5. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2, 6.2A, 6.2D,6.3, 6.3A, 6.6, 7 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR … CR … | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS 38.521-2 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR … CR … | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |

|  |  |
| --- | --- |
| ***This CR’s revision history:*** |  |

***<Start of change1>***

## Transmitter 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 |
| 5 | Fixed wireless access (FWA) UE |

Power class 3 is default power class.

#### 6.2.1.1 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 6.2.1.1-1. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.1-1: 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 6.2.1.1-2 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 6.2.1.1-2: 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 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2.1.1-3: 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 Annex E.2.1. | |

#### 6.2.1.2 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 6.2.1.2-1. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.2-1: 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 6.2.1.2-2 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 6.2.1.2-2: 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 6.2.1.2-3 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2.1.2-3: 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 Annex E.2.1. | |

#### 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 |
| 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) |
| n257 | 23 | 43 |
| n258 | 23 | 43 |
| n259 | 23 | 43 |
| n260 | 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 6.2.1.3-3 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 |
| 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 |
| 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 | | |

#### 6.2.1.4 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 6.2.1.4-1. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.4-1: 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 6.2.1.4-2 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 6.2.1.4-2: 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 6.2.1.4-3 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2.1.4-3: 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 Annex E.2.1. | |

#### 6.2.1.5 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 6.2.1.5-1. The requirement is verified with the test metric of EIRP (Link=TX beam peak direction, Meas=Link angle).

Table 6.2.1.5-1: 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 6.2.1.5-2 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 6.2.1.5-2: 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 6.2.1.5-3 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2.1.4-3: 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 6.2.1.5-4..

Table 6.2.1.5-4: 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 |

***<End of change1>***

***<Start of change2>***

### 6.2.2 UE maximum output power reduction

6.2.2.0 General

The requirements in clause 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 clauses 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 clause 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 clause 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 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.

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 |

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

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 6.2.2.1-1 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.

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

For power class 2, MPR specified in clause 6.2.2.3 applies.

Table 6.2.2.2-1: Void

#### 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,

MPRnarrow = 2.5 dB, when LCRB is less than or equal to 1.44 MHz, and 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil(2/3NRB) ≤ RBstart ≤ NRB-LCRB, MPRnarrow = 2.0 dB, when 1.44 MHz < LCRB <= 4.32 MHz, and 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil(2/3NRB) ≤ RBstart ≤ NRB-LCRB, otherwise MPRnarrow = 0 dB when RB size is greater than 4.32 MHz, where NRB is the maximum transmission bandwidth configuration defined in Table 5.3.2-1.

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 6.2.2.3-1.

Table 6.2.2.3-1 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 6.2.2.3-1:

- 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 LCRB is less than or equal to 1.44 MHz, and 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil(2/3NRB) ≤ RBstart ≤ NRB-LCRB, where NRB is the maximum transmission bandwidth configuration defined in Table 5.3.2-1.

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 6.2.2.3-2.

Table 6.2.2.3-2 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 6.2.2.3-2:

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

For power class 4, MPR specified in sub-clause 6.2.2.3 applies.

Table 6.2.2.4-1: Void

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

For power class 5, MPR specified in sub-clause 6.2.2.3 applies.

### 6.2.3 UE maximum output power with additional requirements

#### 6.2.3.1 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 clause 6.2.1. Unless stated otherwise, an A-MPR of 0 dB shall be used.

Table 6.2.3.1-1 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 and the *additionalSpectrumEmission* to network signalling labels is specified in Table 6.2.3.1-2. Unless otherwise stated, the allowed total back off is maximum of A-MPR and MPR specified in clause 6.2.2.

Table 6.2.3.1-1: Additional maximum power reduction (A-MPR)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Network Signalling label | Requirements (clause) | NR Band | Channel bandwidth (MHz) | Resources Blocks (*N*RB) | A-MPR (dB) |
| NS\_200 |  |  |  |  | N/A |
| NS\_201 | 6.5.3.2.2 | n258 |  |  | 6.2.3.2 |
| NS\_202 | 6.5.3.2.3 | n257, n258 |  |  | 6.2.3.3 |

Table 6.2.3.1-2: Mapping of Network Signaling label

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **NR Band** | **Value of additionalSpectrumEmission** | | | | | | | |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| n257 | NS\_200 | NS\_202 |  |  |  |  |  |  |
| n258 | NS\_200 | NS\_201 | NS\_202 |  |  |  |  |  |
| n259 | NS\_200 |  |  |  |  |  |  |  |
| n260 | NS\_200 |  |  |  |  |  |  |  |
| n261 | NS\_200 |  |  |  |  |  |  |  |
| NOTE: additionalSpectrumEmission corresponds to an information element of the same name defined in sub-clause 6.3.2 of TS 38.331 [13]. | | | | | | | | |

#### 6.2.3.2 A-MPR for NS\_201

##### 6.2.3.2.1 A-MPR for NS\_201 for power class 1

For power class 1, A-MPR for NS\_201 shall be 9 dB.

