**3GPP TSG-RAN WG4 Meeting # 102-e *R4-2203556***

**Electronic, February 21st - March 3rd, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-1** | **CR** |  | **rev** |  | **Current version:** | **17.4.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | Draft CR for Introduction of the Increased MOP for CA and DC feature | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | InterDigital Inc. | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | Power\_Limit\_CA\_DC-Core | | | | |  | ***Date:*** | | | 2022-02-21 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The new feature requires new text that points to the method of deriving the PPowerClass,CA for UEs supporting the Increased power output for inter-band CA and a similar pointer for DC PPowerClass case. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Addition of text pointing to the *powerClass-v17.x.y* UE capability for PPowerClass,CA for CA and PPowerClass for DC respectively, deriving method. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The feature is not specified. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2A.4.1.3, 6.2B.4.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS/TR ... 38.521-3 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

--------------------------------------------------------------------Start Changes----------------------------------------------------

6.2A.4.1.3 Configured transmitted power for Inter-band CA

For uplink carrier aggregation the UE is allowed to set its configured maximum output power PCMAX,*c* for serving cell *c* and its total configured maximum output power PCMAX.

The configured maximum output power PCMAX,*c* on serving cell *c* shall be set as specified in clause 6.2.4.

For uplink inter-band carrier aggregation, MPR*c* and A-MPR*c* apply per serving cell *c* and are specified in clause 6.2.2 and clause 6.2.3, respectively. P-MPR*c* accounts for power management for serving cell *c*. PCMAX,*c* is calculated under the assumption that the transmit power is increased independently on all component carriers.

The total configured maximum output power PCMAX shall be set within the following bounds:

PCMAX\_L ≤ PCMAX ≤ PCMAX\_H

For uplink inter-band carrier aggregation with one serving cell c per operating band when same slot symbol pattern is used in all aggregated serving cells,

PCMAX\_L = MIN {10log10∑ MIN [ pEMAX,c/(tC,c), pPowerClass.c/(MAX(mprc·∆mprc, a-mprc)·tC,c ·tIB,c·tRxSRS,c), pPowerClass,c/pmprc], PEMAX,CA, PPowerClass,CA-ΔPPowerClass, CA}

PCMAX\_H = MIN{10 log10 ∑ pEMAX,c , PEMAX,CA, PPowerClass,CA-ΔPPowerClass, CA}

where

- pEMAX,c is the linear value of PEMAX, *c* which is given by IE *P-Max* for serving cell *c* in [7];

- PPowerClass,CA is the maximum UE power specified in Table 6.2A.1.3-1 as indicated by [*powerClass, powerClass-v1610, powerClass-v17xy*] without taking into account the tolerance specified in the Table 6.2A.1.3-1;

- pPowerClass,c is the linear value of the maximum UE power for serving cell *c* specified in Table 6.2.1-1 without taking into account the tolerance;

- ΔPPowerClass, CA = 3 dB for a power class 2 capable UE when the requirements of default power class are applied as specified in sub-clause 6.2.A.1.3; otherwise ΔPPowerClass, CA = 0 dB; - mpr *c* and a-mpr *c* are the linear values of MPR *c* and A-MPR *c* as specified in clause 6.2.2 and clause 6.2.3, respectively;

- ∆mpr *c* is the linear value of ∆MPR *c* as specified in clause 6.2.2;

- pmprc is the linear value of P-MPR*c*;

- ∆tRxSRS,c is the linear value of ∆TRxSRS,c;

- tC,c is the linear value of TC,ctC,c = 1.41 when NOTE 2 in Table 6.2A.1.3-1 applies for a serving cell *c*, otherwise tC,c = 1;

- tIB,c is the linear value of the inter-band relaxation term TIB,c of the 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; otherwise tIB,c 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.

- PEMAX,CA is the value indicated by *p-NR-FR1* or by *p-UE-FR1* whichever is the smallest if both are present.For uplink inter-band carrier aggregation with one serving cell *c* per operating band when at least one different numerology/slot pattern is used in aggregated cells, the UE is allowed to set its configured maximum output power PCMAX,c(i),i for serving cell c(i) of slot numerology type *i*, and its total configured maximum output power PCMAX.

