**3GPP TSG-RAN WG4 Meeting #100-e *R4-2115125***

**Electronic meeting, August 16-27, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-1** | **CR** | **<CR#>** | **rev** | **-** | **Current version:** | **15.14.0** |  |
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| *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:*** | Big CR for TS 38.101-1 Maintenance part1 (Rel-15) | | | | | | | | | |
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| ***Source to WG:*** | MCC, vivo | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Core,  TEI15 | | | | |  | ***Date:*** | | | 2021-08-30 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-15 |
|  | *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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This big CRs merge the mutile endorsed draf CRs. The reason for change in each endorsed draft CR is copied below.  R4-2111906 CR to 38.101-1: UL MIMO requirements update  TxD is based on the principle of non1:1 mapping between SRS ports and antenna connectors. This principle must be applied to 2 layer transmission also, for consistency  A correct test methodology requires diagonalization (regardless of chosen diagonalization method) of the channel, i.e separating received signals at the TE into their constituent layers prior to EVM calculation.  R4-2113298 Draft CR to TS 38.101-1: corrections on power tolerance and UE additional maximum output power reduction  The current power class tolerance for n83 is ±2/-2.5, the lower tolerance is not clear.  The network signalling NS\_10 is missing for n82.  R4-2114871 Generalization of band edge relaxation for UL band configurations  To avoid the situation that 38.101-1 has errors for band edge relaxation applicability repeatedly  R4-2114874 Clarifications on additional UE co-ex requirements for 2 Band UL CA/DC for Japan(R15)  Due to the clean-up of general/additional UE co-ex requirements, the additional requirements for 2 band UL UE co-ex were deleted and left uncovered for some time.  R4-2114877 Draft CR to TS38.101-1: Inter-band NR CA Tx requirement including single carrier UL configuration.  As discussed in R4-2112904, Some of the Tx requirements are only defined for ‘nXA-nYA’ type of UL CA configurations, which means single carrier, i.e. ‘-’ type of UL CA configurations is missing.  Also as mentioned in [R4-2113021](ftp://ftp.3gpp.org/tsg_ran/WG4_Radio/TSGR4_94_eBis/Docs/R4-2113021.zip), the requirements for “Output power dynamics for CA” for “inter-band carrier aggregation with one uplink carrier” were defined in Rel-15 in Clause 6.3A. However, with introduction of more CA configurations in Rel-16, this part of requirements become a “hanging paragraph” which was not permitted by TS drafting rule defined in clause 5.2.4 in TS 21.801.  R4-2114881 DraftCR to TS38.101-1 for the corrections on configured power requirement for SRS antenna switching  To solve the above identified issues, the following changes introduced:  (1) The describing terms added for the case if SRS-TxSwitch capability is indicated as ’1T4R/2T4R’;  (2) The additional condition of “ΔPPowerClass = 0 dB” and “ΔPPowerClass = 3 dB”, for different expected UE behavior.  (3) A small typo to delete an unnecesary quotation mark.  (4) new bullet to describe 1T2R behavior  (5) Use 1st or 2nd SRS resource rather than SRS port to discriminate primary and non-primary antenna port.  R4-2115108 Draft CR to TS 38.101-1 on corrections to symbols and abbreviations (Rel-15)  Some symbols in clause 3.2 and abbreviations in clause 3.3 are inaccurate and should be corrected. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The summary of change in each each endorsed draft CR is copied below.  R4-2111906 CR to 38.101-1: UL MIMO requirements update  EVM and EVM equalizer flatness requirements changed to apply on per layer basis  R4-2113298 Draft CR to TS 38.101-1: corrections on power tolerance and UE additional maximum output power reduction  1.Revise the UE power class lower tolerance in Table 6.2.1-1 from ±2/-2.5 to +2/-2.5 dB for Band n83.  2.Adding NS\_10 for n82 in the section of UE additional maximum output power reduction  R4-2114871 Generalization of band edge relaxation for UL band configurations  Introduce a note to capture a rule on how to apply band edge relaxation to UL band configurations and stop adding a NOTE as superscript notation to indicate a necessity of band edge relaxation to MOP table for each of the UL CA configurations.  R4-2114874 Clarifications on additional UE co-ex requirements for 2 Band UL CA/DC for Japan(R15)  The new section and table are added to make the requirements clear.  R4-2114877 Draft CR to TS38.101-1: Inter-band NR CA Tx requirement including single carrier UL configuration.  The definition/description of some Tx requirements are added to support single carrier, i.e. ‘-’ type of UL CA configurations.  Move the contents of hanging paragrap of requirments “inter-band carrier aggregation with one uplink carrier” in 6.3A into respective clauses.  R4-2114881 DraftCR to TS38.101-1 for the corrections on configured  power requirement for SRS antenna switching  To solve the above identified issues, the following changes introduced:  (1) The describing terms added for the case if SRS-TxSwitch capability is indicated as ’1T4R/2T4R’;  (2) The additional condition of “ΔPPowerClass = 0 dB” and “ΔPPowerClass = 3 dB”, for different expected UE behavior.  (3) A small typo to delete an unnecesary quotation mark.  (4) new bullet to describe 1T2R behavior  (5) Use 1st or 2nd SRS resource rather than SRS port to discriminate primary and non-primary antenna port.  R4-2115108 Draft CR to TS 38.101-1 on corrections to symbols and abbreviations (Rel-15)   1. To correct symbols in clause 3.2. 2. To correct abbreviations in clause 3.3. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | R4-2111906 CR to 38.101-1: UL MIMO requirements update  Incorrect or invalid requirements remain  R4-2113298 Draft CR to TS 38.101-1: corrections on power tolerance and UE additional maximum output power reduction  It may cause confusion when testing maximum output power requirements for n83  R4-2114871 Generalization of band edge relaxation for UL band configurations  Unnecessary care has to be taken to introduce new band configuraitons and inrease work load to correct errors  R4-2114874 Clarifications on additional UE co-ex requirements for 2 Band UL CA/DC for Japan(R15)  The relevant requirements remain missed.  R4-2114877 Draft CR to TS38.101-1: Inter-band NR CA Tx requirement including single carrier UL configuration.  Incomplete inter-band UL CA requirements, meanwhile hanging paragrap which was not allowed by TS drafting rule remains in clause 6.3A.  R4-2114881 DraftCR to TS38.101-1 for the corrections on configured power requirement for SRS antenna switching  PCMAX for SRS transmission when antenna switched does not properly.  R4-2115108 Draft CR to TS 38.101-1 on corrections to symbols and abbreviations (Rel-15)  The symbols and abbreviations will be inaccurate. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | R4-2111906 CR to 38.101-1: UL MIMO requirements update  6.4D  R4-2113298 Draft CR to TS 38.101-1: corrections on power tolerance and UE additional maximum output power reduction  6.2.1, 6.2.3  R4-2114871 Generalization of band edge relaxation for UL band configurations  6.2A.1.3  R4-2114874 Clarifications on additional UE co-ex requirements for 2 Band UL CA/DC for Japan(R15)  6.2A.3.1.3  R4-2114877 Draft CR to TS38.101-1: Inter-band NR CA Tx requirement including single carrier UL configuration.  6.2A.2.3, 6.2A.3.1.3, 6.3A, 6.3A.2.3, 6.3A.3.3, 6.4A.1.3, 6.4A.2.3  R4-2114881 DraftCR to TS38.101-1 for the corrections on configured power requirement for SRS antenna switching  6.2.4  R4-2115108 Draft CR to TS 38.101-1 on corrections to symbols and abbreviations (Rel-15)  3.2, 3.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS 38.521-1 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## ***<Start of change>***

