**3GPP TSG-WG4 Meeting #100-e *R4-2114968***

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

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| *CR-Form-v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-1** | **CR** |  | **rev** | **-** | **Current version:** | **17.2.0** |  |
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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:***  | Draft CR on SRS antenna switching change |
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| ***Source to WG:*** | OPPO |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_RF\_TxD |  | ***Date:*** | 2021-08-05 |
|  |  |  |  |  |
| ***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 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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | TxD is agreed to be introduced in Rel-16 and can be supported from Rel-15. The SRS IL for UE with TxD needs to be introduced to cover PC2 UE with 23+23 PAs. |
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| ***Summary of change:*** | Introduce SRS IL for UE with TxD;EAB alternative:The Pcmax,c requirements for SRS transmissions with antenna switching should make sure that the UE does not use virtualization and the allowance for R-connectors should not be excessive. The ∆TRxSRS is a maximum allowance due to additional routing loss for RX antennas, and should not depend on the power classe (but can be band dependent), the MPR that also applies for SRS may cover differences between power classes. The ∆TRxSRS = 6 dB allowed for PC2 allows a large difference between the T- and R-port nothwithstanding further differences in antenna gain. The parameter ΔPPowerClass should be used for UEs indicating TxD or supporting Mode-1 and equipped with half-power PAs. This also makes sure that the power on the T-connectors are attenuated by ΔPPowerClass (= 3 dB) with respect to the advertised power class thus making sure that these UEs do not virtualize (switching with a half-power rated PA across all connectors). Other implementations uses the full-power rated PA for switching. ∆TRxSRS = 3 dB for all cases except for n79. |
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| ***Consequences if not approved:*** | TxD SRS IL will not be covered by Rel-17 spec. |
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| ***Clauses affected:*** | 6.2.4 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.521-1  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

## **<Start of 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+∆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 or 6 dB for a power class 1.5 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 evaluation 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); 3 dB for a power class 1.5 capable UE when P-max of between 23 dBm and 26 dB is indicated; or when the field of UE capability *maxUplinkDutyCycle-PC2-FR1* is absent and the percentage of uplink symbols transmitted in a certain evaluation period is between 25% and 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 between *maxUplinkDutyCycle-PC2-FR1* and *maxUplinkDutyCycle-PC2-FR1/2* 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;

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

 ∆TRxSRS is applied when

a) UE transmits SRS to other than first SRS port when the *SRS-TxSwitch* capability in Rel-16 is indicated as ‘t1r1-t1r2’ or ‘t1r1-t1r2-t1r4’ or ‘t1r1-t1r2-t2r2-t1r4-t2r4’ with all the configured SRS resources in the SRS resource set(s) consisting of one SRS port

b) UE transmits SRS to other than first or second SRS port when the *SRS-TxSwitch* capability in Rel-16is indicated as ‘t1r1-t1r2-t2r2-t2r4’ or ‘t1r1-t1r2-t2r2-t1r4-t2r4’ with all the configured SRS resources in the SRS resource set(s) consisting of two SRS ports

c) UE transmits SRS to a DL-only carrier

d) UE supports TxD (IE [*txDiversity-r16*])

When the device is incapable of TxD (IE [*txDiversity-r16*])

* 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.

When the device is capable of TxD (IE [*txDiversity-r16*]), and

* when the *SRS-TxSwitch* capability is indicated as ‘t1r1-t1r2’ or ‘t1r1-t1r2-t1r4’ or ‘t1r1-t1r2-t2r2-t1r4-t2r4’, the value of ∆TRxSRS for first SRS port is 3dB, for SRS ports other than first SRS port is 7.5dB for n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79;
* when the *SRS-TxSwitch* capability is indicated as ‘t1r1-t1r2-t2r2-t2r4’ or ‘t1r1-t1r2-t2r2-t1r4-t2r4’, the value of ∆TRxSRS for SRS ports other than first and second SRS ports is 4.5dB for n79 and 3 dB for bands whose FUL\_high is lower than the FUL\_low of n79.

For other SRS transmissions ∆TRxSRS is zero;

 P-MPRc is the power management maximum power reduction for

*< begin alternative (EAB) >*

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

a) UE transmits SRS to other than first SRS port when the *SRS-TxSwitch* capability is indicated as ‘t1r2’, ‘t1r4’ ‘t1r4-t2r4’, ‘t1r1-t1r2’, ‘t1r1-t1r2-t1r4’ or ‘t1r1-t1r2-t2r2-t1r4-t2r4’ with all the configured SRS resources in the SRS resource set(s) consisting of one SRS port

b) UE transmits SRS to other than first or second SRS port when the *SRS-TxSwitch* capabilityis indicated as ‘t2r4’, ‘t1r4-t2r4’, ‘t1r1-t1r2-t2r2-t2r4’ or ‘t1r1-t1r2-t2r2-t1r4-t2r4’ with all the configured SRS resources in the SRS resource set(s) consisting of two SRS ports

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

For a UE indicating [*txDiversity-r16*] or a UE supporting *ul-FullPwrMode1-r16* or *ul-FullPwrMode2-SRSConfig-diffNumSRSPorts-r16* but not *ul-FullPwrMode2-TPMIGroup-r16*, ΔPPowerClass = 3 dB during SRS transmission occasions with configured SRS resources in the SRS resource set(s) consisting of one SRS port.

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.

For other SRS transmissions ∆TRxSRS is zero;

P-MPRc is the power management maximum power reduction for

*< end alternative (EAB) >*

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 |

## **<End of Change>**