**3GPP TSG-RAN WG4 Meeting #102-e *R4-2205824***

**Electronic Meeting, Feb 21st – Mar 3rd, 2022**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.141-1** | **CR** | **0259** | **rev** | **-** | **Current version:** | **17.4.0** |  |
|  | | | | | | | | |
| *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:*** | CR: big CR for FR1 PUSCH 256QAM conformance testing in TS 38.141-1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | MCC, Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_demod\_enh2-Perf | | | | |  | ***Date:*** | | | 2022-2-14 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This big CR merges the following multiple endorsed draft CRs. The reason for change in each endorsed draft CR is copied below:   * R4-2200132   Manufacture declaration for FR1 PUSCH 256QAM performance should be introduced in TS 38.141-1 based on the latest agreements in WF R4-2120717.   * R4-2205810   WID RP-212636 for Further enhancement on NR demodulation performance was approved. The conducted conformance testing for FR1 PUSCH 256QAM was agreed to be added into TS 38.141-1.   * R4-2203550   FR1 PUSCH with 256QAM requirements has been introduced in Rel-17 Further enhancement on NR performance requirement WI. There is no related 256QAM FRC table definition. This draft CR is the resubmitted tdoc R4-2200753, which was endrosed in RAN4#101-bis-e meeting. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The summary of change in each each endorsed draft CR is copied below:   * R4-2200132: Add manufacturer declaration for FR1 PUSCH 256QAM performance in Table 4.6-1. * R4-2205810:   Added the related conformance testing for FR1 PUSCH 256QAM as per the agreed simulation assumptions included in the approved WF R4-2115748 & R4-2120717 and the simulation results submitted from interested companies.   * R4-2203550:   Add one section for 256QAM FRC table as A.8 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The consequences if not approved for each endorsed draft CR are coppied below:   * R4-2200132   Manufacture declaration of FR1 PUSCH 256QAM support would be missing.   * R4-2205810   The conformance testing for FR1 PUSCH 256QAM will still be missing and the WI will be incomplete.   * R4-2203550 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.6, 8.2.1, A.8(New) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.141-2 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

/\*\*\*\*\*\*\*\*\*\* Start of the Changes from R4-2200132 \*\*\*\*\*\*\*\*\*\*/

## 4.6 Manufacturer declarations

The following BS declarations listed in table 4.6-1, when applicable to the BS under test, are required to be provided by the manufacturer for the conducted requirements testing of the *BS type 1-C* and *BS type 1-H*.

For the *BS type 1-H* declarations required for the radiated requirements testing, refer to TS 38.141-2 [3].

