**3GPP TSG-RAN WG4 Meeting#103-e *R4-22XXXXX***

**Electronic meeting, 9 – 20 May 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.101-2** | **CR** | **CRNum** | **rev** | **-** | **Current version:** | **17.5.0** |  |
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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:*** | Big CR for TS 38.101-2 Maintenance | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | MCC, Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Core  TEI16  NR\_RF\_FR2\_req\_enh | | | | |  | ***Date:*** | | | 2022-05-24 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **A** |  | | | | | ***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 highlighted list will be removed in the final version >  38.101-2 Rel-17  R4-2207786 Correction of FR2 UE configured transmitted power  R4-2207885 CR for 38.101-2-h50: Correction for PC3 MPRnarrow  R4-2209379 Draft CR on clarification of PMPR in FR2 (R17 CAT-A)  R4-2209156 Draft CR to add ‘Annex G Difference of relative phase and power errors’ for FR2 UL coherent MIMO  R4-2207786:  In Clause 6.2.4, the term of PPowerclass is not clearly defined to refer to UE minimum peak EIRP, since FR2 definition of power class consists of four components: minimum peak EIRP, maximum TRP, maximum EIRP, and EIRP spherical coverage. Therefore, it is proposed to define PPowerclass as minimum peak EIRP. Note that this draft CR is a resubmission of R4-2112141, which was endorsed and included in the agreed big CR R4-2115130. However, the change was not implemented by accident.  R4-2207885:  When MPRnarrow was extended to BWalloc,RB less than or equal to 4.32 MHz, the condition on RBstart was not corrected accordingly.    R4-2209156:  The 6.4D.4 Requirements for coherent UL MIMO specify maximum difference of relative phase and power errors, parameters not yet tested in other sections of 38.101-2 or previous 3GPP RATs. It is then necessary to give further details to RAN5 and TE vendors in an annex as done for the EVM so that what is to be measured is made clear and can be implemented as intended.  R4-2209379:  This change is triggerred by Rel-17 FeMIMO WI, but is not dependent on that WI, and this draft CR is proposal of clarification to Rel-16 PMPR.  **Rel-16 MPE PMPR reporting capability needs to be writen explicitly to better understanding of which capability is used to differentiate with upcomming Rel-17 per beam MPE PMPR reporting capability.** | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | R4-2207786:  The definition of PPowerclass as minimum peak EIRP.  R4-2207885:  Modify equation defining the range of eligible RB allocations to MPRnarrow to BWalloc,RB allocations when 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil((2/3 NRB)-LCRB) < RBstart ≤ NRB-LCRB.  R4-2209156:  Addition of Annex G Difference of relative phase and power errors.  R4-2209379:   1. Modification of Note 3 to explicitly writing down the Rel-16 MPE PMPR reporting capability *tdd-MPE-P-MPR-Reporting-r16* | | | | | | | | |
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| ***Consequences if not approved:*** | | R4-2207786:  There is ambiguity in the specification and inconsistence between R15/16 and R17 specifications.  R4-2207885:  RBstart range does not scale with LCRB for MPRnarrow    R4-2209156:  Unclear clause 6.4D.4 leading to misinterpretations.  R4-2209379:  There will be some confusion on the PMPR used in the Pumax definition. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2.2.3, 6.2.4, G (new), G.0 (new), G.1 (new), G.2 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | | |
| ***affected:*** | | **X** |  | Test specifications | | | | R4-2207885: TS.38.521-2 CR 0727 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | Note to the MCC: Annex G (void) exists in v17.5.0, renumbering may be needed | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

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*< start of changes >*

#### 6.2.2.3 UE maximum output power reduction for power class 3

For power class 3, MPR for contiguous allocations is defined as:

MPR = max(MPRWT, MPRnarrow)

For transmission bandwidth configuration less than or equal to 200MHz, and 0 ≤ RBstart < Ceil(1/3 NRB) or Ceil((2/3NRB)- LCRB) < RBstart ≤ NRB-LCRB:

- MPRnarrow = 2.5 dB, when BWalloc,RB is less than or equal to 1.44 MHz,

- MPRnarrow = 2.0 dB, when 1.44 MHz < BWalloc,RB <= 4.32 MHz,

- otherwise MPRnarrow = 0 dB.

*< text omitted >*

### 6.2.4 Configured transmitted power

The UE can configure its maximum output power. The configured UE maximum output power PCMAX,f,c for carrier f of a serving cell c is defined as that available to the reference point of a given transmitter branch that corresponds to the reference point of the higher-layer filtered RSRP measurement as specified in TS 38.215 [11].

The configured UE maximum output power PCMAX,f,c for carrier *f* of a serving cell *c* shall be set such that the corresponding measured peak EIRP PUMAX,f,c is within the following bounds

PPowerclass + DPIBE – MAX(MAX(MPRf,c, A- MPRf,c,) + ΔMBP,n, P-MPRf,c) – MAX{T(MAX(MPRf,c, A- MPRf,c,)), T(P-MPRf,c)} ≤ PUMAX,f,c ≤ EIRPmax

while the corresponding measured total radiated power PTMAX,f,c is bounded by

PTMAX,f,c ≤ TRPmax

with PPowerclass the UE minimum peak EIRP as specified in sub-clause 6.2.1, EIRPmax the applicable maximum EIRP as specified in sub-clause 6.2.1, MPRf,c as specified in sub-clause 6.2.2 , A-MPRf,c as specified in sub-clause 6.2.3, ΔMBP,n the peak EIRP relaxation as specified in clause 6.2.1 and TRPmax the maximum TRP for the UE power class as specified in sub-clause 6.2.1. DPIBE is 1.0 dB if UE declares support for *mpr-PowerBoost-FR2-r16*, UL transmission is QPSK, MPRf,c = 0 and when NS\_200 applies and the network configures the UE to operate with *mpr-PowerBoost-FR2-r16*otherwise DPIBE is 0.0 dB. The requirement is verified in beam peak direction.

