**3GPP TSG-RAN4 Meeting #102-e** ***R4-2206517***

**Electronic Meeting, Feb 21- Mar 03, 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-1** | **CR** |  | **rev** | **1** | **Current version:** | **16.10.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | Draft CR TS 38.101-1: Move PC1.5 MPR to Clause 6.2D |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon, Qualcomm |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_RF\_TxD-Core |  | ***Date:*** | 2022-02-12 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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 canbe 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:*** | It was discussed in RAN4#101e meeting that dual Tx related MPR requirements should be captured in 6.2D rather than the general clause clause. The defintiion of power class PC1.5 is incomplete. The PC1.5 is specified for two antenna connectors and the maximum power is specified by a requirement on single-port transmission with two antenna connectors. PC1.5 does not depend on TxD indication.  |
|  |  |
| ***Summary of change:*** | Move PC1.5 dual-Tx related MPR requirements from Clause 6.2.2 to Clause 6.2D.2. |
|  |  |
| ***Consequences if not approved:*** | The specification will be inconsistent. |
|  |  |
| ***Clauses affected:*** | 6.2.2, 6.2D.2 |
|  |  |
|  | **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:*** | Align the table number of MPR for PC1.5 whith changes in Rel-17 spec. |

## **<Start of Change>**

## 6.1 General

Unless otherwise stated, the transmitter characteristics are specified at the antenna connector of the UE with a single or multiple transmit antenna(s). For UE with integral antenna only, a reference antenna with a gain of 0 dBi is assumed.

Transmitter requirements for UL MIMO operation apply when the UE transmits on 2 ports on the same CDM group. The UE may use higher MPR values outside this limitation.

The applicability of transmitter requirements for Band n90 is in accordance with that for Band n41; a UE supporting Band n90 shall meet the minimum requirements for Band n41.

## 6.1A General

The minimum requirements for band combinations including Band n41 also apply for the corresponding band combinations with Band n90 replacing Band n41 but with otherwise identical parameters. For brevity the said band combinations with Band n90 are not listed in the tables below but are covered by this specification.

## 6.1F General

For wideband operations, the minimum requirements for the transmitter characteristics are specified for transmissions on one scheduled RB set or ≥ 1 scheduled contiguous RB set(s) within the UE channel. The requirements apply with configured UL intra-cell guard bands of non-zero size according to Table 5.3.3-2, with the union of the scheduled RB sets and the intra-cell guard bands between the said RB sets scheduled and available for transmission according to the channel access procedures in [14].

## 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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NRband | 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 | 316 | +2/-3 |  |  |  |  | 23 | ±2 |
| 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 |  |  |  |  | 26 | +2/-3 | 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 | ±23 |
| 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 toleranceNOTE 2: Powerclass 3 is default power class unless otherwise statedNOTE 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 dBNOTE 5: Achieved via dual TxNOTE 6: Generally, PC1 UE for Band n14 is not targeted for smartphone form factor. The UE power class 1 requirements for Band n14 are applicable for public safety scenario only. |

For PC1.5 the maximum output power is defined for single-port transmission as the sum of the maximum output power from both UE antenna connectors. For PUSCH tranmissions, a UEs supporting PC1.5 shall meet the maximum output power requirement when scheduled by DCI format 0\_0 or by DCI format 0\_1 configured for single antenna port.

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-PC2-FR1* 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-PC2-FR1* is not absent and the percentage of uplink symbols transmitted in a certain evaluation period is larger than 0.5\**maxUplinkDutyCycle-PC2-FR1*.(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 and UE power class 1 in Band n14, the allowed maximum power reduction (MPR) is defined in Table6.2D.2-2, Table 6.2.2-2, Table 6.2.2-1 and Table 6.2.2-5, respectively for channel bandwidths ≤ 100 MHz.

If the relative channel bandwidth ≤ 4% for TDD bands or ≤ 3% for FDD bands, the ∆MPR is set to zero.

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

Where relative channel bandwidth = 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 |
|  | Pi/2 BPSK w Pi/2 BPSK DMRS | ≤ 0.52 | ≤ 02 | 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 Void

|  |  |
| --- | --- |
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Table 6.2.2-5 Maximum power reduction (MPR) for power class 1 for Band n14

|  |  |
| --- | --- |
| Modulation | MPR (dB) |
|  | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 0.5 | ≤ 0.5 | 0 |
|  | Pi/2 BPSK w Pi/2 BPSK DMRS | ≤ 0.5 | ≤ 0 | 0 |
|  | 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 |

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 Change>**

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

For 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 defined as the sum of the maximum output power from both UE antenna connectors. 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 dBNOTE 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  | Number of layers | TPMI index |
| Codebook based uplink | DCI format 0\_1 | 2 | 0 |
| NOTE 1: The UE is configured with one SRS resource with the parameter *nrofSRS-Ports* set to 2. |

For UE support uplink full power transmission (ULFPTx) for UL MIMO, the maximum output power requirements specified in Table 6.2D.1-1 shall be met with the PUSCH configurations specified in Table 6.2D.1-3, based upon UE’s support of uplink full power transmission mode.

Table 6.2D.1-3: PUSCH Configuration for uplink full power transmission (ULFPTx)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ULFPTx Mode | Transmission scheme | DCI format  | Modulation | Number of layers | Number of Tx Port | TPMI index |
| Mode-1 | Codebook based uplink | DCI format 0\_1 | DFT-s-OFDM, CP-OFDM NOTE3 | 1 | 2 | 2 |
| Mode-2 | Codebook based uplink | DCI format 0\_1 | DFT-s-OFDM, CP-OFDM | 1 | 2 | 0 or 1NOTE2 |
| Mode-full power | Codebook based uplink | DCI format 0\_1 | DFT-s-OFDM, CP-OFDM | 1 | 2 | 0,1 |
| NOTE 1: The UE is configured with one SRS resource with the parameter *nrofSRS-Ports* set to 2.NOTE 2: TPMI index selected shall be based upon the full power TPMI reported by the UE [8, TS 38.213].NOTE 3: For PUSCH configured with ULFPTxModes set to Mode-1, all the transmitter requirement for CP-OFDM based modulation is not needed to be verified if the requirement for UL MIMO has been validated. |

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, the requirements in clause 6.2.1 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling.

### 6.2D.2 UE maximum output power reduction for UL MIMO

For 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 6.2D.1-1 is specified in Table 6.2.2-1 for PC3, Table 6.2.2-2 for PC2 and Table 6.2D.2-2 for PC1.5 respectively. The requirements shall be met with UL MIMO configurations defined in Table 6.2D.1-2. For UE supporting UL MIMO, the maximum output power is defined as the sum of the maximum output power from both UE antenna connectors.

For UE support uplink full power transmission (ULFPTx) for UL MIMO, the allowed MPR for the maximum output power in Table 6.2D.1-1 is specified in Table 6.2.2-1 for PC3, Table 6.2.2-2 for PC2 and Table 6.2D.2-2 for PC1.5 respectively, and the requirements shall be met with the PUSCH configurations specified in Table 6.2D.1-3, based upon UE’s support of uplink full power transmission mode.

For the UE maximum output power modified by MPR, the power limits specified in clause 6.2D.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, the requirements in clause 6.2.2 apply for the power class as indicated by the *ue-PowerClass* field in capability signaling.

Table 6.2D.2-1 Void

Table 6.2D.2-2 Maximum power reduction (MPR) for power class 1.5 with dual Tx

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

## **<End of Change>**