Table 4.6-1 Manufacturer declarations for *BS type 1-C* and *BS type 1-H* conducted test requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Declaration identifier | Declaration | Description | Applicability | |
|  |  |  | *BS type 1-C* | *BS type 1-H* |
| D.1 | BS requirements set | Declaration of one of the NR base station *requirement's set* as defined for *BS type 1-C*, or *BS type 1-H*. | x | x |
| D.2 | BS class | BS class of the BS, declared as Wide Area BS, Medium Range BS, or Local Area BS. | x | x |
| D.3 | *Operating bands* and frequency ranges | List of NR *operating band(s)* supported by *single-band connector(s)* and/or *multi-band connector(s)* of the BS and if applicable, frequency range(s) within the *operating band(s)* that the BS can operate in.  Declarations shall be made per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.4 | Spurious emission category | Declare the BS spurious emission category as either category A or B with respect to the limits for spurious emissions, as defined in Recommendation ITU-R SM.329 [5]. | x | x |
| D.5 | Additional operating band unwanted emissions | The manufacturer shall declare whether the BS under test is intended to operate in geographic areas where the additional operating band unwanted emission limits defined in clause 6.6.4.5.6 apply. (Note 3, Note 6). | x | x |
| D.6 | Co-existence with other systems | The manufacturer shall declare whether the BS under test is intended to operate in geographic areas where one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD, E-UTRA, PHS and/or NR operating in another band are deployed. | x | x |
| D.7 | Co-location with other base stations | The manufacturer shall declare whether the BS under test is intended to operate co-located with Base Stations of one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD, E-UTRA and/or NR operating in another band. | x | x |
| D.8 | *Single band connector* or *multi-band connector* | Declaration of the single band or multi-band capability of *single band connector(s)* or *multi-band connector(s),* declared for every connector. | x | x |
| D.9 | Contiguous or non-contiguous spectrum operation support | Ability to support contiguous or non-contiguous (or both) frequency distribution of carriers when operating multi-carrier. Declared per *single band connector* or *multi-band connector*, per *operating band*. | x | x |
| D.10 | void | void | x | x |
| D.11 | Maximum *Base Station RF Bandwidth* | Maximum *Base Station RF Bandwidth* in the *operating band* for single-band operation. Declared per supported *operating band,* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* (Note 2) | x | x |
| D.12 | Maximum *Base Station RF Bandwidth* for multi-band operation | Maximum *Base Station RF Bandwidth* for multi-band operation. Declared per supported *operating band,* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.13 | Total RF bandwidth (BWtot) | Total RF bandwidth BWtot of transmitter and receiver, declared per the band combinations (D.27). | x | x |
| D.14 | NR supported channel bandwidths and SCS | NR supported SCS and channel bandwidths per supported SCS. Declared per supported *operating band,* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.15 | CA only operation | Declaration of CA-only operation (with equal power spectral density among carriers) but not multiple carriers, declared per *operating band* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.16 | Single or multiple carrier | Capable of operating with a single carrier (only) or multiple carriers. Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.17 | Maximum number of supported carriers per operating band in single band operation | Maximum number of supported carriers per supported *operation band* in single band operation*.* Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* (Note 2) | x | x |
| D.18 | Maximum number of supported carriers per operating band in multi-band operation | Maximum number of supported carriers per supported *operation band* in multi-band operation. (Note 2) | x | x |
| D.19 | Total maximum number of supported carriers in multi-band operation | Maximum number of supported carriers for all supported *operating bands* in multi-band operation*.* Declared for all connectors (D.18)*.* | x | x |
| D.20 | Other band combination multi-band restrictions | Declare any other limitations under simultaneous operation in the declared band combinations (D.35) for each *multi-band connector* which have any impact on the test configuration generation.  Declared for every *multi-band connector*. | x | x |
| D.21 | Rated carrier output power(Prated,c,AC, or Prated,c,TABC) | Conducted rated carrier output power, per *single band connector* or *multi-band connector.*  Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. (Note 1, 2) | x | x |
| D.22 | R*ated total output power* (Prated,t,AC, or Prated,t,TABC) | Conducted total rated output power*.*  Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.*  For *multi-band connectors* declared for each supported *operating band* in each supported band combination. (Note 1, 2) | x | x |
| D.23 | Rated multi-band total output power, Prated,MB,TABC | Conducted multi-band rated total output power*.*  Declared per supported operating band combinations, per *multi-band connector*. (Note 1) | x | x |
| D.24 | Ncells | Number corresponding to the minimum number of cells that can be transmitted by a BS in a particular *operating band* with transmission on all *TAB connectors* supporting the *operating band*. |  | x |
