**3GPP TSG-RAN4 Meeting #111 *R4-2409477***

**Fukuoka, Japan, 20th – 24th May, 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.141-2** | **CR** | **-** | **rev** | **-** | **Current version:** | **18.5.0** |  |
|  |
| *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 on performance requirements for PUCCH format 2 in TS 38.141-2 |
|  |  |
| ***Source to WG:*** | Samsung |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_FR1\_lessthan\_5MHz\_BW-Perf |  | ***Date:*** | 2024-04-08 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *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)* |
|  |  |
| ***Reason for change:*** | In Rel-18 NR\_FR1\_lessthan\_5MHz\_BW WI, it was agree to introduce the requirement of PUCCH format 2 with 3MHz. The draft big CR R4-2405863 was endorsed in RAN4#110b meeting |
|  |  |
| ***Summary of change:*** | Add the AWGN power level setting for 3MHz in Table 8.3.3.2.4.2-2 |
|  |  |
| ***Consequences if not approved:*** | The requirement of PUCCH format 2 with 3MHz can not be verified well |
|  |  |
| ***Clauses affected:*** | 8.3.2.4 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR … CR …  |
|  |  |
| ***Other comments:*** | Based on endorsed draft big CR R4-2405863 |
|  |  |
| ***This CR’s revision history:*** | Revision of R4-2409477 |

<Start of Change>

#### 8.3.3.2 UCI BLER performance requirements

##### 8.3.3.2.1 Definition and applicability

The UCI block error probability is defined as the probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part 2.

Which specific test(s) are applicable to BS is based on the test applicability rules defined in clause 8.1.2.

The transient period as specified in TS 38.101-1 [24] and TS 38.101-2 [25] clause 6.3.3.1 is not taken into account for performance requirement testing, where the RB hopping is symmetric to the CC center, i.e., intra-slot frequency hopping is enabled.

##### 8.3.3.2.2 Minimum Requirement

For *BS type 1-O*, the minimum requirement is in TS 38.104 [2] clause 11.3.1.4.

For *BS type 2-O*, the minimum requirement is in TS 38.104 [2] clause 11.3.2.4.

##### 8.3.3.2.3 Test Purpose

The test shall verify the receiver's ability to detect UCI under multipath fading propagation conditions for a given SNR.

##### 8.3.3.2.4 Method of test

8.3.3.2.4.1 Initial conditions

Test environment: Normal, see clause B.2.

RF channels to be tested for single carrier: M; see clause 4.9.1

Direction to be tested: OTA REFSENS *receiver target reference direction* (see D.54 in table 4.6-1).

8.3.3.2.4.2 Procedure

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex E.3.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Set the BS in the declared direction to be tested.

4) Connect the BS tester generating the wanted signal, multipath fading simulators and AWGN generators to a test antenna via a combining network in OTA test setup, as shown in annex E.3. Each of the demodulation branches signals should be transmitted on each polarization of the test antenna(s).

5) The characteristics of the wanted signal shall be configured according to TS 38.211 [20], and according to additional test parameters listed in table 8.3.3.2.4.2-1.

Table 8.3.3.2.4.2-1: Test parameters

|  |  |
| --- | --- |
| Parameter | Value |
| Modulation order | QPSK |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | enabled |
| First PRB after frequency hopping | The largest PRB index - (Number of PRBs-1) (Note 1) |
| Number of PRBs | 9 |
| Number of symbols | 2 |
| The number of UCI information bits | 22 |
| First symbol | 12 |
| DM-RS sequence generation | *NID*0=0 |
| Note 1: For 3MHz, the first PRB after frequency hopping is 3 |

6) The multipath fading emulators shall be configured according to the corresponding channel model defined in annex J.

7) Adjust the test signal mean power so the calibrated radiated SNR value at the BS receiver is as specified in clause 8.3.3.2.5.1 and 8.3.3.2.5.2 for *BS type 1-O* and *BS type 2-O* respectively, and that the SNR at the BS receiver is not impacted by the noise floor.

 The power level for the transmission may be set such that the AWGN level at the RIB is equal to the AWGN level in table 8.3.3.2.4.2-2.

