**3GPP TSG-RAN4 Meeting #96-e *R4-2011783***

**Online, , 17th Aug 2020 - 28th Aug 2020 Revison of R4-2010060**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-1** | **CR** | **0432** | **rev** | **1** | **Current version:** | **16.4.0** |  |
|  | | | | | | | | |
| *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:*** | CR for 38.101-1: Introduction of Power Class 1.5 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | T-Mobile USA | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | LTE\_NR\_B41\_Bn41\_PC29dBm-Core | | | | |  | ***Date:*** | | | 2020-08-07 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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:*** | | Introduction of Power Class 1.5 (29 dBm) for UL MIMO and Transmit Diversity. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Adds requirements for standalone Power Class 1.5 for UL MIMO and Transmit Diversity, including MPR and A-MPR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Power Class 1.5 is not supported for standalone NR. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2.1, 6.2.2, 6.2.3.2, 6.2.4, 6.2D.1, 6.5.2.4.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **x** |  | Other core specifications | | | | TS 38.307 CR 0028 | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.521-1 CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Rev 1 updates MPR and A-MPR based on R4-2011782, New note in 6.5A.3.2.3 removed. In Table 6.5.2.4.1-2 dBm changed to dB. | | | | | | | | |

<First changed section>

### 6.2.1 UE maximum output power

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

Table 6.2.1-1: UE Power Class

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR  band | Class 1 (dBm) | | Tolerance (dB) | | Class 1.5 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) |
| n1 |  | |  | |  |  |  |  | 23 | ±2 |
| n2 |  | |  | |  |  |  |  | 23 | ±23 |
| n3 |  | |  | |  |  |  |  | 23 | ±23 |
| n5 |  | |  | |  |  |  |  | 23 | ±2 |
| n7 |  | |  | |  |  |  |  | 23 | ±23 |
| n8 |  | |  | |  |  |  |  | 23 | ±23 |
| n12 |  | |  | |  |  |  |  | 23 | ±23 |
| n14 | 31 | | +2/-3 | |  |  |  |  | 23 | ±23 |
| n18 |  | |  | |  |  |  |  | 23 | ±2 |
| n20 |  | |  | |  |  |  |  | 23 | ±23 |
| n25 |  | |  | |  |  |  |  | 23 | ±23 |
| n26 |  | |  | |  |  |  |  | 23 | ±23 |
| n28 |  | |  | |  |  |  |  | 23 | +2/-2.5 |
| n30 |  | |  | |  |  |  |  | 23 | ±2 |
| n34 |  | |  | |  |  |  |  | 23 | ±2 |
| n38 |  | |  | |  |  |  |  | 23 | ±2 |
| n39 |  | |  | |  |  |  |  | 23 | ±2 |
| n40 |  | |  | |  |  |  |  | 23 | ±2 |
| n41 |  | |  | | 295 | \_2/-33 | 26 | +2/-33 | 23 | ±23 |
| n47 |  | |  | |  |  |  |  | 23 | ±2 |
| n48 |  | |  | |  |  |  |  | 23 | +2/-3 |
| n50 |  | |  | |  |  |  |  | 23 | ±2 |
| n51 |  | |  | |  |  |  |  | 23 | ±2 |
| n53 |  | |  | |  |  |  |  | 23 | ±2 |
| n65 |  | |  | |  |  |  |  | 23 | ±2 |
| n66 |  | |  | |  |  |  |  | 23 | ±2 |
| n70 |  | |  | |  |  |  |  | 23 | ±2 |
| n71 |  | |  | |  |  |  |  | 23 | +2/-2.5 |
| n74 |  | |  | |  |  |  |  | 23 | ±2 |
| n77 |  | |  | |  |  | 26 | +2/-3 | 23 | +2/-3 |
| n78 |  | |  | |  |  | 26 | +2/-3 | 23 | +2/-3 |
| n79 |  | |  | |  |  | 26 | +2/-3 | 23 | +2/-3 |
| n80 |  | |  | |  |  |  |  | 23 | ±2 |
| n81 |  | |  | |  |  |  |  | 23 | ±2 |
| n82 |  | |  | |  |  |  |  | 23 | ±2 |
| n83 |  | |  | |  |  |  |  | 23 | ±2/-2.5 |
| n84 |  | |  | |  |  |  |  | 23 | ±2 |
| n86 |  | |  | |  |  |  |  | 23 | ±2 |
| n89 |  | |  | |  |  |  |  | 23 | ±2 |
| n91 |  | |  | |  |  |  |  | 23 | ±23, 4 |
| n92 |  | |  | |  |  |  |  | 23 | ±23, 4 |
| n93 |  | |  | |  |  |  |  | 23 | ±23, 4 |
| n94 |  | |  | |  |  |  |  | 23 | ±23, 4 |
| n95 |  | |  | |  |  |  |  | 23 | ±2 |
|  | |  | | NOTE 1: PPowerClass is the maximum UE power specified without taking into account the tolerance  NOTE 2: Powerclass 3 is default power class unless otherwise stated  NOTE 3: Refers to the transmission bandwidths confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high – 4 MHz and FUL\_high, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB.  NOTE 4: The maximum output power requirement is relaxed by reducing the lower tolerance limit by 0.3 dB  NOTE 5: Achieved via dual Tx | | | | | | |