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

ΔFGlobal Granularity of the global frequency raster

ΔFRaster Band dependent channel raster granularity

ΔfOOB Δ Frequency of Out Of Band emission

ΔFTX-RX Δ Frequency of default TX-RX separation of the FDD *operating band*

ΔPPowerClass Adjustment to maximum output power for a given power class

RB The starting frequency offset between the allocated RB and the measured non-allocated RB

ΔRIB,c Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell *c*

ΔRIB,4R Reference sensitivity adjustment due to support for 4 antenna ports

ΔShift Channel raster offset

TC Allowed operating band edge transmission power relaxation

TC,*c*Allowed operating band edge transmission power relaxation for serving cell *c*

ΔTIB,c Allowed maximum configured output power relaxation due to support for inter-band CA operation and due to support for SUL operations, for serving cell *c*

BWChannel Channel bandwidth

BWChannel,block Sub-block bandwidth, expressed in MHz. BWChannel,block= Fedge,block,high- Fedge,block,low

BWChannel\_CA Aggregated channel bandwidth, expressed in MHz

BWChannel,max Maximum channel bandwidth supported among all bands in a release

BWGB max( BWGB,Channel(*k*) )

BWGB,Channel(k) Minimum guard band defined in clause 5.3A.1 of carrier *k*

BWDL Channel bandwidth for DL

BWUL Channel bandwidth for UL

BWinterferer Bandwidth of the interferer

Ceil(x) Rounding upwards; ceil(x) is the smallest integer such that ceil(x) ≥ x

Floor(x) Rounding downwards; floor(x) is the greatest integer such that floor(x) ≤ x

FC *RF reference frequency* on the channel raster, given in table 5.4.2.2-1

FC,block, high Fc of the highest transmitted/received carrier in a *sub-block*

FC,block, low Fc of the lowest transmitted/received carrier in a *sub-block*

FC,low The Fc of the lowest carrier, expressed in MHz

FC,high The Fc of the highest carrier, expressed in MHz

FDL\_low The lowest frequency of the downlink *operating band*

FDL\_high The highest frequency of the downlink *operating band*

FUL\_low The lowest frequency of the uplink *operating band*

FUL\_high The highest frequency of the uplink *operating band*

Fedge,block,low The lower *sub-block* edge, where Fedge,block,low = FC,block,low - Foffset, low.