Table 6.2.3.2.1-1: (Void)

##### 6.2.3.2.2 A-MPR for NS\_201 for power class 2

For power class 2, A-MPR specified in clause 6.2.3.2.3 applies

Table 6.2.3.2.2-1: (Void)

##### 6.2.3.2.3 A-MPR for NS\_201 for power class 3

Table 6.2.3.2.3-1: AMPR for NS\_201 for power class 3

|  |  |
| --- | --- |
| Offset Frequency | Channel Bandwidth, MHz |
| 400 |
| Outer RB allocations |
| 0 MHz, ≤ 100 MHz | ≤ 1.5 |
| > 100 MHz, ≤ 300 MHz | 0 |
| > 300 MHz | 0 |
| NOTE 1: The Offset frequency is defined as the frequency from 24.25 GHz to the lower channel edge.  NOTE 2: The allowable back off is max(MPR, AMPR), where the MPR is defined in Table 6.2.2.3-1  NOTE 3: Any undefined region, MPR applies | |

##### 6.2.3.2.4 A-MPR for NS\_201 for power class 4

For power class 4, A-MPR for NS\_201 specified in clause 6.2.3.2.3 applies.

##### 6.2.3.2.4 A-MPR for NS\_201 for power class 5

For power class 5, A-MPR for NS\_201 specified in clause 6.2.3.2.3 applies.

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

##### 6.2.3.3.1 A-MPR for NS\_202 for power class 1

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

##### 6.2.3.3.2 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 applies.

##### 6.2.3.3.3 A-MPR for NS\_202 for power class 3

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

##### 6.2.3.3.4 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 applies.

##### 6.2.3.3.4 A-MPR for NS\_202 for power class 5

For power class 5, A-MPR for NS\_202 specified in clause 6.2.3.3.3 applies.

***<End of change2>***

***<Start of change3>***

## 6.2A Transmitter power for CA

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

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 clause 6.2.1.

For uplink intra-band contiguous carrier aggregation for any CA bandwidth class, the maximum output power is specified in clause 6.2.1.

Power class 3 is default power class.

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

#### 6.2A.2.1 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 clauses below.

The cumulative aggregated channel bandwidth is defined as the frequency band from the lowest edge of the lowest CC to the upper edge of the highest CC of all UL and DL configured CCs inside the bidirectional spectrum of the UE. When the maximum output power of a UE is modified by MPR, the power limits specified in clause 6.2A.4 apply.

The requirements in the following clauses are applicable to the following CA configurations:

- intra-band contiguous uplink CA, with the aggregated channel bandwidth no greater than 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.2.2 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 Table 6.2A.2.2-1.

Table 6.2A.2.2-1: 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 | ≤ 5.51 | 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) | | | | | |

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 BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.1-2 if 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 unallocated 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

BWchannel\_CA is the aggregated channel bandwidth of the UL CA configuration

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

##### 6.2A.2.2.2 Maximum output power reduction for power class 1 intra-band non-contiguous UL CA

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.2.2.2-1

Table 6.2A.2.2.2-1: 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 |

#### 6.2A.2.3 Maximum output power reduction for power class 2

For power class 2, MPR specified in sub-clause 6.2A.2.4.1 applies for intra-band contiguous UL CA and sub-clause 6.2A.2.4.2 applies for intra-band non-contiguous UL CA.

Table 6.2A.2.3-1: (Void)

#### 6.2A.2.4 Maximum output power reduction for power class 3

##### 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 Table 6.2A.2.4-1.

Table 6.2A.2.4-1: Maximum power reduction (MPRC\_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 | ≤ 5.01 | ≤ 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). | | | | | |

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 BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.3-2 if 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 unallocated 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

BWchannel\_CA is the aggregated channel bandwidth of the UL CA configurationWhen 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

##### 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 |

#### 6.2A.2.5 Maximum output power reduction for power class 4

For power class 4, MPR specified in sub-clause 6.2A.2.4.1 applies for intra-band contiguous UL CA and sub-clause 6.2A.2.4.2 applies for intra-band non-contiguous UL CA.

