**3GPP TSG-RAN4 Meeting #103-e *R4-2209150***

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

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **38.101-1** | **CR** | **-** | **rev** | **-** | **Current version:** | **15.17.0** |  |
|  |
| *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 to add ‘Annex G Difference of relative phase and power errors’ for FR1 UL coherent MIMO |
|  |  |
| ***Source to WG:*** | Anritsu Limited |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Core |  | ***Date:*** | 2022-04-25 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Rel-15 |
|  | *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)* |
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| ***Reason for change:*** | 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 38.101-1 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. |
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| ***Summary of change:*** | Addition of Annex G Difference of relative phase and power errors. |
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| ***Consequences if not approved:*** | Unclear clause 6.4D.4 leading to misinterpretations. |
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| ***Clauses affected:*** | G, G.0, G-1, G-2. |
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|  | **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:*** |  |

<<Unchanged sections skipped>>

<<Start of change>>

##

# 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 antenna connectors, 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 unwanted emission falling into non-allocated RB(s) and the EVM for the allocated RB(s).



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 DRMS 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 antenna connectors.

## 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 1 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 maximum value in 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:
2. 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 change>>