**3GPP TSG- RAN WG4 Meeting # 111R4-2410595**

**Fukuoka, Japan, 20th–24th May, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-1** | **CR** | **2314** | **rev** | **1** | **Current version:** | **17.13.0** |  |
|  | | | | | | | | |
| *For* ***[HELP](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)*** *on using this form: comprehensive instructions can be found at  <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:*** | (NR\_RF\_FR1\_enh-Core) CR for TS 38.101-1: Corrections on intra-band UL contiguous CA with UL MIMO for PC3 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | ZTE Corporation, Sanechips | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_RF\_FR1\_enh-Core | | | | |  | ***Date:*** | | | 2024-05-10 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Intra-band UL contiguous CA with UL MIMO for PC3 was introduced in Rel-17, many requirements apply those defined for intra-band contiguous CA and single carrier with UL MIMO. In current specification, some reference clause numbers are incorrect. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Correct reference clause numbers in clause 6 for suffix H. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | It is unclear that the requirement in which clause or table apply. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2H, 6.3H, 6.4H, 6.5H | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | 38.521-1 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## << Start of change >>

## 6.2H Transmitter power for CA with UL MIMO

### 6.2H.1 Transmitter power for intra-band UL contiguous CA with UL MIMO

#### 6.2H.1.1 UE maximum output power for intra-band UL contiguous CA with UL MIMO

For intra-band UL contiguous CA and UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the maximum output power is defined as the sum of the maximum output power from both UE antenna connectors and all UL CCs. The period of measurement shall be at least one sub frame (1 ms), as specified in Table 6.2H.1.1-1. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1-2 for 2 layer configuration and the PUSCH configurations specified in Table 6.2D.1-3 for ULFPTx configuration.

Table 6.2H.1.1-1: UE Power Class for intra-band UL contiguous CA with UL MIMO in closed loop spatial multiplexing scheme

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR CA Configuration | Class 1 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) | Class 4 (dBm) | Tolerance (dB) |
| CA\_n41C |  |  | 26 | +2/-31 | 23 | +2/-31 |  |  |
| CA\_n78C |  |  | 26 | +2/-3 | 23 | +2/-3 |  |  |
| NOTE 1: An uplink CA configuration in which the band 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 the band are confined within FUL\_low and FUL\_low + 4 MHz or FUL\_high - 4 MHz and FUL\_high.  NOTE 2: PPowerClass is the maximum UE power specified without taking into account the tolerance. | | | | | | | | |

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.2A.1.1 apply for at least one antenna connector for the power class as indicated by the *ue-PowerClass* field in capability signalling.

#### 6.2H.1.2 UE maximum output power reduction for intra-band UL contiguous CA with UL MIMO

For intra-band UL contiguous CA and UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2H.1.1-1 is specified in Table 6.2A.2.1-1, Table 6.2A.2.1-2 for power class 3 CA; Table 6.2A.2.1-1b, Table 6.2A.2.1-4 for power class 2 CA.

The requirements shall be met with UL MIMO configurations defined in Table 6.2D.1-2 for 2 layer configuration and the PUSCH configurations specified in Table 6.2D.1-3 for ULFPTx configuration. For the UE maximum output power modified by MPR, the power limits specified in clause 6.2H.1.4 apply.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.2A.2.1 apply for the power class as indicated by the *ue-PowerClass* field in capability signaling.

#### 6.2H.1.3 UE additional maximum output power reduction for intra-band UL contiguous CA with UL MIMO

For intra-band UL contiguous CA and UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the A-MPR values specified in clause 6.2A.3.1.1 shall apply to the maximum output power specified in Table 6.2H.1.1-1. The requirements shall be met with UL MIMO configurations defined in Table 6.2D.1-2 for 2 layer configuration and the PUSCH configurations specified in Table 6.2D.1-3 for ULFPTx configuration.

For the UE maximum output power modified by A-MPR, the power limits specified in clause 6.2H.1.4 apply.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.2A.3.1.1 apply for the power class as indicated by the *ue-PowerClass* field in capability signaling.

#### 6.2H.1.4 Configured transmitted power for intra-band UL contiguous CA with UL MIMO

For UE supporting intra-band UL contiguous CA with UL MIMO, the transmitted power is configured per each UE.