#### 6.2A.2.6 Maximum output power reduction for power class 5

For power class 5, MPR specified in sub-clause 6.2A.2.4.1 applies for intra-band contiguous UL CA and sub-clause 6.2A.2.4.2 applies for intra-band non-contiguous UL CA.

### 6.2A.3 UE maximum output power with additional requirements for CA

#### 6.2A.3.1 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. 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.

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.3.1-1 is allowed for all serving cells of the applicable uplink contiguous CA configurations according to the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell*.

Table 6.2A.3.1-1 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.3.1-2. Unless otherwise stated, the allowed total back off is maximum of A-MPR and MPR specified in clause 6.2A.2.

Table 6.2A.3.1-1: 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 | 6.5.3.2.2 | n258 |  |  | 6.2A.3.2 |
| CA\_NS\_202 | 6.5.3.2.3 | n257, n258 |  |  | 6.2A.3.3 |

Table 6.2A.3.1-2: 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 |  |  |  |  |  |
| n259 | CA\_NS\_200 |  |  |  |  |  |  |  |
| n260 | CA\_NS\_200 |  |  |  |  |  |  |  |
| n261 | CA\_NS\_200 |  |  |  |  |  |  |  |
| NOTE: additionalSpectrumEmission corresponds to an information element of the same name defined in clause 6.3.2 of TS 38.331 [13]. | | | | | | | | |

#### 6.2A.3.2 A-MPR for CA\_NS\_201

##### 6.2A.3.2.1 A-MPR for CA\_NS\_201 for power class 1

For intra-band contiguous CA, AMPR is specified as follows.

Table 6.2A.3.2.1-1: (Void)

For power class 1 CA non-contiguous RB allocations, the following rule for AMPR (dB) applies:

AMPR = max(AMPRC\_CA, -10\*A +12.0)

Where AMPRC\_CA is 9.0

##### 6.2A.3.2.2 A-MPR for CA\_NS\_201 for power class 2

For intra-band contiguous CA, A-MPR specified in sub-clause 6.2A.3.2.3 applies.

Table 6.2A.3.2.2-1: (Void)

##### 6.2A.3.2.3 A-MPR for CA\_NS\_201 for power class 3

For intra-band contiguous CA, AMPR is specified as follows.

Table 6.2A.3.2.3-1: Contiguous Allocations, AMPRC\_CA for CA\_NS\_201 for power class 3

|  |  |  |
| --- | --- | --- |
| Offset Frequency | Cumulative Aggregated Bandwidth, MHz | |
| < 400 | ≥ 400,  ≤ 800 |
| 0 MHz, ≤ 100 MHz | ≤ 1.5 | ≤ 3.0 |
| > 100 MHz, ≤ 300 MHz | 0 | 0 |
| > 300 MHz | 0 | 0 |
| NOTE 1: The Offset frequency is defined as the frequency from 24.25 GHz to the lower channel edge.  NOTE 2: The allowable back off is max(MPR, AMPR), where the MPR is defined in Table 6.2A.2.4-1.  NOTE 3: Any undefined region, MPR applies. | | |

For power class 3 CA non-contiguous RB allocations, the following rule for AMPR applies:

AMPR = max(AMPRC\_CA, - 10\*A + 5.0) , Offset Frequency ≤ 550 MHz

##### 6.2A.3.2.4 A-MPR for CA\_NS\_201 for power class 4

For intra-band contiguous CA, A-MPR for CA\_NS\_201 specified in sub-clause 6.2A.3.2.3 applies.

##### 6.2A.3.2.5 A-MPR for CA\_NS\_201 for power class 5

For intra-band contiguous CA, A-MPR for CA\_NS\_201 specified in sub-clause 6.2A.3.2.3 applies.

#### 6.2A.3.3 A-MPR for CA\_NS\_202

##### 6.2A.3.3.1 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.3.3.2 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.3.3.3 applies.

##### 6.2A.3.3.3 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.3.3.4 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.3.3.3 applies.