If a UE supports a different power class than the default UE power class for the band and the supported power class enables the higher maximum output power than that of the default power class:

- if the field of UE capability *maxUplinkDutyCycle-PC2-FR1* is absent and the percentage of uplink symbols transmitted in a certain evaluation period is larger than 50% (The exact evaluation period is no less than one radio frame); or

- if the field of UE capability *maxUplinkDutyCycle-PC2-FR1* is not absent and the percentage of uplink symbols transmitted in a certain evaluation period is larger than *maxUplinkDutyCycle-PC2-FR1* as defined in TS 38.331 (The exact evaluation period is no less than one radio frame); or

- if the IE P-Max as defined in TS 38.331 [7] is provided and set to the maximum output power of the default power class or lower;

- shall apply all requirements for the default power class to the supported power class and set the configured transmitted power as specified in clause 6.2.4;

- else if the UE does not support a power class with higher maximum output power than PC2; or

- if the field of UE capability maxUplinkDutyCycle is absent and the percentage of uplink symbols transmitted in a certain evaluation period is larger than 25% (The exact evaluation period is no less than one radio frame); or

- if the field of UE capability maxUplinkDutyCycle is not absent and the percentage of uplink symbols transmitted in a certain evaluation period is larger than maxUplinkDutyCycle/2 (The exact evaluation period is no less than one radio frame); or

if the IE P-Max as defined in TS 38.331 [7] is provided and set to the maximum output power of the power class 2 or lower;

shall apply all requirements for power class 2 to the supported power class and set the configured transmitted power as specified in clause 6.2.4;

- else shall apply all requirements for the supported power class and set the configured transmitted power as specified in clause 6.2.4.

### 6.2.2 UE maximum output power reduction

UE is allowed to reduce the maximum output power due to higher order modulations and transmit bandwidth configurations. For UE power class 1.5, 2 and 3, the allowed maximum power reduction (MPR) is defined in Table 6.2.2-4, Table 6.2.2-2 and Table 6.2.2-1, respectively for channel bandwidths that meets both following criteria:

Channel bandwidth ≤ 100 MHz.

Relative channel bandwidth ≤ 4 % for TDD bands and ≤ 3 % for FDD bands. Unless otherwise stated, the ∆MPR is set to zero.

If the relative channel bandwidth is larger than 4% for TDD bands or 3% for FDD bands, the ∆MPR is defined in Table 6.2.2-3.