The configured maximum output power PCMAX,c(i),i (p) in slot p of serving cell c(i) on slot numerology type *i* shall be set within the following bounds:

PCMAX\_L,f,c(i),i (p) ≤ PCMAX,f,c(i), i (p) ≤ PCMAX\_H,f,c(i),i (p)

where PCMAX\_L,f,c (i),i (p) and PCMAX\_H,f,c(i),i (p) are the limits for a serving cell c(i) of slot numerology type i as specified in clause 6.2.4.

The total UE configured maximum output power PCMAX (p,q) in a slot p of slot numerology or symbol pattern *i*, and a slot q of slot numerology or symbol pattern *j* that overlap in time shall be set within the following bounds unless stated otherwise:

PCMAX\_L(p,q) ≤ PCMAX (p,q) ≤ PCMAX\_H (p,q)

When slots p and q have different transmissions lengths and belong to different cells on different bands:

PCMAX\_L (p,q) = MIN {10 log10 [pCMAX\_L,f,c(i),i (p) + pCMAX\_L,f,c(i),j (q)], PPowerClass,CA, PEMAX,CA}

PCMAX\_H (p,q) = MIN {10 log10 [pCMAX\_ H,f,c(i),i (p) + pCMAX\_ H,f,c(i),j (q)], PPowerClass,CA, PEMAX,CA}

where pCMAX\_L,f,c (i),i and pCMAX\_ H,f,c(i),i are the respective limits PCMAX\_L,f,c (i),i and PCMAX\_H,f,c(i),i expressed in linear scale.

For combinations of intra-band and inter-band carrier aggregation with UE configured for transmission on three serving cells (up to two contiguously aggregated carriers per operating band), the following apply:

For the case when p and q belong to the same band and k belongs to a different band, but p, q and k are of the same numerology and slot patterns.

PCMAX\_L = MIN {10log10∑( pCMAX\_L, Bi), PEMAX,CA, PPowerClass}

PCMAX\_H = MIN{10 log10 ∑ pEMAX,c , PEMAX,CA, PPowerClass}

Where

- pCMAX\_L, Bi is the linear values of PCMAX\_L specified for the specific operating band *Bi*.

- The linear value of PCMAX\_L specified for uplink intra-band contiguous carrier aggregation in subclause 6.2A.4.1.1 applies for operating band supporting two contiguous serving cells, designated by its band index *Bi*. The linear value of PCMAX\_L specified for single carrier in subclause 6.2.4 applies for operating band *Bj* supporting one serving cell.

For the case when p and q belong to the same band and are of the same numerology *i* and slot patterns (p,q),while k belong to a different band and is of different numerology *j* and/or slot pattern on the 3rd cell then:

PCMAX\_L (p,q,k) = MIN {10 log10 [pCMAX\_L,Bi,i(p,q) + pCMAX\_L,c(3),Bj,j(k)], PEMAX,CA, PPowerClass}

PCMAX\_H (p,q,k) = MIN {10 log10 [pCMAX\_ H,Bi,i (p,q) + pCMAX\_ H,c(3), Bj,j(k)], PEMAX,CA, PPowerClass}

Where

- pEMAX,c is the linear value of PEMAX, *c* which is given by IE *P-Max* for serving cell *c* in [7];

- PEMAX,CA is p-UE-FR1 value signalled by RRC and defined in [38.331];

- PPowerClass is the maximum UE power specified in Table 6.2A.1.3-1 without taking into account the tolerance specified in the Table 6.2A.1.3-1 or Table 6.2F.1A.1-1 for shared spectrum bands;

- pCMAX\_L,c(3),Bj,j(k) and pCMAX\_ H,c(3), Bj,j(k)are the linear values of PCMAX\_L and PCMAX\_H respectively, specified for single carrier in subclause 6.2.4 and applies for operating band supporting one serving cell in the *Bj* band on numerology *j*, using slot pattern k;

- pCMAX\_L,Bi,i(p,q) and pCMAX\_ H,Bi,i (p,q) are the linear values of PCMAX\_L respectively PCMAX\_H for uplink intra-band contiguous carrier aggregation specified in subclause 6.2A.4.1.1 which applies for operating band *Bi* on numerology *i*, supporting two contiguous serving cells, using the same slot pattern (p,q).

TREF and Teval are specified in Table 6.2A.4.1.3-0 when same and different slot patterns are used in aggregated carriers. For each TREF, the PCMAX\_L is evaluated per Teval and given by the minimum value taken over the transmission(s) within the Teval; the minimum PCMAX\_L over the one or more Teval is then applied for the entire TREF. The lesser of PPowerClass,CA and PEMAX,CA shall not be exceeded by the UE during any period of time.