##### 6.2A.3.3.5 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.3.3.3 applies.

***<End of change3>***

***<Start of change4>***

## 6.2D Transmitter 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 [10, 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 [10, TS 38.213]. | | | | | |

#### 6.2D.1.1 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.1.1-1 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.1.1-1: 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 |
| NOTE 1: Minimum peak EIRP is defined as the lower limit without tolerance | |

Table 6.2D.1.1-2: (void)

The maximum output power values for TRP and EIRP are found in Table 6.2D.1.1-3 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: 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 |

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.1.1-4 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2D.1.1-4: 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 |
| NOTE 1: Minimum EIRP at 85 %-tile CDF is defined as the lower limit without tolerance | |

#### 6.2D.1.2 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.1.2-1 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.1.2-1: UE minimum peak EIRP for UL MIMO for power class 2

|  |  |
| --- | --- |
| Operating band | Min peak EIRP (dBm) |
| n257 | 29 |
| n258 | 29 |
| n261 | 29 |
| 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.1.2-2 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.1.2-2: 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 |

Table 6.2D.1.2-3: (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.1.2-4 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2D.1.2-4: 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 |
| NOTE 1: Minimum EIRP at 60 %-tile CDF is defined as the lower limit without tolerance | |

#### 6.2D.1.3 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.1.3-1 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.1.3-1: 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 |
| 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.1.3-2 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.1.3-2: 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 |

Table 6.2D.1.3-3: (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.1.3-4 below. The requirement is verified with the test metric of EIRP (Link=spherical coverage grid, Meas=Link angle).

Table 6.2D.1.3-4: 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.1.4 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.1.4-1 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.1.4-1: 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 |
| 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.1.4-2 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.1.4-2: 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 |

Table 6.2D.1.4-3: (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.1.4-4 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2D.1.4-4: 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 |
| NOTE 1: Minimum EIRP at 20 %-tile CDF is defined as the lower limit without tolerance | |

#### 6.2D.1.5 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 6.2D.1.5-1 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.1.5-1: 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 6.2D.1.5-3 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.1.5-2: 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 6.2D.1.5-3 below. The requirement is verified with the test metric of EIRP (Link=Spherical coverage grid, Meas=Link angle).

Table 6.2D.1.5-3: 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.2 UE maximum output power reduction for modulation / channel bandwidth for UL MIMO

#### 6.2D.2.1 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.1.1-1 is specified in sub-clause 6.2.2.1. 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.2.2 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.1.2-1 is specified in sub-clause 6.2.2.2. 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 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.1.3-1 is specified in sub-clause 6.2.2.3. 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.2.4 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.1.4-1 is specified in sub-clause 6.2.2.4. 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.2.5 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.1.4-1 is specified in sub-clause 6.2.2.4. 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.3 UE maximum output power reduction with additional requirements for UL MIMO

#### 6.2D.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 shall apply to the maximum output power specified in Table 6.2D.1.1-1. 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 apply.

#### 6.2D.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 shall apply to the maximum output power specified in Table 6.2D.1.2-1. 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 apply.

#### 6.2D.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 shall apply to the maximum output power specified in Table 6.2D.1.3-1. 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 apply.

#### 6.2D.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 shall apply to the maximum output power specified in Table 6.2D.1.4-1. The requirements shall be met with the configurations specified in clause 6.2D.1.0.

#### 6.2D.3.5 UE maximum output power reduction with additional requirements 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 A-MPR values specified in clause 6.2.3 shall apply to the maximum output power specified in Table 6.2D.1.4-1. The requirements shall be met with the configurations specified in clause 6.2D.1.0.

***<End of change4>***

***<Start of change5>***

## 6.3 Output power dynamics

### 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.

#### 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 | 50 | 4 | 47.52 |
| 100 | 4 | 95.04 |
| 200 | 4 | 190.08 |
| 400 | 4 | 380.16 |

#### 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, n259, n260, n261 | 50 | -13 | 47.52 |
| 100 | -13 | 95.04 |
| 200 | -13 | 190.08 |
| 400 | -13 | 380.16 |
| NOTE 1: n260 is not applied for power class 2.  NOTE 2: n259 is not applied for power class 2 and 4. | | | |

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

The minimum output power shall not exceed the values specified in Table 6.3.1.3-1 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 6.3.1.3-1: Minimum output power for power class 5

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

## 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 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.

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

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 | 50 | 4 | 47.52 |
| 100 | 4 | 95.04 |
| 200 | 4 | 190.08 |
| 400 | 4 | 380.16 |

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

The minimum output power shall not exceed the values specified in Table 6.3A.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 | 50 | -13 | 47.52 |
| 100 | -13 | 95.04 |
| 200 | -13 | 190.08 |
| 400 | -13 | 380.16 |
| NOTE 1: n260 is not applied for power class 2.  NOTE 2: n259 is not applied for power class 2 and 4. | | | |