Where relative channel bandwith = 2\*BWChannel / (FUL\_low + FUL\_high)

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

Table 6.2.2-1 Maximum power reduction (MPR) for power class 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPR (dB) | | |
| Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 3.51 | ≤ 1.21 | ≤ 0.21 |
| ≤ 0.52 | ≤ 0.52 | 02 |
| QPSK | ≤ 1 | | 0 |
| 16 QAM | ≤ 2 | | ≤ 1 |
| 64 QAM | ≤ 2.5 | | |
| 256 QAM | ≤ 4.5 | | |
| CP-OFDM | QPSK | ≤ 3 | | ≤ 1.5 |
| 16 QAM | ≤ 3 | | ≤ 2 |
| 64 QAM | ≤ 3.5 | | |
| 256 QAM | ≤ 6.5 | | |
| NOTE 1: Applicable for UE operating in TDD mode with Pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and if the IE *powerBoostPi2BPSK* is set to 1 and 40 % or less slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79. The reference power of 0 dB MPR is 26 dBm.  NOTE 2: Applicable for UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79 with Pi/2 BPSK modulation and if the IE *powerBoostPi2BPSK* is set to 0 and if more than 40 % of slots in radio frame are used for UL transmission for bands n40, n41, n77, n78 and n79. | | | | |

Table 6.2.2-2 Maximum power reduction (MPR) for power class 2

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

Table 6.2.2-3: ∆MPR

|  |  |  |  |
| --- | --- | --- | --- |
| NR Band | Power class | Channel bandwidth | ∆MPR (dB) |
| n28 | Power class 3 | 30 MHz | 0.5 |

Table 6.2.2-4 Maximum power reduction (MPR) for power class 1.5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Modulation | | MPR (dB) | | |
| Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 6.5 | ≤ 3.5 | ≤ 1.5 |
| QPSK | ≤ 6.5 | ≤ 4 | ≤ 1.5 |
| 16 QAM | ≤ 6.5 | ≤ 5 | ≤ 2.5 |
| 64 QAM | ≤ 6.5 | ≤ 5.5 | ≤ 4 |
| 256 QAM | ≤ 7.5 | ≤ 7.5 | ≤ 7.5 |
| CP-OFDM | QPSK | ≤ 6.5 | ≤ 6 | ≤ 3 |
| 16 QAM | ≤ 6.5 | ≤ 6 | ≤ 3.5 |
| 64 QAM | ≤ 6.5 | ≤ 6.5 | ≤ 5 |
| 256 QAM | ≤ 9.5 | ≤ 9.5 | ≤ 9.5 |

Where the following parameters are defined to specify valid RB allocation ranges for Outer and Inner RB allocations:

NRB is the maximum number of RBs for a given Channel bandwidth and sub-carrier spacing defined in Table 5.3.2-1. RBStart,Low = max(1, floor(LCRB/2))

where max() indicates the largest value of all arguments and floor(x) is the greatest integer less than or equal to x.

RBStart,High = NRB – RBStart,Low – LCRB

The RB allocation is an Inner RB allocation if the following conditions are met

RBStart,Low ≤ RBStart ≤ RBStart,High,and

LCRB ≤ ceil(NRB/2)

where ceil(x) is the smallest integer greater than or equal to x.

An Edge RB allocation is the one for which the RB(s) is (are) allocated at the lowermost or uppermost edge of the channel with LCRB ≤ 2 RBs.

The RB allocation is an Outer RB allocation for all other allocations which are not an Inner RB allocation or Edge RB allocation.