**Table 6.2A.4.1.3-0: PCMAX evaluation window for different slot and channel durations**

|  |  |  |
| --- | --- | --- |
| **TREF** | **Teval** | **Teval with frequency hopping** |
| TREF of largest slot duration over both UL CCs | Physical channel length | Min(Tno\_hopping, Physical Channel Length) |

If the UE is configured with multiple TAGs and transmissions of the UE on slot *i* for any serving cell in one TAG overlap some portion of the first symbol of the transmission on slot *i* +1 for a different serving cell in another TAG, the UE minimum of PCMAX\_L for slots *i* and *i* + 1 applies for any overlapping portion of slots *i* and *i* + 1. The lesser of PPowerClass,CA and PEMAX,CA shall not be exceeded by the UE during any period of time.

The measured maximum output power PUMAX over all serving cells with same slot pattern shall be within the following range:

PCMAX\_L – MAX{TL, TLOW(PCMAX\_L) } ≤ PUMAX  ≤ PCMAX\_H + THIGH(PCMAX\_H)

PUMAX = 10 log10 ∑ pUMAX,c

where pUMAX,c denotes the measured maximum output power for serving cell *c* expressed in linear scale. The tolerances TLOW(PCMAX) and THIGH(PCMAX) for applicable values of PCMAX are specified in Table 6.2A.4.1.3-1. The tolerance TL is the absolute value of the lower tolerance for applicable NR CA configuration as specified in Table 6.2A.1.3-1-2 for inter-band carrier aggregation.

The measured maximum output power PUMAX over all serving cells, when at least one slot has a different transmission numerology or symbol pattern, shall be within the following range:

P'CMAX\_L– MAX{TL, TLOW (P'CMAX\_L)} ≤ P'UMAX  ≤ P'CMAX\_H + THIGH (P'CMAX\_H)

P'UMAX = 10 log10 ∑ p'UMAX,c

where p'UMAX,c denotes the average measured maximum output power for serving cell *c* expressed in linear scale over TREF. The tolerances TLOW(P'CMAX) and THIGH(P'CMAX) for applicable values of P'CMAX are specified in Table 6.2A.4.1.3-1 for inter-band carrier aggregation. The tolerance TL is the absolute value of the lower tolerance for applicable NR CA configuration as specified in Table 6.2A.1.3-1 for inter-band carrier aggregation.

where:

P'CMAX\_L  = MIN{ MIN {10log10∑( pCMAX\_L,f,c(i),i), PPowerClass,CA} over all overlapping slots in TREF}

P'CMAX\_H = MAX{ MIN{10 log10 ∑ pEMAX,c , PPowerClass,CA} over all overlapping slots in TREF}

**Table 6.2A.4.1.3-1: PCMAX tolerance for uplink inter-band CA (two bands)**

|  |  |  |
| --- | --- | --- |
| **PCMAX (dBm)** | **Tolerance TLOW(PCMAX) (dB)** | **Tolerance THIGH(PCMAX) (dB)** |
| 23 ≤ PCMAX ≤ 27.8 | 3.0 | 2.0 |
| 22 ≤ PCMAX < 23 | 5.0 | 2.0 |
| 21 ≤ PCMAX < 22 | 5.0 | 3.0 |
| 20 ≤ PCMAX < 21 | 6.0 | 4.0 |
| 16 ≤ PCMAX < 20 | 5.0 | |
| 11 ≤ PCMAX < 16 | 6.0 | |
| -40 ≤ PCMAX < 11 | 7.0 | |

--------------------------------------------------------------------End Changes----------------------------------------------------

--------------------------------------------------------------------Start Changes----------------------------------------------------

6.2B.4 Configured output power for NR-DC

6.2B.4.1 Configured transmitted power level for NR-DC

The UE is allowed to set its configured maximum output power PCMAX,f,*c,*MCGand PCMAX,f,*c,*SCGfor the respective MCG and SCG and its total configured maximum output power for NR-DC operation with as specified in clause 7.6.2 of [8]. The UE is configured with an inter-CG power sharing mode by *NR-DC-PC-mode.*The requirements apply for one uplink serving cell configured per CG and for asynchronous and synchronous NR-DC if not otherwise stated.

