**3GPP TSG- Meeting #**

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| *CR-Form-v12.3* |
| **DRAFT CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
|  |
| *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:***  |  |
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| ***Source to WG:*** | , vivo |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
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| ***Reason for change:*** | In RP-240828, it is noted that a large margin exists between the current MPR requiremant and measured power back-off for intra-band CA. MPR for FR2 single carrier UL or intra band UL CA with DL intra band CA can be defined based on only UL CBW. |
|  |  |
| ***Summary of change:*** | * MPR based on configured/activated UL BWchannel\_CA applies instead that based on cumulative aggregated channel BW (CABW) with UE capabilities.
* For the case of single carrier UL with DL intra band CA is configured/activated, the MPR requirements of single carrier case in clause 6.2.2 of TS 38.101-2 applies with UE capabilities.
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| ***Consequences if not approved:*** | FR2 CA MPR based on CABW still prevent the NW from fully utilizing the UE performance. |
|  |  |
| ***Clauses affected:*** | 6.2A.2.2, 6.2A.2.3, 6.2A.2.4 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS38.521-2  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | This draft CR is divided into two parts: configuration based improvements that have already been captured in the endorsed draft CR R4-2417110 and activation based improvements that are being proposed at this meeting.(additional changes are marked as yellow). |
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| ***This CR's revision history:*** |  |

**<Unchanged sections are omitted>**

#### 6.2A.2.2 Maximum output power reduction for power class 1

##### 6.2A.2.2.1 Maximum output power reduction for power class 1 intra-band contiguous UL CA

For power class 1, MPR for intra-band contiguous UL CA with contiguous allocations within the cumulative aggregated bandwidth is defined as:

MPRC\_CA = max(MPRWT\_C\_CA+∆MPR, MPRnarrow)

Where,

 MPRnarrow = 14.4 dB, when BWalloc,RB is less than or equal to 1.44 MHz, MPRnarrow = 10 dB, when 1.44 MHz < BWalloc,RB ≤ 10.8 MHz, where BWalloc,RB is the bandwidth of the RB allocation size.

 MPRWT\_C\_CA is the maximum power reduction due to modulation orders, transmit bandwidth configurations, and waveform types. MPRWT\_C\_CA is defined in Tables 6.2A.2.2-1 and 6.2A.2.2-2. If [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported and the intra-band contiguous CA is configured with single UL CC, MPRWT\_C\_CA shall be determined from Tables 6.2.2.1-1 and 6.2.2.1-2. If [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and the intra-band contiguous CA is activated with single UL CC, MPRWT\_C\_CA shall be determined from Tables 6.2.2.1-1 and 6.2.2.1-2.

 ∆MPR for FR2-1 256 QAM as specified in Table 6.2.2.1-5 applies.

Table 6.2A.2.2-1: Maximum power reduction (MPRWT\_C\_CA) for UE power class 1 in FR2-1

|  |  |
| --- | --- |
| Waveform Type | bandwidth basis3 |
|  | < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.51 | ≤ 7.7 | ≤ 8.2 | ≤ 8.7 |
|  | QPSK | ≤ 6.51 | ≤ 8.7 | ≤ 9.7 | ≤ 9.7 |
|  | 16 QAM | ≤ 6.5 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
|  | 256 QAM2 | ≤ 12.5 | ≤ 14.2 | ≤ 14.7 | ≤ 15.7 |
| CP-OFDM | QPSK | ≤ 6.5 | ≤ 8.7 | ≤ 8.7 | ≤ 9.7 |
|  | 16 QAM | ≤ 6.5 | ≤ 8.7 | ≤ 8.7 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
|  | 256 QAM2 | ≤ 12.5 | ≤ 14.2 | ≤ 14.7 | ≤ 15.7 |
| NOTE 1: (Void)NOTE 2: Refer to clause 6.1 for 256 QAM applicability.NOTE 3: If [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported, configured UL BWchannel\_CA is used as bandwidth basis. If [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and all the activated CCs form a contiguous block, activated UL BWchannel\_CA is used as bandwidth basis. Otherwise, Cumulative aggregated channel bandwidth (CABW) is used as bandwidth basis.  |

Table 6.2A.2.2-2: Maximum power reduction (MPRWT\_C\_CA) for UE power class 1 in FR2-2

|  |  |
| --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth |
| < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2000 MHz |
| Pi/2 BPSK | ≤ 7.0 | ≤ 5.0 | ≤ 2.0 | ≤ 2.0 |
| QPSK | ≤ 8.0 | ≤ 6.0 | ≤ 3.0 | ≤ 3.0 |
| 16 QAM | ≤ 8.0 | ≤ 6.0 | ≤ 4.0 | ≤ 4.0 |
| 64 QAM | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 |

In case of a contiguous RB, DFT-s-BPSK or DFT-s-QPSK UL allocation in a single CC of a CA configuration with contiguous CCs, and whose cumulative aggregated BW ≤ 400 MHz, MPRWT\_C\_CA shall instead be MPR2 if [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported, and be MPR3 if [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and all the activated CCs form a contiguous block, and derived as MAX(MPR1, MPR2) otherwise, where:

 MPR1 shall be determined from Table 6.2.2.1-1 if CABW ≤ 200 MHz, from Table 6.2.2.1-2 if CABW > 200 MHz.

