**3GPP TSG- Meeting #**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  |
| *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:***  | Big CR on FR1 256QAM requirements TS 38.104 |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | R4-2205816 Draft CR on FR1 256QAM requirementsDefinition of FR1 BS PUSCH demodulation requirements for scenarios with 256QAM modulation.R4-2201802 draftCR on FR1 PUSCH 256QAM FRC for TS 38.104New section and Table for FRC of 256QAM according to the agreed WF R4-2120717: - 5/10MHz / 15kHz SCS-10/40/100MHz/30kHz SCS |
|  |  |
| ***Summary of change:*** | R4-2205816 Draft CR on FR1 256QAM requirementsAdded tests for FR1 PUSCH demodulation requirements for scenarios with 256QAM modulationR4-2201802 draftCR on FR1 PUSCH 256QAM FRC for TS 38.104Add new section A.9 for Fixed Reference Channels for performance requirements (256QAM, R=682.5/1024) |
|  |  |
| ***Consequences if not approved:*** | R4-2205816 Draft CR on FR1 256QAM requirementsFR1 256QAM PUSCH demodulation requirements are missingR4-2201802 draftCR on FR1 PUSCH 256QAM FRC for TS 38.104No demodulation performance requirements for PUSCH 256QAM |
|  |  |
| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  |  |
| ***affected:*** | **x** |  |  Test specifications | TS 38.141-1, 38.141-2 |
| ***(show related CRs)*** |  | **x** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

***<Start of change1 [R4-2205816]>***

#### 8.2.1.2 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs stated in tables 8.2.1.2-1 to 8.2.1.2-18 at the given SNR for 1Tx or for 2Tx two-layer spatial multiplexing transmission. FRCs are defined in annex A.

Table 8.2.1.2-1: Minimum requirements for PUSCH with 70% of maximum throughput, Type A, 5 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -2.3 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 10.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 12.3 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-1 | pos1 | 19.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -5.8 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 6.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 8.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-1 | pos1 | 15.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -8.7 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 3.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 5.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-1 | pos1 | 12.4 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | 1.0 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 18.2 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | -2.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 11.0 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | -5.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 6.8 |

Table 8.2.1.2-2: Minimum requirements for PUSCH with 70% of maximum throughput, Type A, 10 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -2.5 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 10.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 12.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-2 | pos1 | 19.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -6.0 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 6.3 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 8.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-2 | pos1 | 15.9 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -8.7 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 3.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 5.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-2 | pos1 | 12.6 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | 1.7 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 18.3 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | -2.0 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 11.2 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | -5.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 6.8 |

Table 8.2.1.2-3: Minimum requirements for PUSCH with 70% of maximum throughput, Type A, 20 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -2.1 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 10.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 12.4 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -5.5 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 6.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 8.6 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -8.5 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 3.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 5.5 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | 2.1 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 18.3 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | -1.8 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 11.1 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | -5.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 6.9 |

Table 8.2.1.2-4: Minimum requirements for PUSCH with 70% of maximum throughput, Type A, 10 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -2.3 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 10.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 12.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-3 | pos1 | 19.3 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -5.6 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 6.4 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 8.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-3 | pos1 | 15.6 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -8.6 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 3.3 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 5.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-3 | pos1 | 12.6 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | 1.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 18.4 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | -2.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 11.2 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | -5.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 7.0 |

Table 8.2.1.2-5: Minimum requirements for PUSCH with 70% of maximum throughput, Type A, 20 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -2.9 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 10.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 12.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -6.0 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 6.4 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 8.6 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -8.8 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 3.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 5.5 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | 1.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 18.1 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | -2.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 11.3 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | -5.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 6.9 |

Table 8.2.1.2-6: Minimum requirements for PUSCH with 70% of maximum throughput, Type A, 40 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -2.5 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 10.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 12.4 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-4 | pos1 | 19.9 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -5.8 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 6.3 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 8.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-4 | pos1 | 16.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -8.7 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 3.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 5.4 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-4 | pos1 | 12.6 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | 1.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 19.5 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | -2.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 11.3 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | -5.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 6.9 |

Table 8.2.1.2-7: Minimum requirements for PUSCH with 70% of maximum throughput, Type A, 100 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -2.8 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 10.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 13.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-5 | pos1 | 21.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -5.8 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 6.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 9.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-5 | pos1 | 16.7 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -8.7 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 3.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 5.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-5 | pos1 | 13.1 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | 1.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 19.2 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | -2.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 11.6 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | -5.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 7.1 |

Table 8.2.1.2-8: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 5 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -2.3 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 10.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 12.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-1 | pos1 | 19.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -5.7 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 6.3 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 8.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-1 | pos1 | 15.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -8.7 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 3.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 5.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-1 | pos1 | 12.3 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | 1.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 18.3 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | -2.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 11.1 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | -5.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 6.8 |

Table 8.2.1.2-9: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 10 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -2.3 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 10.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 12.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-2 | pos1 | 19.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -5.7 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 6.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 8.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-2 | pos1 | 15.9 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -9.0 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 3.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 5.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-2 | pos1 | 12.5 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | 2.0 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 18.7 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | -2.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 11.3 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | -5.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 7.0 |

Table 8.2.1.2-10: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 20 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -2.1 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 10.4 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 12.3 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -5.7 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 6.3 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 8.8 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -8.5 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 3.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 5.7 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | 1.6 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 18.1 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | -2.0 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 11.2 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | -5.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 6.9 |

Table 8.2.1.2-11: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 10 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -2.4 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 10.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 12.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-3 | pos1 | 19.2 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -5.7 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 6.4 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 8.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-3 | pos1 | 15.7 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -8.8 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 3.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 5.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-3 | pos1 | 12.4 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | 1.1 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 18.5 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | -2.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 11.3 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | -5.6 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 7.0 |

Table 8.2.1.2-12: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 20 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -2.9 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 10.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 12.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -6.0 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 6.3 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 8.6 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -9.0 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 3.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 5.6 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | 1.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 18.2 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | -2.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 11.2 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | -5.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 7.0 |

Table 8.2.1.2-13: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 40 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -2.5 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 10.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 12.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-4 | pos1 | 19.9 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -5.8 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 6.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 8.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-4 | pos1 | 16.0 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -8.8 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 3.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 5.5 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-4 | pos1 | 12.7 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | 1.7 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 18.7 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | -2.1 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 11.2 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | -5.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 6.9 |

Table 8.2.1.2-14: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 100 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC(Annex A) | Additional DM-RS position | SNR(dB) |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -2.5 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 10.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 13.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-5 | pos1 | 21.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -5.8 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 6.3 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 9.2 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-5 | pos1 | 16.9 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -8.7 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 3.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 5.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A9-5 | pos1 | 13.2 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | 1.6 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 19.3 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | -2.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 11.6 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | -5.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 7.1 |

***<End of change1>***

***<Start of chang2 [R4-2201802]>***

# A.9-1 Fixed Reference Channels for performance requirements (256QAM, R=682.5/1024)

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.

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]. |

***<End of change 2>***