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

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 | 50 | -6 | 47.52 |
| 100 | -6 | 95.04 |
| 200 | -6 | 190.08 |
| 400 | -6 | 380.16 |

***<End of change5>***

***<Start of change6>***

# 7 Receiver characteristics

## 7.3 Reference sensitivity

### 7.3.1 General

The reference sensitivity power level REFSENS is defined as the EIS level at the centre of the quiet zone in the RX beam peak direction, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

### 7.3.2 Reference sensitivity power level

#### 7.3.2.1 Reference sensitivity power level for power class 1

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.1-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3.2.1-1: Reference sensitivity for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | REFSENS (dBm) / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257 | -97.5 | -94.5 | -91.5 | -88.5 |
| n258 | -97.5 | -94.5 | -91.5 | -88.5 |
| n260 | -94.5 | -91.5 | -88.5 | -85.5 |
| n261 | -97.5 | -94.5 | -91.5 | -88.5 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 | | | | |

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Table 7.3.2.1-2: Uplink configuration for reference sensitivity

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Operating band | NR Band / Channel bandwidth / NRB / SCS / Duplex mode | | | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz | SCS | Duplex Mode |
| n257 | 32 | 64 | 128 | 256 | 120 kHz | TDD |
| n258 | 32 | 64 | 128 | 256 | 120 kHz | TDD |
| n260 | 32 | 64 | 128 | 256 | 120 kHz | TDD |
| n261 | 32 | 64 | 128 | 256 | 120 kHz | TDD |

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

Table 7.3.2.1-3: Network signaling value for reference sensitivity

|  |  |
| --- | --- |
| Operating band | Network Signalling value |
| n258 | NS\_201 |

#### 7.3.2.2 Reference sensitivity power level for power class 2

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.2-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3.2.2-1: Reference sensitivity for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | REFSENS (dBm) / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257 | -92.0 | -89.0 | -86.0 | -83.0 |
| n258 | -92.0 | -89.0 | -86.0 | -83.0 |
| n261 | -92.0 | -89.0 | -86.0 | -83.0 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 | | | | |

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

#### 7.3.2.3 Reference sensitivity power level for power class 3

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.3-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

For the UEs that support multiple FR2 bands, the minimum requirement for Reference sensitivity in Table 7.3.2.3-1 shall be increased per band, respectively, by the reference sensitivity relaxation parameter ∆MBP,n as specified in clause 6.2.1.3. The requirement for the UE which supports a single FR2 band is specified in Table 7.3.2.3-1. The requirement for the UE which supports multiple FR2 bands is specified in both Table 7.3.2.3-1 and Table 6.2.1.3-4.

Table 7.3.2.3-1: Reference sensitivity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | REFSENS (dBm) / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257 | -88.3 | -85.3 | -82.3 | -79.3 |
| n258 | -88.3 | -85.3 | -82.3 | -79.3 |
| n259 | -84.7 | -81.7 | -78.7 | -75.7 |
| n260 | -85.7 | -82.7 | -79.7 | -76.7 |
| n261 | -88.3 | -85.3 | -82.3 | -79.3 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 | | | | |

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

#### 7.3.2.4 Reference sensitivity power level for power class 4

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.4-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3.2.4-1: Reference sensitivity for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | REFSENS (dBm) / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257 | -97.0 | -94.0 | -91.0 | -88.0 |
| n258 | -97.0 | -94.0 | -91.0 | -88.0 |
| n260 | -95.0 | -92.0 | -89.0 | -86.0 |
| n261 | -97.0 | -94.0 | -91.0 | -88.0 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 | | | | |

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

#### 7.3.2.5 Reference sensitivity power level for power class 5

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.3.2 and A.3.3.2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1) with peak reference sensitivity specified in Table 7.3.2.5-1. The requirement is verified with the test metric of EIS (Link=RX beam peak direction, Meas=Link Angle).