Fedge,block,high The upper *sub-block* edge, where Fedge,block,high = FC,block,high + Foffset, high.

Fedge , low The *lower edge* of *aggregated channel bandwidth*, expressed in MHz. Fedge,low = FC,low - Foffset,low.

Fedge, high The *higher edge* of *aggregated channel bandwidth*, expressed in MHz. Fedge,high = FC,high + Foffset,high.

FInterferer (offset) Frequency offset of the interferer (between the center frequency of the interferer and the carrier frequency of the carrier measured)

FInterferer Frequency of the interferer

FIoffset Frequency offset of the interferer (between the center frequency of the interferer and the closest edge of the carrier measured)

Foffset Frequency offset from FC\_high to the *higher edge* or FC\_low to the *lower edge.*

Foffset,high Frequency offset from FC,high to the upper *UE RF Bandwidth edge*, or from FC,block, high to the upper sub-block edge

Foffset,low Frequency offset from FC,low to the lower *UE RF Bandwidth edge*, or from FC,block, low to the lower sub-block edge

FOOB The boundary between the NR out of band emission and spurious emission domains

FREF RF reference frequency

FREF-Offs Offset used for calculating FREF

FREF, shift RF reference frequency for Supplementary Uplink (SUL) bands, the uplink of all FDD bands, and TDD bands

Fuw (offset) The frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer

GBChannel Minimum guard band defined in clause 5.3.3

LCRB Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resources blocks

Max() The largest of given numbers

Min() The smallest of given numbers

 Physical resource block number

NRACLR NR ACLR

NRB Transmission bandwidth configuration, expressed in units of resource blocks

NRB\_agg The number of the aggregated RBs within the fully allocated aggregated channel bandwidth

NRB\_agg The number of the aggregated RBs within the fully allocated aggregated channel bandwidth

for carrier 1 to j, where μ is defined in TS 38.211 [6]

NRB,c The transmission bandwidth configuration of component carrier c, expressed in units of resource blocks

for carrier j, where *μ* is defined in TS 38.211 [6]

NRB,low The transmission bandwidth configurations according to Table 5.3.2-1 for the lowest assigned component carrier in section 5.3A.1

NRB,high The transmission bandwidth configurations according to Table 5.3.2-1 for the highest assigned component carrier in section 5.3A.1

NREF NR Absolute Radio Frequency Channel Number (NR-ARFCN)

NREF-Offs Offset used for calculating NREF

PCMAX The configured maximum UE output power

PCMAX, *c* The configured maximum UE output power for serving cell *c*

PCMAX, *f*, *c* The configured maximum UE output power for carrier *f* of serving cell *c* in each slot

PEMAX Maximum allowed UE output power signalled by higher layers

PEMAX, *c* Maximum allowed UE output power signalled by higher layers for serving cell *c*

PInterferer Modulated mean power of the interferer

Plargest BW Power of the largest transmission bandwidth configuration of the component carriers in the bandwidth combination

PPowerClass The nominal UE power (i.e., no tolerance)

P-MPR*c* Power Management Maximum Power Reduction for serving cell *c*

PRB The transmitted power per allocated RB, measured in dBm

PUMAX The measured configured maximum UE output power

Puw Power of an unwanted DL signal

Pw Power of a wanted DL signal

RBstart The lowest RB index of transmitted resource blocks

SCSc SCS for the component carrier c

SCSlargest BW SCS for the largest transmission bandwidth configuration of the component carriers in the bandwidth combination

SCSlow SCS for the lowest assigned component carrier in section 5.3A.1

SCShigh SCS for the highest assigned component carrier in section 5.3A.1

T(PCMAX, *f*, *c*) Tolerance for applicable values of PCMAX, *f*, *c* for configured maximum UE output power for carrier *f* of serving cell *c*

TL,c Absolute value of the lower tolerance for the applicable *operating band* as specified in section 6.2.1

SSREF SS block reference frequency position

UTRAACLR UTRA ACLR

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

ACLR Adjacent Channel Leakage Ratio

ACS Adjacent Channel Selectivity

A-MPR Additional Maximum Power Reduction

BS Base Station

BW Bandwidth

BWP Bandwidth Part

CA Carrier Aggregation

CA\_nX-nY Inter-band CA of component carrier(s) in one sub-block within Band nX and component carrier(s) in one sub-block within Band nY where nX and nY are the applicable NR *operating bands*