Unless otherwise stated, the configured maximum output power PCMAX,f,*c,*MCG(*q*) in physical-channel *q* for carrier *f* of serving cell *c* shall be set within the bounds if contained in the MCG,

PCMAX\_L,f,*c,*MCG (*q*) ≤ PCMAX,f,*c,*MCG(*q*) ≤ PCMAX\_H,f,*c,*MCG (*q*)

and the corresponding PCMAX\_L,f,*c,*SCG (*q*) for a serving cell contained in the SCG,

PCMAX\_L,f,*c,*SCG (*q*) ≤ PCMAX,f,*c,*SCG(*q*) ≤ PCMAX\_H,f,*c,*SCG (*q*)

where PCMAX\_L,f,c,MCG, PCMAX\_H,f,c,MCG, PCMAX\_L,f,c,SCG and PCMAX\_H,f,c,SCG are the limits for a serving cell *c* as specified in clause 6.2.4 modified as follows:

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

PCMAX\_H,f,c,MCG = MIN{PEMAX,c, PEMAX,NR-DC, PNR, PPowerClass – ΔPPowerClass}

for the MCG and

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

PCMAX\_H,f,c,SCG = MIN{PEMAX,c, PEMAX,NR-DC, PNR, PPowerClass – ΔPPowerClass}

for the SCG, where

- PEMAX,NR-DC is the value given by the field *p-UE-FR1* of the *PhysicalCellGroupConfig* IE for the MCG as defined in [7];

- PNR is the value given by the field *p-NR-FR1* of the *PhysicalCellGroupConfig* IE as defined in [7];

- PPowerClass is the maximum UE power specified in Table 6.2.1-1 for the MSG or SCG respective band without taking into account the tolerance specified in the Table 6.2.1-1;

- ∆TIB,c is the additional tolerance for serving cell c as specified in clause 6.2B.4.2 for NR-DC; ∆TIB,c = 0 dB otherwise;

- ∆TC,c = 1.5dB when NOTE 2 in Table 6.2B.1.3-1 applies for a serving cell c, otherwise ∆TC,c = 0 dB ;

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

- ΔPPowerClass = 0 dB for a power class 3 capable UE.

When MSG or SCG are configured with intra-band contiguous carrier aggregation, then intra-band carrier aggregation PCMAX*,*CA*,*MCG(*q*) and/or PCMAX,CA,SCG(*q*) in physical-channel *q* shall be set within the bounds:

PCMAX\_L,CA, MCG (*q*) ≤ PCMAX,CA,MCG(*q*) ≤ PCMAX\_H,CA,MCG (*q*)

for MSG, and/or

PCMAX\_L,CA,SCG (*q*) ≤ PCMAX,CA,SCG(*q*) ≤ PCMAX\_H,CA,SCG (*q*)

for SCG, where PCMAX\_L,CA,MCG, PCMAX\_H,CA,MCG, PCMAX,CA,SCG and PCMAX\_H,CA,SCG are the limits for a carrier aggregation uplink as specified in clause 6.2A.4.1.1 modified as follows:

PCMAX\_L,CA,MCG = MIN{10 log10 ∑ pEMAX,c  - TC , PEMAX,CA, PEMAX,NR-DC, PNR,MCG, (PPowerClass – ΔPPowerClass) – MAX(MAX(MPR, A-MPR) + ΔTIB,c + TC + TRxSRS, P-MPRc ) }

PCMAX\_H,CA,MCG  = MIN{10 log10 ∑ pEMAX,c , PEMAX,CA , PEMAX,NR-DC, PNR,MCG, PPowerClass – ΔPPowerClass }

for the MCG, and

PCMAX\_L,CA,SCG = MIN{10 log10 ∑ pEMAX,c  - TC , PEMAX,CA, PEMAX,NR-DC, PNR,SCG, (PPowerClass – ΔPPowerClass) – MAX(MAX(MPR, A-MPR) + ΔTIB,c + TC + TRxSRS, P-MPRc ) }

PCMAX\_H,CA,SCG  = MIN{10 log10 ∑ pEMAX,c , PEMAX,CA , PEMAX,NR-DC, PNR,SCG, PPowerClass – ΔPPowerClass }

for SCG.