If CP-OFDM allocation satisfies following conditions, it is considered as almost contiguous allocation

NRB\_gap / (NRB\_alloc + NRB\_gap ) ≤ 0.25

and NRB\_alloc + NRB\_gap is larger than 106, 51 or 24 RBs for 15 kHz, 30 kHz or 60 kHz respectively where NRB\_gap is the total number of unallocated RBs between allocated RBs and NRB\_alloc is the total number of allocated RBs. The size and location of allocated and unallocated RBs are restricted by RBG parameters specified in clause 6.1.2.2 of TS 38.214 [10]. For these almost contiguous signals in power class 2 and 3, the allowed maximum power reduction defined in Table 6.2.2-1 is increased by

CEIL{ 10 log10(1 + NRB\_gap / NRB\_alloc), 0.5 } dB,

where CEIL{x,0.5} means x rounding upwards to closest 0.5dB. The parameters of RBStart,Low and RBStart,High to specify valid RB allocation ranges for Outer and Inner RB allocations are defined as following:

RBStart,Low = max(1, floor((NRB\_alloc + NRB\_gap)/2))

RBStart,High = NRB – RBStart,Low – NRB\_alloc –NRB\_gap

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

<Next changed section>

#### 6.2.3.2 A-MPR for NS\_04

For NS\_04, A-MPR is not added to MPR. Also, when NS\_04 is signalled, MPR shall be set to zero in the PCMAX equations to avoid double counting MPR.

Allowed maximum power reduction is defined as A-MPR = max(MPR, A-MPR'),

Note that A-MPR' = 0 dB means only MPR is applied,

where A-MPR' is defined as

if RBstart ≤ fstart,max,IMD3 / (12⋅SCS) and LCRB ≤ AWmax,IMD3 / (12⋅SCS) and FC - BWChannel/2 < FUL\_low + offsetIMD3,  
then

the A-MPR' is defined according to Table 6.2.3.2-2 PC3\_A2 relative to 23 dBm for power class 3, PC2\_A4 relative to 26 dBm for power class 2, and PC1.5\_A6 relative to 29 dBm for power class 1.5,

else,

if RBstart ≤ LCRB/2 + start / (12⋅SCS) and LCRB ≤ AWmax,regrowth / (12⋅SCS) and FC - BWChannel/2 < FUL\_low + offsetregrowth,  
then

the A-MPR' is defined according to Table 6.2.3.2-2 PC3\_A1 relative to 23 dBm for power class 3, PC2\_A3 relative to 26 dBm for power class 2, , and PC1.5\_A5 relative to 29 dBm for power class 1.5,

else

A-MPR' = 0 dB and apply MPR.

With the parameters defined in Table 6.2.3.2-1.

Table 6.2.3.2-1: Parameters for region edges and frequency offsets

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Symbol | Value | | | Related condition |
| CP-OFDM | | DFT-s-OFDM |
| Max allocation start in IMD3 region | fstart,max,IMD3 | 0.33 BWChannel | | | RBstart ≤ fstart,max,IMD3 / (12SCS) |
| Max allocation BW in IMD3 region | AWmax,IMD3 | 4 MHz | | | LCRB ≤ AWmax,IMD3 / (12SCS) |
| Freq. offset required to avoid A-MPR in IMD3 region | offsetIMD3 | BWChannel – 6 MHz | | | FC - BWChannel/2 ≥ FUL\_low + offsetIMD3 |
| Right edge of regrowth region | start | 0.08 BWChannel | | | RBstart ≤ LCRB/2 + start / (12SCS) |
| Max allocation BW in regrowth region | AWmax,regrowth | 100 MHz | | | LCRB ≤ Min(LCRB,Max, AWmax,regrowth / (12SCS)) |
| Freq. offset required to avoid A-MPR in regrowth region | offsetregrowth | Max (10 MHz, 0.25\* BWChannel MHz) | Max (10 MHz, 0.45\* BWChannel MHz) | | FC - BWChannel/2 ≥ FUL\_low + offsetregrowth |