CC Component Carriers

CP-OFDM Cyclic Prefix-OFDM

CW Continuous Wave

DC Dual Connectivity

DFT-s-OFDM Discrete Fourier Transform-spread-OFDM

DM-RS Demodulation Reference Signal

DTX Discontinuous TransmissionE-UTRA Evolved UTRA

EVM Error Vector Magnitude

FR Frequency Range

FRC Fixed Reference Channel

GSCN Global Synchronization Channel Number

IBB In-band Blocking

IDFT Inverse Discrete Fourier Transformation

ITU‑R Radiocommunication Sector of the International Telecommunication Union

MBW Measurement bandwidth defined for the protected band

MOP Maximum Output Power

MPR Allowed maximum power reduction

MSD Maximum Sensitivity Degradation

NR New Radio

NR-ARFCN NR Absolute Radio Frequency Channel Number

NS Network Signalling

OCNG OFDMA Channel Noise Generator

OOB Out-of-band

P-MPR Power Management Maximum Power Reduction

PRB Physical Resource Block

QAM Quadrature Amplitude Modulation

RE Resource Element

REFSENS Reference Sensitivity

RF Radio Frequency

RMS Root Mean Square (value)

RSRP Reference Signal Receiving Power

Rx Receiver

SC Single Carrier

SCS Subcarrier spacing

SDL Supplementary Downlink

SEM Spectrum Emission Mask

SNR Signal-to-Noise Ratio

SRS Sounding Reference SymbolSUL Supplementary uplink

SS Synchronization Symbol

SUL Supplementary uplink

TAE Time Alignment Error

Tx Transmitter

UL MIMO Uplink Multiple Antenna transmission

## ***<Next change>***

## 6.2 Transmitter power

### 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 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 |
| n20 |  |  |  |  | 23 | ±23 |
| n25 |  |  |  |  | 23 | ±23 |
| n28 |  |  |  |  | 23 | +2/-2.5 |
| n34 |  |  |  |  | 23 | ±2 |
| n38 |  |  |  |  | 23 | ±2 |
| n39 |  |  |  |  | 23 | ±2 |
| n40 |  |  |  |  | 23 | ±2 |
| n41 |  |  | 26 | +2/-33 | 23 | ±23 |
| n50 |  |  |  |  | 23 | ±2 |
| n51 |  |  |  |  | 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 |
| 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 | | | | | | |

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 IE *P-Max* as defined in TS 38.331 [7] is not provided or set to the higher value than the maximum output power of the default power class and the percentage of uplink symbols transmitted in a certain evaluation period is less than or equal to *maxUplinkDutyCycle-PC2-FR1* as defined in TS 38.331; or

- if the IE *P-Max* as defined in TS 38.331 [7] is not provided or set to the higher value than the maximum output power of the default power class and the percentage of uplink symbols transmitted in a certain evaluation period is less than or equal to 50% when *maxUplinkDutyCycle-PC2-FR1* is absent. (The exact evaluation period is no less than one radio frame):

- 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

## ***<Next change>***

### 6.2.3 UE additional maximum output power reduction

#### 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 [7]*.*

To meet the additional requirements, additional maximum power reduction (A-MPR) is allowed for the maximum output power as specified in Table 6.2.1-1. Unless stated otherwise, the total reduction to UE maximum output power is max(MPR, A-MPR) where MPR is defined in clause 6.2.2. Outer and inner allocation notation used in clause 6.2.3 is defined in clause 6.2.2 In absense of modulation and waveform types the A-MPR applies to all modulation and waveform types.

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. In case of a power class 3 UE, when IE *powerBoostPi2BPSK* is set to 1, power class 2 A-MPR values apply. The mapping of NR frequency band numbers and values of the *additionalSpectrumEmission* to network signalling labels is specified in Table 6.2.3.1-1A.

For almost contiguous allocations in CP-OFDM waveforms in power class 3, the allowed A-MPR defined in clause 6.2.3 is increased by CEIL{ 10 log10(1 + NRB\_gap / NRB\_alloc), 0.5 } dB, where NRB\_gap is the total number of unallocated RBs between allocated RBs and NRB\_alloc is the total number of allocated RBs, and the parameter LCRB is replaced by NRB\_alloc + NRB\_gap in specifying the RB allocation regions.