For a UE provided with *NR-DC-PC-mode* = *Semi-static-mode1*,

= MIN{PEMAX, NR-DC, PPowerClass,NR-DC} + 0.3 dB

with PPowerClass set to power class 3 in case the UE indicates a higher power class in any CG by [*powerClass, powerClass-v1610, powerClass-v17xy*]. The UE determines the maximum transmission power for the MCG and the SCG using the respective configured maximum power PCMAX,f,*c,*MCGand PCMAX,f,*c,*SCG for a single serving cell per band or PCMAX,CA,MCG and/or PCMAX,CA,SCGwhen it is configured with contiguous intra-band carrier aggregation in one or both cell groups.

If for synchronous NR-DC operation a UE is provided *NR-DC-PC-mode* = *Semi-static-mode2*, the is determined as above and

- if at least one symbol of slot of the MCG/SCG is indicated as uplink or flexible to a UE by *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated*, if provided, overlaps with a symbol for any ongoing transmission overlapping with slot of the SCG/MCG, the UE determines a maximum power for the transmission on the SCG/MCG overlapping with slot using the configured maximum power PCMAX,f,*c,*SCGor PCMAX,f,*c,*MCG or PCMAX,CA,MCG and/or PCMAX,CA,SCGwhen it is configured with intra-band contiguous carrier aggregation in one or both cell gropups for the SCG or MSG, respectively,

- otherwise (i.e. an ongoing transmission overlapping with slot of the SCG/MCG overlaps with only semi-static downlink symbols within slot of the MCG/SCG), the UE determines a maximum power for the transmission on MCG or the SCG overlapping with slot using the configured maximum power as specified in clause 6.2.4 or the modified 6.2A.4.1.1 as described in this clause.

If a UE indicates a capability for dynamic power sharing between the MCG and the SCG and is provided with *NR-DC-PC-mode = Dynamic*,

= MIN{PEMAX, NR-DC, PPowerClass, NR-DC }

with PPowerClass, NR-DC set to power class 3 in case the UE indicates a higher power class in any CG by [*powerClass, powerClass-v1610, powerClass-v17xy*]. The UE determines the maximum transmission power for the MCG and the SCG using the respective configured maximum power PCMAX,f,*c,*MCGand PCMAX,f,*c,*SCG or PCMAX,CA,MCG and/or PCMAX,CA,SCG or a combination of PCMAX,f,*c,*MCGor PCMAX,f,*c,*SCG and PCMAX,CA,MCG or PCMAX,CA,SCG when it is configured with intra-band contiguous carrier aggregation in one or both cell groups except

- if UE transmission(s) in slot of the MCG or in slot of the SCG do not overlap in time with any UE transmission(s) on the SCG or the MCG, respectively, the UE determines a maximum transmission power in slot of the MCG or in slot of the SCG using the configured maximum power as specified in clause 6.2.4 or the modified 6.2A.4.1.1 as described in this clause for the uplink contiguous carrier aggregation configured cell group.

If a UE indicates a capability to determine a total transmission power on the SCG at a first symbol of a transmission occasion on the SCG by determining transmissions on the MCG as specified in clause 7.6.2 of [8], and is provided with *NR-DC-PC-mode = Dynamic*,

= MIN{PEMAX, NR-DC, PPowerClass,NR-DC}

with PPowerClass,NR-DC set to power class 3 in case the UE indicates a higher power class in any CG by [*powerClass, powerClass-v1610, powerClass-v17xy*]. The UE determines the maximum transmission power for the MCG and the SCG using the respective configured maximum power PCMAX,f,*c,*MCGand PCMAX,f,*c,*SCG or PCMAX,CA,MCG and/or PCMAX,CA,SCG or a combination of PCMAX,f,*c,*MCGor PCMAX,f,*c,*SCG and PCMAX,CA,MCG or PCMAX,CA,SCG when it is configured with intra-band contiguous carrier aggregation in one or both cell groups.

The measured total maximum output power PUMAX over both CGs measured over the transmission reference time duration is

PUMAX = 10 log10 (pUMAX,MCG + pUMAX,SCG),

where pUMAX,MSG and pUMAX,SCG denote the measured output power of serving cells contained in the respective MSG and SCG expressed in linear scale.

The measured total configured maximum output power PUMAX shall be within the following bounds:

PCMAX\_L -TLOW (PCMAX\_L) ≤ PUMAX  ≤ PCMAX\_H + THIGH (PCMAX\_H)

with the tolerances TLOW(PCMAX\_H) and THIGH(PCMAX\_H) for applicable values of PCMAX specified in Table 6.2B.4.1.3-2.