Table 6.2.3.2-2: A-MPR' values Access

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Modulation/Waveform | | A-MPR' (dB) | | | | | |
| PC3\_A1 | PC3\_A2 | PC2\_A3 | PC2\_A4 | PC1.5\_A51 | PC1.5\_A61 |
| DFT-s-OFDM | Pi/2-BPSK | ≤ 3.5 | ≤ 3.5 | ≤ 3.5 | ≤ 5.5 | ≤ 5 | ≤ 7 |
| QPSK | ≤ 4 | ≤ 4 | ≤ 4.5 | ≤ 6 | ≤ 6 | ≤ 7.5 |
| 16 QAM | ≤ 4 | ≤ 4 | ≤ 5 | ≤ 6 | ≤ 6.5 | ≤ 7.5 |
| 64 QAM | ≤ 4 | ≤ 4.5 | ≤ 5 | ≤ 6.5 | ≤ 6.5 | ≤ 8 |
| 256 QAM | ≤ 4.5 | ≤ 6 | ≤ 6.5 | ≤ 8 | ≤ 8 | ≤ 9.5 |
| CP-OFDM | QPSK | ≤ 5.5 | ≤ 5.5 | ≤ 6.5 | ≤ 7.5 | ≤ 8 | ≤ 9 |
| 16 QAM | ≤ 5.5 | ≤ 5.5 | ≤ 6.5 | ≤ 7.5 | ≤ 8 | ≤ 9 |
| 64 QAM | ≤ 5.5 | ≤ 5.5 | ≤ 6.5 | ≤ 7.5 | ≤ 8 | ≤ 9 |
| 256 QAM | ≤ 6.5 | ≤ 8 | ≤ 7.5 | ≤ 10 | ≤ 9 | ≤ 11.5 |
| NOTE 1: PC1.5 assumes dual Tx. | | | | | | | |

<Next changed section>

### 6.2.4 Configured transmitted power

The UE is allowed to set its configured maximum output power PCMAX,f,c for carrier f of serving cell c in each slot. The configured maximum output power PCMAX,f,c is set within the following bounds:

PCMAX\_L,f,c ≤ PCMAX,f,c ≤ PCMAX\_H,f,c with

PCMAX\_L,f,c = MIN {PEMAX,c– ∆TC,c, (PPowerClass – ΔPPowerClass) – MAX(MAX(MPRc+∆MPRc, A-MPRc)+ ΔTIB,c + ∆TC,c +∆TRxSRS, P-MPRc) }

PCMAX\_H,f,c = MIN {PEMAX,c, PPowerClass – ΔPPowerClass }

where

PEMAX,c is the value given by either the *p-Max* IE or the field *additionalPmax* of the *NR-NS-PmaxList IE*, whichever is applicable according to TS 38.331[7];

PPowerClass is the maximum UE power specified in Table 6.2.1-1 without taking into account the tolerance specified in the Table 6.2.1-1;

When the IE *powerBoostPi2BPSK* is set to 1, PEMAX,c is increased by +3 dB for a power class 3 capable UE operating in TDD bands n40, n41, n77, n78, and n79 with PI/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and 40% or less symbols in certain evaluation period are used for UL transmission when PEMAX,c ≥ 20 dBm (The exact evaluation period is no less than one radio frame).

When the IE *powerBoostPi2BPSK* is set to 1, ΔPPowerClass = -3 dB for a power class 3 capable UE operating in TDD bands n40, n41, n77, n78, and n79 with Pi/2 BPSK modulation and UE indicates support for UE capability *powerBoosting-pi2BPSK* and 40% or less slots in radio frame are used for UL transmission.