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\_01 |  | Table 5.2-1 | 5, 10, 15, 20, 25, 30, 40, 50, 60, 80, 90, 100 | Table 5.3.2-1 | N/A |
| NS\_03 | 6.5.2.3.3 | n2, n25, n66,  n70, n86 |  |  | Clause 6.2.3.7 |
| NS\_03U | 6.5.2.3.3, 6.5.2.4.2 | n2, n25, n66, n86 |  |  | Clause 6.2.3.7 |
| NS\_04 | 6.5.2.3.2, 6.5.3.3.1 | n41 | 10, 15, 20, 40, 50, 60 80, 90, 100 |  | Clause 6.2.3.2 |
| NS\_05 | 6.5.3.3.4 | n1, n84 | 5, 10, 15, 20(NOTE 2) |  | Clause 6.2.3.4 |
| NS\_05U | 6.5.3.3.4, 6.5.2.4.2 | n1, n84 | 5, 10, 15, 20 |  | Clause 6.2.3.4 |
| NS\_06 | 6.5.2.3.4 | n12 | 5, 10, 15 |  | N/A |
| NS\_10 |  | n20, n82 | 15, 20 | Table 6.2.3.3-1 | Table  6.2.3.3-1 |
| NS\_17 | 6.5.3.3.2 | n28, n83 | 5,10 | Table 5.3.2-1 | N/A |
| NS\_18 | 6.5.3.3.3 | n28, n83 | 5 |  | Table 6.2.3.13-1, A1 |
| 10, 15, 20 |  | Table 6.2.3.13-1, A2 |
| NS\_35 | 6.5.2.3.1 | n71 | 5, 10, 15, 20 | Table 5.3.2-1 | N/A |
| NS\_37 | 6.5.3.3.6 | n74  (NOTE 3) | 10, 15 | Table 6.2.3.8-1 | Table  6.2.3.8-1 |
| NS\_38 | 6.5.3.3.7 | n74 | 5, 10, 15, 20 | Table 6.2.3.9-1 | Table  6.2.3.9-1 |
| NS\_39 | 6.5.3.3.8 | n74 | 10, 15, 20 | Table 6.2.3.10-1 | Table 6.2.3.10-1 |
| NS\_40 | 6.5.3.3.9 | n51 | 5 |  | Table  6.2.3.5-1 |
| NS\_41 | 6.5.3.3.10 | n50 | 5, 10, 15, 20, 40, 50, 60 |  | Table 6.2.3.11-1 |
| NS\_42 | 6.5.3.3.11 | n50 | 5, 10, 15, 20, 40, 50, 60 |  | Table 6.2.3.12-1 |
| NS\_43 | 6.5.3.3.5 | n8, n81 | 5, 10, 15 |  | Clause 6.2.3.6 |
| NS\_43U | 6.5.3.3.5, 6.5.2.4.2 | n8, n81 | 5, 10, 15 |  | Clause 6.2.3.6 |
| NS\_50 | 6.5.3.3.16 | n39 | 25, 30, 40 |  | Clause 6.2.3.19 |
| NS\_100 | 6.5.2.4.2 | n1, n2, n3, n5, n8, n25, n66, n80, n81, n84, n86  (NOTE 1) |  |  | Table  6.2.3.1-2 |
| NOTE 1: This NS can be signalled for NR bands that have UTRA services deployed  NOTE 2: No A-MPR is applied for 5 MHz BWChannel where the lower channel edge is ≥ 1930 MHz,10 MHz BWChannel where the lower channel edge is ≥ 1950 MHz and 15 MHz BWChannel where the lower channel edge is ≥ 1955 MHz.  NOTE 3: Applicable when the NR carrier is within 1447.9 – 1462.9 MHz | | | | | |

[The NS\_01 label with the field *additionalPmax* [7] absent is default for all NR bands.]

Table 6.2.3.1-1A: Mapping of network signaling label

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR band | Value of additionalSpectrumEmission | | | | | | | |
| **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| n1 | NS\_01 | NS\_100 | NS\_05 | NS\_05U |  |  |  |  |
| n2 | NS\_01 | NS\_100 | NS\_03 | NS\_03U |  |  |  |  |
| n3 | NS\_01 | NS\_100 |  |  |  |  |  |  |
| n5 | NS\_01 | NS\_100 |  |  |  |  |  |  |
| n7 | NS\_01 |  |  |  |  |  |  |  |
| n8 | NS\_01 | NS\_100 | NS\_43 | NS\_43U |  |  |  |  |
| n12 | NS\_01 | NS\_06 |  |  |  |  |  |  |
| n20 | NS\_01 | Void | NS\_10 |  |  |  |  |  |
| n25 | NS\_01 | NS\_100 | NS\_03 | NS\_03U |  |  |  |  |
| n28 | NS\_01 | NS\_17 | NS\_18 |  |  |  |  |  |
| n34 | NS\_01 |  |  |  |  |  |  |  |
| n38 | NS\_01 |  |  |  |  |  |  |  |
| n39 | NS\_01 | NS\_50 |  |  |  |  |  |  |
| n40 | NS\_01 |  |  |  |  |  |  |  |
| n41 | NS\_01 | NS\_04 |  |  |  |  |  |  |
| n50 | NS\_01 | NS\_41 | NS\_42 |  |  |  |  |  |
| n51 | NS\_01 | NS\_40 |  |  |  |  |  |  |
| n66 | NS\_01 | NS\_100 | NS\_03 | NS\_03U |  |  |  |  |
| n70 | NS\_01 | NS\_03 |  |  |  |  |  |  |
| n71 | NS\_01 | NS\_35 |  |  |  |  |  |  |
| n74 | NS\_01 | NS\_37 | NS\_38 | NS\_39 |  |  |  |  |
| n77 | NS\_01 |  |  |  |  |  |  |  |
| n78 | NS\_01 |  |  |  |  |  |  |  |
| n79 | NS\_01 |  |  |  |  |  |  |  |
| n80 | NS\_01 | NS\_100 |  |  |  |  |  |  |
| n81 | NS\_01 | NS\_100 | NS\_43 | NS\_43U |  |  |  |  |
| n82 | NS\_01 | Void | NS\_10 |  |  |  |  |  |
| n83 | NS\_01 | NS\_17 | NS\_18 |  |  |  |  |  |
| n84 | NS\_01 | NS\_100 | NS\_05 | NS\_05U |  |  |  |  |
| n86 | NS\_01 | NS\_100 | NS\_03 | NS\_03U |  |  |  |  |
| NOTE: *additionalSpectrumEmission* corresponds to an information element of the same name defined in clause 6.3.2 of TS 38.331 [7]. | | | | | | | | |