When a subframe *p* on the MSG overlap with a physical-channel *q* on the SCG*,* then for PUMAX evaluation, the subframe *p* on the MCG is takenas reference period TREF and always considered as the reference measurement duration and the following rules are applicable.

TREF and Teval are specified in Table 6.2B.4.1.3-1 when same or different subframe and physical-channel durations are used on the carriers. The PPowerClass shall not be exceeded by the UE during any evaluation period of time.

**Table 6.2B.4.1.3-1: PCMAX evaluation window**

|  |  |  |
| --- | --- | --- |
| **Transmission duration** | **TREF** | **Teval** |
| Different transmission duration in different CG carriers | MCG subframe | MIN(*Tno\_hopping*, Physical Channel Length) |

For each TREF, the PCMAX\_H is evaluated per Teval and given by the maximum value over the transmission(s) within the Teval as follows:

PCMAX\_H = MAX{PCMAX\_NR-DC\_H(*p,q*), PCMAX\_NR-DC\_H(*p,q+1*), … , PCMAX\_NR-DC\_H(*p,q+n*)}

where PCMAX\_NR-DC\_H entries are the applicable upper limits for each overlapping scheduling unit pairs *(p,q*), (*p, q+1*), up to *(p, q+n*) for each applicable Teval duration, where *q+n* is the last physical-channel on the SCG overlapping with subframe *p* on the MCG, while PCMAX\_L is computed as follows:

PCMAX\_L = MIN{PCMAX\_NR-DC\_L(*p,q*), PCMAX\_NR-DC\_L(*p,q+1*), … , PCMAX\_NR-DC\_L(*p,q+n*)}

where PCMAX\_NR-DC\_L entries are the applicable lower limits for each overlapping scheduling unit pairs *(p,q*), (*p, q+1*) up to *(p, q+n*) for each applicable Teval duration, where *q+n* is the last physical-channel on the SCG overlapping with subframe *p* on the MCG.

For a UE provided with *NR-DC-PC-mode* = *Semi-static-mode1* and configured with pNR,MCG + pNR,SCG ≤ with pNR,MCG and pNR,SCG the values of the PNR for the respective MCG and SCG expressed in linear scale

PCMAX\_NR-DC\_L(*p,q*) = 10 log10 [pCMAX\_L, MCG (*p*) + pCMAX\_L, SCG (*q*)]

PCMAX\_NR-DC\_H(*p,q*) = 10 log10 [pCMAX\_H, MCG (*p*) + pCMAX\_H, SCG (*q*)]

where

pCMAX\_L, MCG, pCMAX\_L, SCG, pCMAX\_H, MCG, pCMAX\_H, SCG can be pCMAX\_L,f,c,MCG, pCMAX\_H,f,c,MCG, pCMAX\_L,f,c,SCG, and pCMAX\_H,f,c,SCG the values of the respective PCMAX\_L,f,c,MCG, PCMAX\_H,f,c,MCG, PCMAX\_L,f,c,MCG, and PCMAX\_H,f,c,SCG expressed in linear scale, or pCMAX\_L,CA,MCG, pCMAX\_H,CA,MCG, pCMAX\_L,CA,SCG, and pCMAX\_H,CA,SCG the values of the respective PCMAX\_L,CA,MCG, PCMAX\_H,CA,MCG, PCMAX\_L,CA,SCG, and PCMAX\_H,CA,SCG expressed in linear scale if the contiguous carrier aggregation is configured in MCG and/or SCG or a combinations of single cell and carrier aggregation while the measured configured maximum power PUMAX  for each CG shall meet the requirements as specified in clause 6.2.4 but with bounds for PCMAX,f,*c,*MCG(*p*) and PCMAX,f,*c,*SCG as specified in this clause or 6.2A.4.1.1 as modified in this clause for contiguous carrier aggregation configured cell group.