ΔPPowerClass = 3 dB for a power class 2 capable UE or 6 dB for a power class 1.5 UE when P-max of 23 dBm or lower is indicated; or when the field of UE capability *maxUplinkDutyCycle-PC2-FR1* is absent and the percentage of uplink symbols transmitted in a certain evaluation period is larger than 50%; or when the field of UE capability *maxUplinkDutyCycle-PC2-FR1* is not absent and the percentage of uplink symbols transmitted in a certain evaluation period is larger than *maxUplinkDutyCycle-PC2-FR1* as defined in TS 38.331 (The exact evaluation period is no less than one radio frame); 3 dB for a power class 1.5 capable UE when P-max of between 23 dBm and 26 dB is indicated; or when the field of UE capability *maxUplinkDutyCycle-PC2-FR1* is absent and the percentage of uplink symbols transmitted in a certain evaluation period is between 25% and 50%; or when the field of UE capability *maxUplinkDutyCycle-PC2-FR1* is not absent and the percentage of uplink symbols transmitted in a certain evaluation period is between *maxUplinkDutyCycle-PC2-FR1* and *maxUplinkDutyCycle-PC2-FR1/2* as defined in TS 38.331 (The exact evaluation period is no less than one radio frame);otherwise ΔPPowerClass = 0 dB;

∆TIB,c is the additional tolerance for serving cell c as specified in clause 6.2A.4.2 for NR CA, clause 6.2C.2 for SUL, or TS 38.101-3 clause 6.2B.4.2 for EN-DC; ∆TIB,c = 0 dB otherwise;

∆TC,c = 1.5dB when NOTE 3 in Table 6.2.1-1 in 38.101-1 applies for a serving cell c, otherwise ∆TC,c = 0 dB ;

MPRc and A-MPRc for serving cell c are specified in clause 6.2.2 and clause 6.2.3, respectively;

∆MPRc for serving cell c is specified in clause 6.2.2.

∆TRxSRS is applied when UE transmits SRS to other than first SRS port when the *SRS-TxSwitch* capability is indicated as '1T2R', '1T4R' or, '1T4R/2T4R' with UE configured with 4 SRS resources in the SRS resource set, and when UE transmits SRS to other than first or second SRS port when the *SRS-TxSwitch* capabilityis indicated as '2T4R' or '1T4R/2T4R' with the UE configured with 2 SRS resources in the SRS resource set. The value of ∆TRxSRS is 4.5dB for n79 and 3 dB for bands whose FUL\_high is lower than the FUL\_low of n79.

For other SRS transmissions ∆TRxSRS is zero;

P-MPRc is the allowed maximum output power reduction for

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

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

The UE shall apply P-MPRc for serving cell c only for the above cases. For UE conducted conformance testing P-MPRc shall be 0 dB

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

NOTE 2: P-MPRc may impact the maximum uplink performance for the selected UL transmission path.

TREF and Teval are specified in Table 6.2.4-1. For each TREF, the PCMAX,L,c for serving cell c are evaluated per Teval and given by the minimum value taken over the transmission(s) within the Teval; the minimum PCMAX\_L,f,c over one or more Teval is then applied for the entire TREF

Table 6.2.4-1: Evaluation and reference periods for Pcmax

|  |  |  |
| --- | --- | --- |
| TREF | Teval | Teval with frequency hopping |
| Physical channel length | Physical channel length | Min(*Tno\_hopping*, Physical Channel Length) |

The measured configured maximum output power PUMAX,f,c shall be within the following bounds:

PCMAX\_L,f,c – MAX{TL,c, T(PCMAX\_L,f,c)} ≤ PUMAX,f,c ≤ PCMAX\_H,f,c + T(PCMAX\_H,f,c).

where the tolerance T(PCMAX,f,c) for applicable values of PCMAX,f,c is specified in Table 6.2.4-1. The tolerance TL,c is the absolute value of the lower tolerance for the applicable operating band as specified in Table 6.2.1-1.

Table 6.2.4-1: PCMAX tolerance

|  |  |
| --- | --- |
| PCMAX,f,c (dBm) | Tolerance T(PCMAX,f,c) (dB) |
| 23 < PCMAX,c ≤ 33 | 2.0 |
| 21 ≤ PCMAX,c ≤ 23 | 2.0 |
| 20 ≤ PCMAX,c < 21 | 2.5 |
| 19 ≤ PCMAX,c < 20 | 3.5 |
| 18 ≤ PCMAX,c < 19 | 4.0 |
| 13 ≤ PCMAX,c < 18 | 5.0 |
| 8 ≤ PCMAX,c < 13 | 6.0 |
| -40 ≤ PCMAX,c < 8 | 7.0 |

<Next changed section>

### 6.2D.1 UE maximum output power for UL MIMO

For power class 2 UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the maximum output power for any transmission bandwidth within the channel bandwidth is specified in Table 6.2D.1-1. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1-2. For UE supporting UL MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1 ms).