Table 6.2.3.1-2: A-MPR for NS\_100 (UTRA protection)

|  |  |  |
| --- | --- | --- |
| Modulation/Waveform | | Outer (dB) |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 2 |
| QPSK | ≤ 2 |
| 16 QAM | ≤ 2.5 |
| 64 QAM | ≤ 3 |
| 256 QAM | ≤ 4.5 |
| CP-OFDM | QPSK | ≤ 4 |
| 16 QAM | ≤ 4 |
| 64 QAM | ≤ 4 |
| 256 QAM | ≤ 6.5 |
| NOTE 1: Void  NOTE 2: Void | | |

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

## ***<Next change>***

### 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, 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 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 evalutation 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); 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; In case the UE supports more than one of band combinations for CA, SUL or DC, and an operating band belongs to more than one band combinations then

a) When the operating band frequency range is ≤ 1 GHz, the applicable additional ∆TIB,c shall be the average value for all band combinations defined in clause 6.2A.4.2, 6.2C.2 in this specification and 6.2B.4.2 in TS 38.101-3 [3], truncated to one decimal place that apply for that operating band among the supported band combinations. In case there is a harmonic relation between low band UL and high band DL, then the maximum ∆TIB,c among the different supported band combinations involving such band shall be applied

b) When the operating band frequency range is > 1 GHz, the applicable additional ∆TIB,c shall be the maximum value for all band combinations defined in clause 6.2A.4.2, 6.2C.2 in this specification and 6.2B.4.2 in TS 38.101-3 [3] for the applicable operating bands.

∆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;

∆TRxSRS is applied during SRS transmission occasions with *usage* in *SRS-ResourceSet* set as ‘antennaSwitching’ when

a) UE transmits SRS on the second SRS resource in every configured SRS resource set when the *SRS-TxSwitch* capability is indicated as 't1r2'

b) UE transmits SRS on the second, third and fourth SRS resources of the total 4 SRS resources from all configured SRS resource set(s) consisting of one SRS port when the *SRS-TxSwitch* capability is indicated as 't1r4' or, 't1r4-t2r4'

c) UE transmits SRS from the second SRS port pair on the second SRS resource in every configured SRS resource set consisting of two SRS ports when the *SRS-TxSwitch* capabilityis indicated as 't2r4' or 't1r4-t2r4', or

d) UE transmits SRS to a DL-only carrier.

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 when the device is capable of power class 3 in the band, or when the device is capable of power class 2 in the band and ΔPPowerClass = 3 dB. The value of ∆TRxSRS is 7.5dB for n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79 when the device is capable of power class 2 in the band and ΔPPowerClass = 0 dB.

For other SRS transmissions ∆TRxSRS is zero;

P-MPRc is the power management maximum 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 change>***

#### 6.2A.1.3 UE maximum output power for Inter-band CA

For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the transmitter power requirements in clause 6.2 apply.

For inter-band carrier aggregation with uplink assigned to two NR bands, UE maximum output power shall be measured over all component carriers from different bands. If each band has separate antenna connectors, maximum output power is measured as the sum of maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1 ms). The maximum output power is specified in Table 6.2A.1.3-1.