Table 8.3.3.2.4.2-2: AWGN power level at the BS input

|  |  |  |  |
| --- | --- | --- | --- |
| BS type | Sub-carrier spacing(kHz) | Channel bandwidth(MHz) | AWGN power level |
| BS type 1-O (Note 4) | 15 kHz | 3  | -88.7-ΔOTAREFSENS dBm /2.7 MHz |
|  |  | 5 | -83.5 - ΔOTAREFSENS dBm / 4.5 MHz |
|  |  | 10 | -80.3 - ΔOTAREFSENS dBm / 9.36 MHz |
|  |  | 20 | -77.2 -ΔOTAREFSENS dBm / 19.08 MHz |
|  | 30 kHz | 10 | -80.6 - ΔOTAREFSENS dBm / 8.64 MHz |
|  |  | 20 | -77.4 - ΔOTAREFSENS dBm / 18.36 MHz |
|  |  | 40 | -74.2 - ΔOTAREFSENS dBm / 38.16 MHz |
|  |  | 100 | -70.1 - ΔOTAREFSENS dBm / 98.28 MHz |
| BS type 2-O (Note 5) | 60 kHz | 50 | EISREFSENS\_50M + ΔFR2\_REFSENS + 15 dBm / 47.52MHz  |
|  |  | 100 | EISREFSENS\_50M + ΔFR2\_REFSENS + 18 dBm / 95.04 MHz  |
|  | 120 kHz | 50 | EISREFSENS\_50M + ΔFR2\_REFSENS + 15 dBm / 46.08 MHz  |
|  |  | 100 | EISREFSENS\_50M + ΔFR2\_REFSENS + 18 dBm / 95.04 MHz  |
|  |  | 200 | EISREFSENS\_50M + ΔFR2\_REFSENS + 21 dBm / 190.08 MHz  |
|  |  | 400 | EISREFSENS\_50M + ΔFR2\_REFSENS + 24 dBm / 380.16 MHz |
|  | 480 kHz | 400 | EISREFSENS\_50M + ΔFR2\_REFSENS + 24 dBm / 380.16 MHz |
| NOTE 1: ΔOTAREFSENS as declared in D.53 in table 4.6-1 and clause 7.1.NOTE 2: ΔFR2\_REFSENS = -3 dB as declared in clause 7.1.NOTE 3: EISREFSENS\_50M as declared in D.28 in table 4.6-1.NOTE 4: The AWGN power level contains an AWGN offset of 16dB by default. If needed for test purposes, the AWGN level can be reduced from the default by any value in the range 0dB to 16dB. Changing the AWGN level does not impact the validity of the test, as it reduces the effective base band SNR level.NOTE 5: The AWGN power level contains an AWGN offset of 15dB by default. If needed for test purposes, the AWGN level can be reduced from the default by any value in the range 0dB to 15dB. Changing the AWGN level does not impact the validity of the test, as it reduces the effective base band SNR level. |

8) The signal generator sends a test pattern with the pattern outlined in figure 8.3.3.2.4.2-1. The following statistics are kept: the number of incorrectly decoded UCI.



Figure 8.3.3.2.4.2-1: Test signal pattern for PUCCH format 2 demodulation tests

##### 8.3.3.2.5 Test requirement

8.3.3.2.5.1 Requirements for BS type 1-O

The fraction of incorrectly decoded UCI is shall be less than 1% for the SNR listed in table 8.3.3.2.5.1-1 and table 8.3.3.2.5.1-2.

Table 8.3.3.2.5.1-1: Required SNR for PUCCH format 2 with 15 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of | Number of | Cyclic | Propagation | Channel bandwidth / SNR (dB) |
| TX antennas | demodulation branches | Prefix | conditions and correlation matrix (annex J) | 3 MHz (Note 1) | 5 MHz | 10 MHz | 20 MHz |
| 1 | 2 | Normal | TDLC300-100 Low | [2.1] | 0.8 | 1.4 | 1.8 |
| NOTE 1: The frist PRB after frequency hopping is 3. |

Table 8.3.3.2.5.1-2: Required SNR for PUCCH format 2 with 30 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of | Number of | Cyclic | Propagation | Channel bandwidth/ SNR (dB) |
| TX antennas | demodulation branches | Prefix | conditions and correlation matrix (annex J) | 10MHz | 20 MHz | 40MHz | 100MHz |
| 1 | 2 | Normal | TDLC300-100 Low | 1.1 | 1.7 | 1.0 | 0.9 |

8.3.3.2.5.2 Requirements for *BS type 2-O*

The fraction of incorrectly decoded UCI is shall be less than 1% for the SNR listed in table 8.3.3.2.5.2-1 to table 8.3.3.2.5.2-4.

Table 8.3.3.2.5.2-1: Required SNR for PUCCH format 2 with 60 kHz SCS in FR2-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of | Number of | Cyclic | Propagation | Channel bandwidth / SNR (dB) |
| TX antennas | demodulation branches | Prefix | conditions and correlation matrix (annex J) | 50 MHz | 100 MHz |
| 1 | 2 | Normal | TDLA30-300 Low | 3.2 | 1.7 |

Table 8.3.3.2.5.2-2: Required SNR for PUCCH format 2 with 120 kHz SCS in FR2-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of | Number of | Cyclic | Propagation | Channel bandwidth / SNR (dB) |
| TX antennas | demodulation branches | Prefix | conditions and correlation matrix (annex J) | 50 MHz | 100 MHz | 200 MHz |
| 1 | 2 | Normal | TDLA30-300 Low | 1.8 | 1.8 | 1.7 |

Table 8.3.3.2.5.2-3: Required SNR for PUCCH format 2 and 120 kHz SCS in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of TX | Number of demodulation | Cyclic Prefix | Propagation conditions and correlation matrix (annex J) | Channel bandwidth / SNR (dB) |
| antennas | branches |  |  | 100 MHz |
| 1 | 2 | Normal | TDLA30-650 Low | 2.7 |

Table 8.3.3.2.5.2-4: Required SNR for PUCCH format 2 and 480 kHz SCS in FR2-2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of TX | Number of demodulation | Cyclic Prefix | Propagation conditions and correlation matrix (annex J) | Channel bandwidth / SNR (dB) |
| antennas | branches |  |  | 400 MHz |
| 1 | 2 | Normal | TDLA10-650 Low | 3.2 |

<End of Change>