**3GPP TSG-RAN4 Meeting #111 *R4-2409833***

**Fukuoka, Fukuoka City, Japan, May 19 - May 24, 2024**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.104** | **CR** | **0615** | **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:***  | (NR\_RF\_FR2\_req\_Ph3) Updates for FRCs and performance requirements for 256 QAM BS Demod for TS 38.104 |
|  |  |
| ***Source to WG:*** | Nokia, NEC |
| ***Source to TSG:*** | WG4 |
|  |  |
| ***Work item code:*** | NR\_RF\_FR2\_req\_Ph3 |  | ***Date:*** | 20/5/24 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | 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:*** | FRC numbers are not shown correctly in some requirement tables. FRCs for performance requirements (256QAM, R=682.5/1024) are defined in annex A.9 and A.12. There is no reason to define in plural  |
|  |  |
| ***Summary of change:*** | FRCs defined in annex A.12 are moved to annex A.9. FRC numbers are allocated accordingly. Annex A.12 is voided.Removal of square brackets. |
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| ***Consequences if not approved:*** | FRCs for performance requirements (256QAM, R=682.5/1024) remain defined in plural annexes. It may lead to unnecessary confusion. |
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| ***Clauses affected:*** | 11.2.2.1.2, A.9, A.12 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **x** |  |  Test specifications | TS 38.141-1, 38.141-2 |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Revision of R4-2408188 |

**--------------Start of change-------------**

##### 11.2.2.1.2 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput stated in the tables 11.2.2.1.2-1 to 11.2.2.1.2-10 at the given SNR for 1Tx and for 2Tx two-layer spatial multiplexing transmission.

Table 11.2.2.1.2-1: Minimum requirements for PUSCH with 70% of maximum throughput, 50 MHz channel bandwidth, 60 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | PT-RS | SNR(dB) |
| 1 | 2 | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-1 | pos0 | No | -2.0 |
|  |  |  |  |  | G-FR2-A3-13 | pos1 | No | -2.2 |
|  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-1 |  pos0 | Yes | 12.0 |
|  |  |  |  |  |  | No | 11.5 |
|  |  |  | G-FR2-A4-11 |  pos1 | Yes | 10.7 |
|  |  |  |  |  | No | 10.7 |
| Normal | TDLA30-75 Low | 70 % | G-FR2-A5-1 |  pos0 | Yes | 13.7 |
|  |  |  |  |  | No | 13.1 |
|  |  |  | G-FR2-A5-6 |  pos1 | Yes | 13.4 |
|  |  |  |  |  | No | 12.9 |
| Normal | TDLD30-35 Low | 70 % | G-FR2-A9-3 | pos0 | Yes | 19.8 |
| No | 19.4 |
| G-FR2-A9-6 | pos1 | Yes | 19.8 |
| No | 19.2 |
| 2 |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-6 |  pos0 | No | 1.5 |
|  |  |  |  |  | G-FR2-A3-18 |  pos1 | No | 1.2 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A7-1 | pos0 | Yes | 15.2 |
|  |  |  |  |  |  |  | No | 14.3 |
|  |  |  |  |  | G-FR2-A7-6 |  pos1 | Yes | 13.8 |
|  |  |  |  |  |  |  | No | 13.0 |

Table 11.2.2.1.2-2: Minimum requirements for PUSCH with 70% of maximum throughput, 100 MHz channel bandwidth, 60 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position  | PT-RS | SNR(dB) |
| 1 | 2 | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-2 | pos0 | No | -2.1 |
|  |  |  |  |  | G-FR2-A3-14 | pos1 | No | -2.4 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-2 | pos0 | Yes | 12.2 |
|  |  |  |  |  |  |  | No | 11.2 |
|  |  |  |  |  | G-FR2-A4-12 | pos1 | Yes | 11.2 |
|  |  |  |  |  |  |  | No | 10.6 |
|  |  | Normal | TDLA30-75 Low | 70 % | G-FR2-A5-2 | pos0 | Yes | 14.2 |
|  |  |  |  |  |  |  | No | 13.3 |
|  |  |  |  |  | G-FR2-A5-7 | pos1 | Yes | 13.7 |
|  |  |  |  |  |  |  | No | 13.1 |
| 2 |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-7 | pos0 | No | 1.5 |
|  |  |  |  |  | G-FR2-A3-19 | pos1 | No | 1.2 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A7-2 | pos0 | Yes | 16.0 |
|  |  |  |  |  |  |  | No | 14.9 |
|  |  |  |  |  | G-FR2-A7-7 | pos1 | Yes | 13.8 |
|  |  |  |  |  |  |  | No | 13.1 |