Table 6.2A.1.3-1 UE Power Class for uplink inter-band CA (two bands)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Class 1 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance  (dB) | Class 3 (dBm) | Tolerance (dB) | Class 4 (dBm) | Tolerance (dB) |
| CA\_n3A-n78A |  |  |  |  | 23 | +2/-3 |  |  |
| CA\_n8A-n78A |  |  |  |  | 23 | +2/-3 |  |  |
| NOTE 1: Void  NOTE 2: For an NR CA configuration with one uplink carrier assingned to one NR band, if the uplink NR band has NOTE 3 in Table 6.2.1-1, the band is allowed to reduce the lower tolerance limit by 1.5 dB when the transmission bandwidths of the band(s) is confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high - 4 MHz and FUL\_high. An uplink NR CA configuration in which at least one of the bands has NOTE 3 in Table 6.2.1-1 is allowed to reduce the lower tolerance limit by 1.5 dB when the transmission bandwidths of at least one of the bands is confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high - 4 MHz and FUL\_high.  NOTE 3: PPowerClass is the maximum UE power specified without taking into account the tolerance  NOTE 4: For inter-band carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).  NOTE 5: Power class 3 is the default power class unless otherwise stated | | | | | | | | |

## ***<Next change>***

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

#### 6.2A.2.1 Void

#### 6.2A.2.2 Void

#### 6.2A.2.3 UE maximum output power reduction for Inter-band CA

For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the requirements in subclause 6.2.2 apply.

For inter-band carrier aggregation with uplink assigned to two NR bands, the requirements in clause 6.2.2 apply for each uplink component carrier.

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

##### 6.2A.3.1.1 Void

##### 6.2A.3.1.2 Void

##### 6.2A.3.1.3 UE additional maximum output power reduction for Inter-band CA

Unless otherwise stated, for inter-band carrier aggregation with one uplink carrier assigned to one NR band, the requirements in subclause 6.2.3 apply.

Unless specified in Table 6.2A.3.1.3-1, for inter-band carrier aggregation with uplink assigned to two NR bands, the requirements in clause 6.2.3 apply for each uplink component carrier. The requirements in Table 6.2A.3.1.3-1 are specified in terms of an additional spectrum emission requirement with their associated network signalling values and the allowed A-MPR. These requirements apply on each component carrier when both component carriers are activated. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet the additional requirement for a specific deployment scenario as part of the cell handover/broadcast message. For inter-band carrier aggregation with uplink assigned to one NR band, the requirements defined in clause 6.2.3 apply.

To meet the additional requirements, additional maximum power reduction (A-MPR) is allowed for the maximum output power as specified in Table 6.2.1-1. Unless stated otherwise, the total reduction to UE maximum output power is max(MPR, A-MPR) where MPR is defined in clause 6.2.2. In case of a power class 3 UE, when IE powerBoostPi2BPSK is set to 1, power class 2 A-MPR values apply.

For almost contiguous allocations in CP-OFDM waveforms in power class 3, the allowed A-MPR defined in clause 6.2.3 is increased by CEIL{ 10 log10(1 + NRB\_gap / NRB\_alloc), 0.5 } dB, where NRB\_gap is the total number of unallocated RBs between allocated RBs and NRB\_alloc is the total number of allocated RBs, and the parameter LCRB is replaced by NRB\_alloc + NRB\_gap in specifying the RB allocation regions.

Unless otherwise specified, pi/2 BPSK in following A-MPR tables refers to both variants of pi/2 BPSK referenced in 6.2.2 tables 6.2.2-1.

The emission requirements specified in Table 6.2A.3.1.3-1 also apply for the frequency ranges that are less than FOOB (MHz) in Table 6.5.3.1-1 from the edge of the channel bandwidth.

Table 6.2A.3.1.3-1: Additional Requirements for uplink inter-band carrier aggregation (two-bands)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR CA combination | Band | Applied  NS | Requirements  (clause) | A-MPR  (table/clause) | Note |
| CA\_n3-n78 | n3 | 100 | 6.5.2.4.2 | Table 6.2.3.1-2 | 1 |
| CA\_n8-n78 | n8 | 43 | 6.5.3.3.5 | Clause 6.2.3.6 | 1 |
| 43U | 6.5.3.3.5, 6.5.2.4.2 | Clause 6.2.3.6 |
| NOTE 1: NS\_05U, NS\_43U and NS\_100 can be signalled for NR bands that have UTRA services deployed. | | | | | |

## ***<Next change>***

## 6.3A Output power dynamics for CA

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

#### 6.3A.1.1 Void

#### 6.3A.1.2 Void

#### 6.3A.1.3 Minimum output power for inter-band CA

For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the minimum output power requirements in clause 6.3.1 apply.

For inter-band carrier aggregation with uplink assigned to two NR bands, the minimum output power is defined per carrier and the requirement is specified in clause 6.3.1.

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

#### 6.3A.2.1 Void

#### 6.3A.2.2 Void

#### 6.3A.2.3 Transmit OFF power for inter-band CA

For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the transmit OFF power requirements in subclause 6.3.2 apply.

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

### 6.3A.3 Transmit ON/OFF time mask for CA

#### 6.3A.3.1 Void

#### 6.3A.3.2 Void

#### 6.3A.3.3 Transmit ON/OFF time mask for inter-band CA

For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the transmit ON/OFF time mask requirements in subclause 6.3.3 apply.