 MPR2 shall be determined from Table 6.2.2.1-1 if congigured UL BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.1-2 if configured UL BWchannel\_CA > 200 MHz.

 MPR3 shall be determined from Table 6.2.2.1-1 if activated UL BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.1-2 if activated UL CCs bandwidth > 200 MHz.

and assume all UL CCs use the same SCS for the purpose of determination of inner and outer RB allocations in Table 6.2.2.1-1 and Table 6.2.2.1-2:

 NRB shall be chosen as the sum of NRB of all constituent UL CCs in the CA configuration.

 LCRB shall be chosen as BWalloc,RB

 RBstart shall be derived as: RBstart\_allocatedCC+NRB\_unallocatedCC\_low

 RBstart\_allocatedCC is the index of the first allocated RB in the CC with allocation

 NRB\_unallocatedCC\_low is the sum of NRB in all UL CCs lower in frequency compared to the CC with allocation

When different waveform types exist across CCs, the requirement is set by the waveform type used in the configuration with the largest MPRC\_CA.

For intra-band contiguous UL CA with non-contiguous RB allocations, the following rule for MPR applies:

MPR = max(MPRC\_CA, -10\*A + 14.4)

Where:

 A = NRB\_alloc / NRB\_agg\_C.

 NRB\_alloc is the total number of allocated UL RBs

 NRB\_agg\_C is the number of the aggregated RBs within the fully allocated cumulative aggregated channel bandwidth assuming lowest SCS among all configured CCs; If [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported, NRB\_agg\_C is the number of the aggregated RBs within the fully allocated UL configured BWchannel\_CA assuming lowest SCS among all configured CCs. If [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and all the activated CCs form a contiguous block, NRB\_agg\_C is the number of the aggregated RBs within the fully allocated UL activated BWchannel\_CA bandwidth assuming lowest SCS among all activated CCs**<Unchanged sections are omitted>**

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

For power class 2, MPR (except 256 QAM) specified in sub-clause 6.2A.2.4.1 applies for intra-band contiguous UL CA and sub-clause 6.2A.2.4.2 applies for intra-band non-contiguous UL CA.

Table 6.2A.2.3-1: (Void)

For FR2-1 256 QAM, for intra-band contiguous UL CA with contiguous allocations within the cumulative aggregated bandwidth, the following rule for MPR applies:

MPR = MPRC\_CA+∆MPR

MPRC\_CA is defined in Table 6.2A.2.3-2. △MPR as specified in Table 6.2.2.1-5 applies.; If [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported and the intra-band contiguous CA is configured with single UL CC, MPRC\_CA shall be determined from Tables 6.2.2.2-2 and 6.2.2.2-3. If [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and the intra-band contiguous CA is activated with single UL CC, MPRC\_CA shall be determined from Tables 6.2.2.2-2 and 6.2.2.2-3.

Table 6.2A.2.3-2: Maximum power reduction (MPRC\_CA) for UE power class 2 in FR2-1

|  |  |
| --- | --- |
|  | bandwidth basis2 |
|  | ≤ 400 MHz | > 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | 256 QAM1 | ≤ 12.5 | ≤ 14.2 | ≤ 14.7 | ≤ 15.7 |
| CP-OFDM | 256 QAM1 | ≤ 12.5 | ≤ 14.2 | ≤ 14.7 | ≤ 15.7 |
| NOTE 1: Refer to clause 6.1 for 256QAM applicability.NOTE 2: If [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported, configured UL BWchannel\_CA is used as bandwidth basis. If [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and all the activated CCs form a contiguous block, activated BWchannel\_CA bandwidth is used as bandwidth basis. Otherwise, Cumulative aggregated channel bandwidth (CABW) is used as bandwidth basis. |

For FR2-1 256 QAM, for intra-band contiguous UL CA with non-contiguous RB allocations, the following rule for MPR applies:

MPR = max(MPRC\_CA+∆MPR, -10\*A +7.0)

Where:

 A = NRB\_alloc / NRB\_agg\_C.

 NRB\_alloc is the total number of allocated UL RBs

 NRB\_agg\_C is the number of the aggregated RBs within the fully allocated cumulative aggregated channel bandwidth assuming lowest SCS among all configured CCs; If [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported, NRB\_agg\_C is the number of the aggregated RBs within the fully allocated UL configured BWchannel\_CA assuming lowest SCS among all configured CCs. If [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and all the activated CCs form a contiguous block, NRB\_agg\_C is the number of the aggregated RBs within the fully allocated UL activated BWchannel\_CA assuming lowest SCS among all activated CCs.

**<Unchanged sections are omitted>**

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

##### 6.2A.2.4.1 Maximum output power reduction for power class 3 intra-band contiguous CA

For power class 3, MPR for intra-band contiguous UL CA with contiguous allocations within the cumulative aggregated bandwidth is denoted as MPRC\_CA and is defined in Tables 6.2A.2.4-1 and 6.2A.2.4-2. If [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported and the intra-band contiguous CA is configured with single UL CC, MPRC\_CA shall be determined from Tables 6.2.2.3-1 and 6.2.2.3-2. If [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and the intra-band contiguous CA is activated with single UL CC, MPRC\_CA shall be determined from Tables 6.2.2.3-1 and 6.2.2.3-2.