Table 11.2.2.1.2-3: Minimum requirements for PUSCH with 70% of maximum throughput, 50 MHz channel bandwidth, 120 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position  | PT-RS | SNR(dB) |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-3 |  pos0 | No | -1.8 |
|  |  |  |  |  | G-FR2-A3-15 |  pos1 | No | -2.1 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-3 |  pos0 | Yes | 11.6 |
|  |  |  |  |  |  |  | No | 10.9 |
| 1 |  |  |  |  | G-FR2-A4-13 |  pos1 | Yes | 10.9 |
|  |  |  |  |  |  |  | No | 10.5 |
|  | 2 | Normal | TDLA30-75 Low | 70 % | G-FR2-A5-3 |  pos0 | Yes | 13.7 |
|  |  |  |  |  |  |  | No | 13.1 |
|  |  |  |  |  | G-FR2-A5-8 |  pos1 | Yes | 13.2 |
|  |  |  |  |  |  |  | No | 13.0 |
|  |  |  |  |  | G-FR2-A9-1 | pos0 | Yes | 20.0 |
|  |  | Normal | TDLD30-35 Low | 70 % |  |  | No | 19.3 |
|  |  |  |  |  | G-FR2-A9-4 | pos1 | Yes | 19.7 |
|  |  |  |  |  |  |  | No | 18.9 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-8 |  pos0 | No | 1.4 |
|  |  |  |  |  | G-FR2-A3-20 |  pos1 | No | 1.3 |
| 2 |  | Normal | TDLA30-300 Low | 70 % |  G-FR2-A7-3 |  pos0 | Yes | 14.2 |
|  |  |  |  |  |  |  | No | 13.6 |
|  |  |  |  |  | G-FR2-A7-8 |  pos1 | Yes | 13.9 |
|  |  |  |  |  |  |  | No | 13.1 |

Table 11.2.2.1.2-4: Minimum requirements for PUSCH with 70% of maximum throughput, 100 MHz channel bandwidth, 120 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position  | PT-RS | SNR(dB) |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-4 |  pos0 | No | -2.4 |
|  |  |  |  |  | G-FR2-A3-16 |  pos1 | No | -2.5 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-4 |  pos0 | Yes | 11.9 |
|  |  |  |  |  |  |  | No | 10.5 |
| 1 |  |  |  |  | G-FR2-A4-14 |  pos1 | Yes | 11.1 |
|  |  |  |  |  |  |  | No | 10.5 |
|  | 2 | Normal | TDLA30-75 Low | 70 % | G-FR2-A5-4 |  pos0 | Yes | 13.5 |
|  |  |  |  |  |  |  | No | 12.9 |
|  |  |  |  |  | G-FR2-A5-9 |  pos1 | Yes | 13.4 |
|  |  |  |  |  |  |  | No | 12.8 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-9 |  pos0 | No | 1.4 |
|  |  |  |  |  | G-FR2-A3-21 |  pos1 | No | 1.2 |
| 2 |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A7-4 | pos0 | Yes | 13.9 |
|  |  |  |  |  |  |  | No | 13.2 |
|  |  |  |  |  | G-FR2-A7-9 | pos1 | Yes | 13.5 |
|  |  |  |  |  |  |  | No | 12.9 |

Table 11.2.2.1.2-5: Minimum requirements for PUSCH with 70% of maximum throughput, 200 MHz channel bandwidth, 120 kHz SCS in FR2-1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of demodulation branches | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | PT-RS | SNR(dB) |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-5 |  pos0 | No | -2.1 |
|  |  |  |  |  | G-FR2-A3-17 |  pos1 | No | -2.4 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-5 |  pos0 | Yes | 11.3 |
|  |  |  |  |  |  |  | No | 10.9 |
| 1 |  |  |  |  | G-FR2-A4-15 |  pos1 | Yes | 11.2 |
|  |  |  |  |  |  |  | No | 10.7 |
|  | 2 | Normal | TDLA30-75 Low | 70 % | G-FR2-A5-5 |  pos0 | Yes | 14.1 |
|  |  |  |  |  |  |  | No | 13.4 |
|  |  |  |  |  | G-FR2-A5-10 |  pos1 | Yes | 13.7 |
|  |  |  |  |  |  |  | No | 13.3 |
|  |  |  |  |  | G-FR2-A9-2 | pos0 | Yes | 19.9 |
|  |  | Normal | TDLD30-35 Low | 70 % |  |  | No | 19.5 |
|  |  |  |  |  | G-FR2-A9-5 | pos1 | Yes | 19.8 |
|  |  |  |  |  |  |  | No | 19.3 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-10 |  pos0 | No | 1.4 |
|  |  |  |  |  | G-FR2-A3-22 |  pos1 | No | 1.1 |
| 2 |  | Normal | TDLA30-300 Low | 70 % |  G-FR2-A7-5 |  pos0 | Yes | 14.0 |
|  |  |  |  |  |  |  | No | 13.3 |
|  |  |  |  |  |  G-FR2-A7-10 |  pos1 | Yes | 13.6 |
|  |  |  |  |  |  |  | No | 13.0 |

**--------------Next change-------------**

# A.9 Fixed Reference Channels for performance requirements (256QAM, R=682.5/1024)

Note: Different FRC numbers are assigned in TS 38.141-1 [5] for the FRCs in this annex.