The requirements shall be met with the UL MIMO configurations of using 2-layer UL MIMO transmission with codebook of. DCI Format for UE configured in PUSCH transmission mode for uplink single-user MIMO shall be used.

Table 6.2D.1-1: UE Power Class for UL MIMO in closed loop spatial multiplexing scheme

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR band | Class 1.5 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) | Class 4 (dBm) | Tolerance (dB) |
| n1 |  |  |  |  | 23 | +2/-3 |  |  |
| n2 |  |  |  |  | 23 | +2/-31 |  |  |
| n3 |  |  |  |  | 23 | +2/-31 |  |  |
| n7 |  |  |  |  | 23 | +2/-31 |  |  |
| n25 |  |  |  |  | 23 | +2/-31 |  |  |
| n30 |  |  |  |  | 23 | +2/-3 |  |  |
| n34 |  |  |  |  | 23 | +2/-3 |  |  |
| n38 |  |  |  |  | 23 | +2/-3 |  |  |
| n39 |  |  |  |  | 23 | +2/-3 |  |  |
| n40 |  |  |  |  | 23 | +2/-3 |  |  |
| n41 | 29 | +2/-31 | 26 | +2/-31 | 23 | +2/-31 |  |  |
| n48 |  |  |  |  | 23 | +2/-3 |  |  |
| n66 |  |  |  |  | 23 | +2/-3 |  |  |
| n70 |  |  |  |  | 23 | +2/-3 |  |  |
| n71 |  |  |  |  | 23 | +2/-3 |  |  |
| n77 |  |  | 26 | +2/-3 | 23 | +2/-3 |  |  |
| n78 |  |  | 26 | +2/-3 | 23 | +2/-3 |  |  |
| n79 |  |  | 26 | +2/-3 | 23 | +2/-3 |  |  |
| NOTE 1: The transmission bandwidths confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high – 4 MHz and FUL\_high, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB  NOTE 2: Power class 3 is the default power class unless otherwise stated | | | | | | | | |

Table 6.2D.1-2: UL MIMO configuration in closed-loop spatial multiplexing scheme

|  |  |  |
| --- | --- | --- |
| Transmission scheme | DCI format | Codebook Index |
| Codebook based uplink | DCI format 0\_1 | Codebook index 0 |

If UE is configured for transmission on single-antenna port, the requirements in clause 6.2.1 apply.

<Next changed section>

##### 6.5.2.4.1 NR ACLR

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

The assigned NR channel power and adjacent NR channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.5.2.4.1-1.

If the measured adjacent channel power is greater than –50 dBm then the NRACLR shall be higher than the value specified in Table 6.5.2.4.1-2.

Table 6.5.2.4.1-1: NR ACLR measurement bandwidth

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR channel bandwidth / NR ACLR measurement bandwidth | | | | | | | | | | | | | |
|  | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 70 MHz | 80 MHz | 90 MHz | 100 MHz |
| NR ACLR measurement bandwidth  (MHz) | 4.515 | 9.375 | 14.235 | 19.095 | 23.955 | 28.815 | 38.895 | 48.615 | 58.35 | 68.07 | 78.15 | 88.23 | 98.31 |

Table 6.5.2.4.1-2: NR ACLR requirement

|  |  |  |  |
| --- | --- | --- | --- |
|  | Power class 1.5 | Power class 2 | Power class 3 |
| NR ACLR | 31 dB | 31 dB | 30 dB |

<End of changes>