For inter-band carrier aggregation with uplink assigned to two NR bands, the general output power ON/OFF time mask specified in clause 6.3.3.1 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in clause 6.3.3.1 shall only be applicable for each component carrier when all the component carriers are OFF.

## ***<Next change>***

## 6.4A Transmit signal quality for CA

### 6.4A.1 Frequency error for CA

#### 6.4A.1.1 Void

#### 6.4A.1.2 Void

#### 6.4A.1.3 Frequency error for inter-band CA

For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the frequency error requirements in subclause 6.4.1 apply.

For inter-band carrier aggregation with uplink assigned to two NR bands, the frequency error requirements defined in clause 6.4.1 shall apply on each component carrier with all component carriers active.

### 6.4A.2 Transmit modulation quality for CA

#### 6.4A.2.1 Void

#### 6.4A.2.2 Void

#### 6.4A.2.3 Transmit modulation quality for inter-band CA

For inter-band carrier aggregation with one uplink carrier assigned to one NR band, the transmit modulation quality requirements in subclause 6.4.2 apply.

For inter-band carrier aggregation with uplink assigned to two NR bands, the transmit modulation quality requirements shall apply on each component carrier as defined in clause 6.4.2 with all component carriers active: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.

## ***<Next change>***

## 6.4D Transmit signal quality for UL MIMO

### 6.4D.1 Frequency error for UL MIMO

For UE(s) supporting UL MIMO, the basic measurement interval of modulated carrier frequency is 1 UL slot. The mean value of basic measurements of UE modulated carrier frequency at each transmit antenna connector shall be accurate to within ± 0.1 PPM observed over a period of 1 ms of cumulated measurement intervals compared to the carrier frequency received from the NR Node B.

### 6.4D.2 Transmit modulation quality for UL MIMO

For UE supporting UL MIMO, the transmit modulation quality requirements are specified based on measurements made at each transmit antenna connector.

If UE is configured for transmission on single-antenna port, the requirements specified for single carrier apply.

The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)

- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process

- Carrier leakage (caused by IQ offset)

- In-band emissions for the non-allocated RB

In case the parameter 3300 or 3301 is reported from UE via the parameter *txDirectCurrentLocation* in *UplinkTxDirectCurrentList* IE (as defined in TS 38.331 [7]), carrier leakage measurement requirement in clause 6.4D.2.2 and 6.4D.2.3 shall be waived, and the RF correction with regard to the carrier leakage and IQ image shall be omitted during the calculation of transmit modulation quality.

#### 6.4D.2.1 Error Vector Magnitude

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Error Vector Magnitude requirements specified in in clause 6.4.2.1 apply per layer. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1-2

#### 6.4D.2.2 Carrier leakage

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Relative Carrier Leakage Power requirements specified in Table 6.4.2.2-1 which is defined in clause 6.4.2.2 apply at each transmit antenna connector. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1-2

#### 6.4D.2.3 In-band emissions

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the In-band Emission requirements specified in Table 6.4.2.3-1 which is defined in clause 6.4.2.3 apply at each transmit antenna connector. The requirements shall be met with the uplink MIMO configurations specified in Table 6.2D.1-2

#### 6.4D.2.4 EVM equalizer spectrum flatness for UL MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the EVM Equalizer Spectrum Flatness requirements specified in clause 6.4.2.4 apply per layer. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1-2

### 6.4D.3 Time alignment error for UL MIMO

For UE(s) with multiple transmit antenna connectors supporting UL MIMO, this requirement applies to frame timing differences between transmissions on multiple transmit antenna connectors in the closed-loop spatial multiplexing scheme.

The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different transmit antenna connectors.

For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 ns.

### 6.4D.4 Requirements for coherent UL MIMO

For coherent UL MIMO, Table 6.4D.4-1 lists the maximum allowable difference between the measured relative power and phase errors between different antenna ports in any slot within the specified time window from the last transmitted SRS on the same antenna ports, for the purpose of uplink transmission (codebook or non-codebook usage) and those measured at that last SRS. The requirements in Table 6.4D.4-1 apply when the UL transmission power at each antenna port is larger than 0 dBm for SRS transmission and for the duration of time window.

Table 6.4D.4-1: Maximum allowable difference of relative phase and power errors in a given slot compared to those measured at last SRS transmitted

|  |  |  |
| --- | --- | --- |
| Difference of relative phase error | Difference of relative power error | Time window |
| 40 degrees | 4 dB | 20 msec |

The above requirements when all the following conditions are met within the specified time window:

- UE is not signaled with a change in number of SRS ports in SRS-config, or a change in PUSCH-config

- UE remains in DRX active time (UE does not enter DRX OFF time)

- No measurement gap occurs

- No instance of SRS transmission with the usage antenna switching occurs

- Active BWP remains the same

- EN-DC and CA configuration is not changed for the UE (UE is not configured or de-configured with PSCell or SCell(s))

## ***<End of change>***