The parameters for the reference measurement channels are specified in table A.9-1 for FR1 PUSCH performance requirements:

- FRC parameters are specified in table A.9-1 for FR1 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

The parameters for the reference measurement channels are specified in table A.9-2 and A.9-3 for FR2-1 PUSCH performance requirements:

- FRC parameters are specified in table A.9-2 for FR2-1 PUSCH with transform precoding disabled, *Additional DM-RS position = pos0* and 1 transmission laye.

- FRC parameters are specified in table A.9-3 for FR2-1 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

Table A.9-1: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, Additional DM-RS position = pos1 and 1 transmission layer (256QAM, R=682.5/1024)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A9-1 | G-FR1-A9-2 | G-FR1-A9-3 | G-FR1-A9-4 | G-FR1-A9-5 |
| Subcarrier spacing [kHz] | 15 | 15 | 30 | 30 | 30 |
| Allocated resource blocks | 25 | 52 | 24 | 106 | 273 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 |
| Modulation | 256QAM | 256QAM | 256QAM | 256QAM | 256QAM |
| Code rate (Note 2) | 682/1024 | 682/1024 | 682/1024 | 682/1024 | 682/1024 |
| Payload size (bits) | 18960 | 39936 | 18432 | 81976 | 208976 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 | 24 | 24 | 24 |
| Number of code blocks - C | 3 | 5 | 3 | 10 | 25 |
| Code block size including CRC (bits) (Note 2) | 6352 | 8016 | 6176 | 8224 | 8384 |
| Total number of bits per slot | 28800 | 59904 | 27648 | 122112 | 314496 |
| Total symbols per slot | 3600 | 7488 | 3456 | 15264 | 39312 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos1*, *l0*= 2 and *l* =11 for PUSCH mapping type A, *l0*= 0 and *l* =10 for PUSCH mapping type B as per table 6.4.1.1.3-3 of TS 38.211 [5].NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [15]. |

Table A.9-2: FRC parameters for FR2-1 PUSCH performance requirements, transform precoding disabled, Additional DM-RS position = pos0 and 1 transmission layer (256QAM, R=682.5/1024)

|  |  |  |  |
| --- | --- | --- | --- |
| Reference channel | G-FR2-A9-1 | G-FR2-A9-2 | G-FR2-A9-3 |
| Subcarrier spacing [kHz] | 120 | 120 | 60 |
| Allocated resource blocks | 32 | 132 | 66 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 9 | 9 | 9 |
| Modulation | 256QAM | 256QAM | 256QAM |
| Code rate (Note 2) | 682.5/1024 | 682.5/1024 | 682.5/1024 |
| Payload size (bits) | 18432 | 75792 | 37896 |
| Transport block CRC (bits) | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 | 24 |
| Number of code blocks - C | 3 | 9 | 5 |
| Code block size including CRC (bits) (Note 2) | 6176 | 8448 | 7608 |
| Total number of bits per slot without PT-RS | 27648 | 114048 | 57024 |
| Total number of bits per slot with PT-RS (Note 3) | 26496 | 109296 | 54648 |
| Total resource elements per slot without PT-RS | 3456 | 14256 | 7128 |
| Total resource elements per slot with PT-RS (Note 3) | 3312 | 13662 | 6831 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos0* with *l0*= 0 as per Table 6.4.1.1.3-3 of TS 38.211 [9].NOTE 2: Code block size including CRC (bits) equals to *K'* in sub-clause 5.2.2 of TS 38.212 [15].NOTE 3: PT-RS configuration *KPT-RS =2, LPT-RS =1*. |

Table A.9-3: FRC parameters for FR2-1 PUSCH performance requirements, transform precoding disabled, Additional DM-RS position = pos1 and 1 transmission layer (256QAM, R=682.5/1024)

|  |  |  |  |
| --- | --- | --- | --- |
| Reference channel | G-FR2-A9-4 | G-FR2-A9-5 | G-FR2-A9-6 |
| Subcarrier spacing [kHz] | 120 | 120 | 60 |
| Allocated resource blocks | 32 | 132 | 66 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 8 | 8 | 8 |
| Modulation | 256QAM | 256QAM | 256QAM |
| Code rate (Note 2) | 682.5/1024 | 682.5/1024 | 682.5/1024 |
| Payload size (bits) | 16392 | 67584 | 33816 |
| Transport block CRC (bits) | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 | 24 |
| Number of code blocks - C | 2 | 9 | 5 |
| Code block size including CRC (bits) (Note 2) | 8232 | 7536 | 6792 |
| Total number of bits per slot without PT-RS | 24576 | 101376 | 50688 |
| Total number of bits per slot with PT-RS (Note 3) | 23552 | 97152 | 48576 |
| Total resource elements per slot without PT-RS | 3072 | 12672 | 6336 |
| Total resource elements per slot with PT-RS (Note 3) | 2944 | 12144 | 6072 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos1* with *l0*= 0 and *l* =8 as per Table 6.4.1.1.3-3 of TS 38.211 [9].NOTE 2: Code block size including CRC (bits) equals to *K'* in sub-clause 5.2.2 of TS 38.212 [15].NOTE 3: PT-RS configuration *KPT-RS =2, LPT-RS =1*. |

**--------------Next change-------------**

# A.12 Void

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**--------------End of change-------------**