The definitions of configured maximum output power PCMAX,*c*, the lower bound PCMAX\_L,*c*, and the higher bound PCMAX\_H,*c* specified in clause 6.2A.4.1.1 shall apply to UE supporting intra-band UL contiguous CA with UL MIMO, where

- ΔPPowerClass,CA and ∆TC,c are specified in clause 6.2A.4.1.1 unless otherwise stated;

- PPowerClass,CA is the maximum UE power specified in Table 6.2H.1.1-1 without taking into account the tolerance;

- MPR, AMPR is specified in clause 6.2H.1.2 and 6.2H.1.3;

The measured configured maximum output power PUMAX over all serving cells shall be within the following bounds:

PCMAX\_L – MAX{TL, T LOW(PCMAX\_L)} ≤ PUMAX  ≤ PCMAX\_H + T HIGH(PCMAX\_H)

where TLOW(PCMAX\_L) and THIGH(PCMAX\_H) are defined as the tolerance and applies to PCMAX\_L and PCMAX\_H separately, while TL is the absolute value of the lower tolerance in Table 6.2H.1.1-1 for the applicable operating band.

For UE supporting intra-band UL contiguous CA with UL MIMO, the tolerance is specified in Table 6.2H.1.4-1.

Table 6.2H.1.4-1: PCMAX tolerance for intra-band UL contiguous CA with UL MIMO

|  |  |  |
| --- | --- | --- |
| PCMAX (dBm) | Tolerance TLOW(PCMAX) (dB) | Tolerance THIGH(PCMAX) (dB) |
| 23 < PCMAX ≤ 26 | 3.0 | 2.0 |
| 21 ≤ PCMAX ≤ 23 | 2.0 | |
| 20 ≤ PCMAX < 21 | 2.5 | |
| 19 ≤ PCMAX < 20 | 3.5 | |
| 18 ≤ PCMAX < 19 | 4.0 | |
| 13 ≤ PCMAX < 18 | 5.0 | |
| 8 ≤ PCMAX < 13 | 6.0 | |
| -40 ≤ PCMAX < 8 | 7.0 | |

## << Next change >>

## 6.3H Output power dynamics for CA with UL MIMO

### 6.3H.1 Output power dynamics for intra-band UL contiguous CA with UL MIMO

#### 6.3H.1.1 Minimum output power for intra-band UL contiguous CA with UL MIMO

For intra-band UL contiguous CA and UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the minimum output power is defined as the sum of the mean power from both transmit connector in one sub-frame (1 ms) on each CC. The minimum output power shall not exceed the values specified in clause 6.3A.1.1.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.3A.1.1 apply.

#### 6.3H.1.2 Transmit OFF power for intra-band UL contiguous CA with UL MIMO

The transmit OFF power is defined as the mean power at each transmit antenna connector in a duration of at least one sub-frame (1 ms) excluding any transient periods.

The transmit OFF power at each transmit antenna connector on each CC shall not exceed the values specified in clause 6.3A.2.1.

#### 6.3H.1.3 Transmit ON/OFF time mask for intra-band UL contiguous CA with UL MIMO

For UE supporting intra-band UL contiguous CA and UL MIMO, the ON/OFF time mask requirements in clause 6.3A.3.1 apply at each transmit antenna connector on each CC. The requirements shall be met with the UL MIMO configurations described in Table 6.2D.1-2.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.3A.3.1 apply.

#### 6.3H.1.4 Power control for intra-band UL contiguous CA with UL MIMO

For UE supporting intra-band UL contiguous CA and UL MIMO, the power control tolerance in clause 6.3A.4.1 applies to the sum of output powers from both transmit antenna connector on each CC. The requirements shall be met with UL MIMO configurations described in Table 6.2D.1-2.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.3A.4.1 apply.

## << Next change >>

## 6.4H Transmit signal quality for CA with UL MIMO

### 6.4H.1 Transmit signal quality for intra-band UL contiguous CA with UL MIMO

#### 6.4H.1.1 Frequency error for intra-band UL contiguous CA with UL MIMO

For UE supporting intra-band UL contiguous CA and 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 on each CC shall be accurate to within ± 0.1 PPM observed over a period of 1 ms of cumulated measurement intervals compared to the carrier frequency of primary component carrier received from the NR Node B.

#### 6.4H.1.2 Transmit modulation quality for intra-band UL contiguous CA with UL MIMO

##### 6.4H.1.2.0 General

For UE supporting intra-band UL contiguous CA and UL MIMO, the transmit modulation quality requirements are specified based on measurements made at each transmit antenna connector on each CC.

The requirements in this clause apply with PCC and SCC in the UL configured and activated: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.4A.2.1 apply.