*maxUplinkDutyCycle-FR2,* as defined in TS 38.306 [14], is a UE capability to facilitate electromagnetic power density exposure requirements. This UE capability is applicable to all FR2 power classes.

If the field of UE capability *maxUplinkDutyCycle-FR2* is present and the percentage of uplink symbols transmitted within any 1 s evaluation period is larger than *maxUplinkDutyCycle-FR2*, the UE follows the uplink scheduling and can apply P-MPRf,c.

If the field of UE capability *maxUplinkDutyCycle-FR2* is absent, the compliance to electromagnetic power density exposure requirements are ensured by means of scaling down the power density or by other means.

P-MPRf,c is the power management maximum output power reduction. The UE shall apply P-MPRf,c for carrier f of serving cell c only for the cases described below. For UE conformance testing P-MPRf,c shall be 0 dB.

a) ensuring compliance with applicable electromagnetic power density exposure 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 power density exposure requirements in case of proximity detection is used to address such requirements that require a lower maximum output power.

NOTE 1: P-MPRf,c 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-MPRf,c and *maxUplinkDutyCycle-FR2* may impact the maximum uplink performance for the selected UL transmission path.

NOTE 3: MPE P-MPR Reporting capability *tdd-MPE-P-MPR-Reporting-r16*, as defined in TS 38.306 [14], is used to report P-MPRf,c when the reporting conditions configured by gNB are met. This UE capability is applicable to all FR2 power classes.

The tolerance T(∆P) for applicable values of ∆P (values in dB) is specified in Table 6.2.4-1.

Table 6.2.4-1: PUMAX,f,c tolerance

|  |  |  |
| --- | --- | --- |
| Operating Band | ∆P (dB) | Tolerance T(∆P)  (dB) |
| n257, n258, n259, n260, n261, n262 | P = 0 | 0 |
|  | 0 < P ≤ 2 | 1.5 |
|  | 2 < P ≤ 3 | 2.0 |
|  | 3 < P ≤ 4 | 3.0 |
|  | 4 < P ≤ 5 | 4.0 |
|  | 5 < P ≤ 10 | 5.0 |
|  | 10 < P ≤ 15 | 7.0 |
|  | 15 < P ≤ X | 8.0 |
| NOTE: X is the value such that Pumax,f,c lower bound, PPowerclass - P – T(P) = minimum output power specified in clause 6.3.1 | | |

*< text omitted >*

# Annex G (normative):

Difference of relative phase and power errors

# G.0 General

This annex gives further information needed for understanding and implementing 6.4D.4. The following terms should be understood as follows:

* Relative phase error: refers to the phase difference between signals at different physical antenna ports, which should be ideally 0. It should be understood as for a slot i.e. (slot) relative phase. It is calculated based on DMRS symbols of that slot or on SRS symbols.
* Difference of relative phase error: refers to the difference between the relative phase error determined per slot and the relative phase error determined based on the SRS transmitted.

# G.1 Measurement Point

Figure G.1-1 shows the measurement point for the difference of relative phase and power errors.



Figure G.1-1 - Measurement point for difference of relative phase/power error for UL coherent MIMO

# G.2 Relative Phase Error Measurement

Here are listed the different aspects that may lead to different interpretations.

## G.2.1. Symbols used

Phase error is determined based on DMRS REs (3 DMRS symbols per slot).

## G.2.2. CFO (carrier frequency offset) correction

The TE performs a CFO correction on a slot-by-slot basis using a common frequency correction at the two uplink layers.

## G.2.3. Steps of the measurement method

Below are detailed the steps necessary to obtain the maximum difference of relative phase error during the 20ms time window.

1. Determination for each subcarrier and at each antenna, the SRS relative phase error based on the last SRS transmitted on Ant1 and Ant2, that relative phase error serves as a reference for the calculation of the difference of relative phase error for each slot inside the 20 ms time window.

* The output is the “SRS relative phase error” vector for the last SRS transmitted: .

1. Calculation for the last SRS transmitted, for each RB of the SRS relative phase errors based on the arithmetic mean of the subcarrier SRS relative phase errors determined in previous step.
   * The output is the “SRS relative phase error” vector for the last SRS transmitted: .
2. CFO correction on slot-by-slot basis using a common frequency correction for both antenna outputs.
3. Determination for each subcarrier and at each antenna, the phase over the slot being analyzed. The phase is extracted from the channel estimate derived from the 3 DMRS symbols of the slot using the LSE technique.

* The output is one vector of dimension for each antenna.

1. Calculation for a slot for each subcarrier of the relative phase error (difference between the vectors determined in the previous step).

* The output is subcarrier relative phase errors of a slot: .

1. Calculation for a slot, for each RB of the relative phase errors based on the arithmetic mean of the subcarrier relative phase errors determined in previous step.

* The output is a “slot relative phase error” vector for a slot:.

1. Calculation for a slot of the difference of relative phase errors based on the “SRS relative phase error” (reference) determined in step 2 and the “slot relative phase error” determined in previous step.

* The output is a “difference of relative phase error” vector for a slot:.

1. Calculation for a slot of the arithmetic mean value of the “difference of relative phase error” vector determined in previous step, this value corresponds to an RB.

* The output is a “difference of relative phase error” value for a slot:

1. Perform for each slot of the 20ms time window, steps 3 to 8.

* The output is a “difference of relative phase error” vector: .

1. Calculation of the maximum value of the “difference of relative phase error”.

* The output is the “difference of relative phase error” that should be verified as complying with the 40° maximum allowable difference of relative phase error requirement: .

*< end of changes >*