Table 7.3.2.5-1: Reference sensitivity for power class 5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | REFSENS (dBm) / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257 | -92.6 | -89.6 | -86.6 | -83.6 |
| n258 | -92.8 | -89.8 | -86.8 | -83.8 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4 | | | | |

The REFSENS requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

### 7.3.3 Void

### 7.3.4 EIS spherical coverage

7.3.4.1 EIS spherical coverage for power class 1

The reference measurement channels and throughput criterion shall be as specified in clause 7.3.2.1

The maximum EIS at the 85th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.1-1 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

Table 7.3.4.1-1: EIS spherical coverage for power class 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | EIS at 85th %-tile CCDF (dBm) / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257 | -89.5 | -86.5 | -83.5 | -80.5 |
| n258 | -89.5 | -86.5 | -83.5 | -80.5 |
| n260 | -86.5 | -83.5 | -80.5 | -77.5 |
| n261 | -89.5 | -86.5 | -83.5 | -80.5 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4  NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in Annex E.2.1. | | | | |

The requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

7.3.4.2 EIS spherical coverage for power class 2

The reference measurement channels and throughput criterion shall be as specified in clause 7.3.2.2

The maximum EIS at the 60th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.2-1 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

Table 7.3.4.2-1: EIS spherical coverage for power class 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating band** | **EIS at 60th %-tile CCDF (dBm) / Channel bandwidth** | | | |
| **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** |
| n257 | -81.0 | -78.0 | -75.0 | -72.0 |
| n258 | -81.0 | -78.0 | -75.0 | -72.0 |
| n261 | -81.0 | -78.0 | -75.0 | -72.0 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4  NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in Annex E.2.1. | | | | |

The requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

#### 7.3.4.3 EIS spherical coverage for power class 3

The reference measurement channels and throughput criterion shall be as specified in clause 7.3.2.3

The maximum EIS at the 50th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.3-1 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

For the UEs that support multiple FR2 bands, the minimum requirement for EIS spherical coverage in Table 7.3.4.3-1 shall be increased per band, respectively, by the EIS spherical coveragerelaxation parameter ∆MBS,n as specified in clause 6.2.1.3. The requirement for the UE which supports a single FR2 band is specified in Table 7.3.4.3-1. The requirement for the UE which supports multiple FR2 bands is specified in both Table 7.3.4.3-1 and Table 6.2.1.3-4.

Table 7.3.4.3-1: EIS spherical coverage for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating band** | **EIS at 50th %-tile CCDF (dBm) / Channel bandwidth** | | | |
| **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** |
| n257 | -77.4 | -74.4 | -71.4 | -68.4 |
| n258 | -77.4 | -74.4 | -71.4 | -68.4 |
| n259 | -71.9 | -68.9 | -65.9 | -62.9 |
| n260 | -73.1 | -70.1 | -67.1 | -64.1 |
| n261 | -77.4 | -74.4 | -71.4 | -68.4 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4  NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in Annex E.2.1. | | | | |

The requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

7.3.4.4 EIS spherical coverage for power class 4

The reference measurement channels and throughput criterion shall be as specified in clause 7.3.2.4

The maximum EIS at the 20th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.4-1 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

Table 7.3.4.4-1: EIS spherical coverage for power class 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating band** | **EIS at 20th %-tile CCDF (dBm) / Channel bandwidth** | | | |
| **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** |
| n257 | -88.0 | -85.0 | -82.0 | -79.0 |
| n258 | -88.0 | -85.0 | -82.0 | -79.0 |
| n260 | -83.0 | -80.0 | -77.0 | -74.0 |
| n261 | -88.0 | -85.0 | -82.0 | -79.0 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4  NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in Annex E.2.1. | | | | |

The requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

7.3.4.5 EIS spherical coverage for power class 5

The reference measurement channels and throughput criterion shall be as specified in clause 7.3.2.4

The maximum EIS at the 85th percentile of the CCDF of EIS measured over the full sphere around the UE is defined as the spherical coverage requirement and is found in Table 7.3.4.5-1 below. The requirement is verified with the test metric of EIS (Link=Spherical coverage grid, Meas=Link angle).

Table 7.3.4.5-1: EIS spherical coverage for power class 5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating band** | **EIS at 85th %-tile CCDF (dBm) / Channel bandwidth** | | | |
| **50 MHz** | **100 MHz** | **200 MHz** | **400 MHz** |
| n257 | -84.6 | -81.6 | -78.6 | -75.6 |
| n258 | -84.8 | -81.8 | -78.8 | -75.8 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4  NOTE 2: The EIS spherical coverage requirements are verified only under normal thermal conditions as defined in Annex E.2.1. | | | | |

The requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for reference sensitivity shall be verified with the network signalling value NS\_200 (Table 6.2.3-1) configured.

***<End of change7>***