The transmit modulation quality requirements listed below shall be met with UL MIMO configurations specified in Table 6.2D.1-2.

For all Transmit modulation quality requirements the Carrier leakage frequency is indicted by the UE with IE *UplinkTxDirectCurrentTwoCarrierList-r16* *or* *UplinkTxDirectCurrentMoreCarrierList-r17 or UplinkTxDirectCurrentList*.

The carrier leakage measurement requirement in clauses 6.4H.1.2.2 and 6.4H.1.2.3 shall be waived and the UE’s UL signal left uncorrected for carrier leakage when one of the following qualifying conditions apply:

1. UE reports the parameter 3300 or 3301

2. UE doesn’t indicate the DC location parameters

Any requirement relaxation to accommodate the IQ image shall be omitted if the qualifying conditions above are present or if the IQ image frequency is outside the activated UL component carriers.

##### 6.4H.1.2.1 Error Vector Magnitude

For intra-band UL contiguous CA and UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Error Vector Magnitude requirements specified in clause 6.4A.2.1.1 apply per layer.

##### 6.4H.1.2.2 Carrier leakage

For UE supporting intra-band UL contiguous CA and UL MIMO, the relative carrier leakage power requirements specified in clause 6.4A.2.1.3 apply at each transmit antenna connector.

##### 6.4H.1.2.3 In-band emissions

For UE supporting intra-band UL contiguous CA and UL MIMO, the In-band emission requirements specified in clause 6.4A.2.1.2 apply at each transmit antenna connector.

#### 6.4H.1.3 Time alignment error for intra-band UL contiguous CA with UL MIMO

For intra-band UL contiguous CA and UE(s) with multiple transmit antenna connectors supporting UL MIMO, this requirement applies as specified in clause 6.4D.3: The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different transmit antenna connectors for each CC. For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 ns.

#### 6.4H.1.4 Coherent UL MIMO requirement for intra-band UL contiguous CA with UL MIMO

For UE supporting intra-band UL contiguous CA and UL MIMO, the coherent UL MIMO requirement are specified on each CC as in clause 6.4D.4.

## << Next change >>

## 6.5H Output RF spectrum emissions for CA with UL MIMO

### 6.5H.1 Output RF spectrum emissions for intra-band UL contiguous CA with UL MIMO

#### 6.5H.1.1 Occupied bandwidth for intra-band UL contiguous CA with UL MIMO

For UE supporting intra-band UL contiguous CA and UL MIMO, the requirements for occupied bandwidth specified in clause 6.5A.1.1a apply to the sum of the powers from both UE transmit antenna connectors and all UL CCs. The requirements shall be met with UL MIMO configurations described in Table 6.2D.1-2.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.5A.1.1a apply.

#### 6.5H.1.2 Out of band emission for intra-band UL contiguous CA with UL MIMO

For UE supporting intra-band UL contiguous CA and UL MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters is defined as the sum of the emissions from both UE transmit antenna connectors and all UL CCs, the requirements in subclause 6.5A.2.2.1, 6.5A.2.3.1 and 6.5A.2.4.1.1 apply. The requirements shall be met with UL MIMO configurations described in Table 6.2D.1-2.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.5A.2.2.1, 6.5A.2.3.1 and 6.5A.2.4.1.1 apply.

#### 6.5H.1.3 Spurious emission for intra-band UL contiguous CA with UL MIMO

For UE supporting intra-band UL contiguous CA and UL MIMO, the requirements for Spurious emissions is defined as the sum of the emissions from both UE transmit antenna connectors and all UL CCs, the requirements specified in subclasuse 6.5A.3.1, 6.5A.3.2.1 and 6.5A.3.3.1 apply. The requirements shall be met with the UL MIMO configurations described in Table 6.2D.1-2.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.5A.3.1, 6.5A.3.2.1 and 6.5A.3.3.1 apply.

#### 6.5H.1.4 Transmit intermodulation for intra-band UL contiguous CA with UL MIMO

For UE supporting intra-band UL contiguous CA and UL MIMO, the transmit intermodulation requirements are specified at each transmit antenna connector and the wanted signal is defined as the sum of output powers from both UE transmit antenna connectors, the requirements specified in clause 6.5A.4.2.1 apply. The requirements shall be met with the UL MIMO configurations described in Table 6.2D.1-2.

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission with precoding matrix *W*=1 [6.3.1.5 TS 38.211], the requirements in clause 6.5A.4.2.1 apply.

## << End of change >>