If for synchronized NR-DC a UE is provided with *NR-DC-PC-mode* = *Semi-static-mode2* and configured with pNR,MCG + pNR,SCG ≤ with pNR,MCG and pNR,SCG the linear-scale values of the PNR for the respective MCG and SCG

PCMAX\_NR-DC\_L(*p,q*) = 10 log10 [pCMAX\_L, MCG (*p*) + pCMAX\_L, SCG (*q*)]

PCMAX\_NR-DC\_H(*p,q*) = 10 log10 [pCMAX\_H, MCG (*p*) + pCMAX\_H, SCG (*q*)]

while the measured configured maximum power PUMAX for each CG shall meet the requirements specified in Table 6.2.4-2 but with bounds for PCMAX,f,*c,*MCG(*p*) and PCMAX,f,*c,*SCG(*q*) as specified in this clause or 6.2A.4.1.1-1when intra-band carrier aggregation contiguous is configured in the MCG and/or SCG with the bounds PCMAX,CA*,*MCG(*p*) and PCMAX,CA*,*SCG defined in this clause except

- if an ongoing transmission overlapping with physical channel *q* of the SCG or subframe *p* of the MCG overlaps with only semi-static downlink symbols within the respective subframe *p* of the MCG or physical channel *q* of the SCG as indicated to a UE by *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated*, if provided,

then the measured configured maximum power PUMAX for the transmission subframe *p* on the MCG or physical channel *q* on the SCG shall meet the requirements as specified in clause 6.2.4 and with bounds for PCMAX,f,*c,*MCG(*p*) or PCMAX,f,*c,*SCG as specified in this clause or Table 6.2A.4.1.1-1when intra-band carrier aggregation contiguous is configured in the MCG and/or SCG with bounds for PCMAX,CA*,*MCG(*p*) and PCMAX,CA*,*SCG defined in this clause For a UE provided with *NR-DC-PC-mode* = *Dynamic*,

PCMAX\_NR-DC\_L(*p,q*) = MIN{10 log10 [pCMAX\_L, MCG (*p*) + pCMAX\_L, SCG (*q*)], }

PCMAX\_NR-DC\_H(*p,q*) = MIN{10 log10 [pCMAX\_H, MCG (*p*) + pCMAX\_H, SCG (*q*)], }

while the measured configured maximum power PUMAX on the MCG shall meet the requirements as specified in clause 6.2.4-2 but with bounds for PCMAX,f,*c,*MCG(*p*) as specified in this clause, or as specified in Table 6.2A.4.1.1-1 when intra-band carrier aggregation contiguous is configured in the MCG with the bounds for PCMAX,CA,MCG(*p*) as specified in this clause and the PUMAX on the SCG shall be within

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

where for single uplink cell SCG

PCMAX\_L = MIN{PCMAX\_L,f,c,SCG (*p*), 10 log10 ( – pNR,MSG)}

PCMAX\_H = MIN{PCMAX\_H,f,c,SCG (*p*), 10 log10 ( – pNR,MSG)}

and for intra-band carrier aggregation configured SCG

PCMAX\_L = MIN{PCMAX\_L,CA,SCG (*p*), 10 log10 ( – pNR,MSG)}

PCMAX\_H = MIN{PCMAX\_H,CA,SCG (*p*), 10 log10 ( – pNR,MSG)}

where PCMAX\_L,CA,SCG and PCMAX\_H,CA,SCG bounds are defined in this clause,

with limits as specified in Table 6.2.4-2 or as specified in Table 6.2A.4.1.1-1 when intra-band carrier aggregation contiguous is configured in the MCG and pNR,MCG the value of the PNR for the MCG expressed in linear scale.

**Table 6.2B.4.1.3-2: PCMAX tolerance for NR-DC**

|  |  |  |
| --- | --- | --- |
| **PCMAX(dBm)** | **Tolerance**  **TLOW (PCMAX\_L) (dB)** | **Tolerance**  **THIGH (PCMAX\_H) (dB)** |
| 23 ≤ PCMAX ≤ 33 | 3.0 | 2.0 |
| 22 ≤ PCMAX < 23 | 5.0 | 2.0 |
| 21 ≤ PCMAX< 22 | 5.0 | 3.0 |
| 20 ≤ PCMAX < 21 | 6.0 | 4.0 |
| 16 ≤ PCMAX < 20 | 5.0 | |
| 11 ≤ PCMAX < 16 | 6.0 | |
| -40 ≤ PCMAX < 11 | 7.0 | |
| NOTE 1: For UEs provided with *NR-DC-PC-mode* = *Semi-static-mode1 or* with *NR-DC-PC-mode* = *Semi-static-mode2*, the upper tolerance Thigh shall be reduced by 0.3 dB for P ≥ 20 dBm. | | |

--------------------------------------------------------------------End Changes----------------------------------------------------