Table 6.2A.2.4-1: Maximum power reduction (MPRC\_CA) for UE power class 3 in FR2-1

|  |  |
| --- | --- |
|  | bandwidth basis2 |
|  | ≤ 400 MHz | > 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2400 MHz |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 5.01 | ≤ 7.7 | ≤ 8.2 | ≤ 8.7 |
|  | QPSK | ≤ 5.01 | ≤ 7.7 | ≤ 8.2 | ≤ 9.7 |
|  | 16 QAM | ≤ 6.5 | ≤ 8.7 | ≤ 9.3 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
| CP-OFDM | QPSK | ≤ 5.0 | ≤ 7.5 | ≤ 8.0 | ≤ 9.7 |
|  | 16 QAM | ≤ 6.5 | ≤ 8.7 | ≤ 9.2 | ≤ 9.7 |
|  | 64 QAM | ≤ 9.0 | ≤ 10.7 | ≤ 11.2 | ≤ 11.7 |
| NOTE 1: (Void).NOTE 2: If [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported, configured UL BWchannel\_CA is used as bandwidth basis. If [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and all the activated CCs form a contiguous block, activated UL BWchannel\_CA is used as bandwidth basis. Otherwise, Cumulative aggregated channel bandwidth (CABW) is used as bandwidth basis. |

Table 6.2A.2.4-2: Maximum power reduction (MPRWT\_C\_CA) for UE power class 3 in FR2-2

|  |  |
| --- | --- |
| Waveform Type | Cumulative aggregated channel bandwidth |
| < 400 MHz | ≥ 400 MHz and < 800 MHz | ≥ 800 MHz and ≤ 1400 MHz | > 1400 MHz and ≤ 2000 MHz |
| Pi/2 BPSK | ≤ 1.0 | ≤ 1.0 | ≤ 1.0 | ≤ 1.0 |
| QPSK | ≤ 2.0 | ≤ 2.0 | ≤ 2.0 | ≤ 2.0 |
| 16 QAM | ≤ 4.0 | ≤ 4.0 | ≤ 4.0 | ≤ 4.0 |
| 64 QAM | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 | ≤ 10.0 |

In case of a contiguous RB, DFT-s-BPSK or DFT-s-QPSK UL allocation in a single CC of a CA configuration with contiguous CCs, and whose cumulative aggregated BW ≤ 400 MHz, MPRC\_CA shall instead be MPR2 if [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported, and be MPR3 if [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and all the activated CCs form a contiguous block, and derived as MAX(MPR1, MPR2) otherwise, where:

 MPR1 shall be determined from Table 6.2.2.3-1 if CABW ≤ 200 MHz, from Table 6.2.2.3-2 if CABW > 200 MHz.

 MPR2 shall be determined from Table 6.2.2.3-1 if configured UL BWchannel\_CA ≤ 200 MHz, from Table 6.2.2.3-2 if configured UL BWchannel\_CA > 200 MHz.

 MPR3 shall be determined from Table 6.2.2.3-1 if activated UL CCs bandwidth ≤ 200 MHz, from Table 6.2.2.3-2 if activated UL CCs bandwidth > 200 MHz.

and assume all UL CCs use the same SCS for the purpose of determination of inner and outer RB allocations in Table 6.2.2.3-1 and Table 6.2.2.3-2:

 NRB shall be chosen as the sum of NRB of all constituent UL CCs in the CA configuration.

 LCRB shall be chosen as BWalloc,RB

 RBstart shall be derived as: RBstart\_allocatedCC+NRB\_unallocatedCC\_low

 RBstart\_allocatedCC is the index of the first allocated RB in the CC with allocation

 NRB\_unallocatedCC\_low is the sum of NRB in all UL CCs lower in frequency compared to the CC with allocation

When different waveform types exist across CCs, the requirement is set by the waveform type used in the configuration with the highest contiguous MPR.

For intra-band contiguous UL CA with non-contiguous RB allocations, the following rule for MPR applies:

MPR = max(MPRC\_CA, -10\*A +7.0)

Where:

 A = NRB\_alloc / NRB\_agg\_C.

 NRB\_alloc is the total number of allocated UL RBs

 NRB\_agg\_C is the number of the aggregated RBs within the fully allocated cumulative aggregated channel bandwidth assuming lowest SCS among all configured CCs; If [*fr2-MPR-ImprovementUplinkDependent-r19*] is supported, NRB\_agg\_C is the number of the aggregated RBs within the fully allocated UL configured BWchannel\_CA assuming lowest SCS among all configured CCs. If [*fr2-MPR-ImprovementActivatedUplinkDependent-r19*] is supported and all the activated CCs form a contiguous block, NRB\_agg\_C is the number of the aggregated RBs within the fully allocated UL activated BWchannel\_CA assuming lowest SCS among all activated CCs.**<Unchanged sections are omitted>**