| D.25 | Maximum supported power difference between carriers | Maximum supported power difference between carriers. Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.26 | Maximum supported power difference between carriers is different *operating bands* | Supported power difference between any two carriers in any two different supported *operating bands.* Declared per supported operating band combination, per *multi-band connector.* | x | x |
| D.27 | Operating band combination support | List of operating bands combinations supported by *single-band connector(s)* and/or *multi-band connector(s)* of the BS. Declared per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.28 | void | void | x | x |
| D.29 | Intra-system interfering signal declaration list | List of *single band connector(s)* or *multi-band connector(s)* for which an intra-system interfering signal level is required to be declared. Declaration is required if the intra-system interfering signal level is larger than the co-location interfering signal level. |  | x |
| D.30 | Intra-system interfering signal level | The interfering signal level in dBm. Declared per supported *operating band*, per *TAB connector* for *BS type 1-H* covered by D.29. |  | x |
| D.31 | TAE groups | Set of declared *TAB connector beam forming groups* on which the TAE requirements apply.  *All TAB connectors* belong to at least one *TAB connector beam forming group* (even if it's a *TAB connector beam forming group* consisting of one connector).  The smallest possible number of *TAB connector beam forming groups* need to be declared such that there is no *TAB connector* not contained in at least one of the declared *TAB connector beam forming groups*.  Declared per supported *operating band*. |  | x |
| D.32 | Equivalent connectors | List of *antenna connectors* of *BS type 1-C*, or *TAB connector* of *BS type 1-H*, which have been declared equivalent.  Equivalent connectors imply that the *antenna connector* of *BS type 1-C*, or *TAB connector* of *BS type 1-H*, are expected to behave in the same way when presented with identical signals under the same operating conditions. All declarations made for the *antenna connector* of *BS type 1-C*, or *TAB connector* of *BS type 1-H* are identical and the transmitter unit and/or receiver unit driving the *antenna connector* of *BS type 1-C* or *TAB connector* of *BS type 1-H* are of identical design. | x | x |
| D.33 | *TAB connector RX min cell group* | Declared as a group of *TAB connectors* to which RX requirements are applied. This declaration corresponds to group of *TAB connectors* which are responsible for receiving a cell when the *BS type 1-H* setting corresponding to the declared minimum number of cells (Ncells) with transmission on all *TAB connectors* supporting an *operating band*. |  | x |
| D.34 | *TAB connector TX min cell group* | Declared group of *TAB connectors* to which TX requirements are applied. This declaration corresponds to group of *TAB connectors* which are responsible for transmitting a cell when the *BS type 1-H* setting corresponding to the declared minimum number of cells (Ncells) with transmission on all *TAB connectors* supporting an *operating band*. |  | x |
| D.35 | Connecting network loss range for BS testing with ancillary RF amplifiers | Declaration of the range of connecting network losses (in dB) for *BS type 1-C* testing with ancillary Tx RF amplifier only, or with Rx RF amplifier only, or with combined Tx/Rx RF amplifiers. (Note 4) | x |  |
| D.36 | Relation between supported maximum RF bandwidth, number of carriers and Rated total output power | If the rated total output power and total number of supported carriers are not simultaneously supported, the manufacturer shall declare the following additional parameters:  - The reduced number of supported carriers at the rated total output power;  - The reduced total output power at the maximum number of supported carriers. | x | x |
| D.37 | *TAB connectors* used for performance requirement testing | To reduce test complexity, declaration of a representative (sub)set of *TAB connectors* to be used for performance requirement test purposes. At least one *TAB connector* mapped to each *demodulation branch* is declared. |  | x |
| D.38 | Inter-band CA | Band combinations declared to support inter-band CA (per CA capable *multi-band connector(s)*, as in D.15).  Declared for every *multi-band connector* which support CA. | x | x |
| D.39 | Intra-band contiguous CA | Bands declared to support intra-band contiguous CA (per CA capable *single band connector(s)* or *multi-band connector(s)*, as in D.15).  Declared per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.40 | Intra-band non-contiguous CA | Bands declared to support intra-band non-contiguous CA (per CA capable *single band connector(s)* or *multi-band connector(s)*, as in D.15).  Declared per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.41 | NB-IoT operation | Manufacturer shall declare the support of NB-IoT operation in NR in-band and the number of supported NB-IoT carriers in total and for each supported band, frequency range and channel bandwidth. | x |  |
| D.42 | NB-IoT sub-carrier spacing | If the BS supports NB-IoT operation in NR in-band, manufacturer shall declare if it supports 15 kHz sub-carrier spacing, 3.75 kHz sub-carrier spacing, or both for NPUSCH. | x |  |
| D.43 | NB-IoT power dynamic range | If the BS supports NB-IoT operation in NR in-band, manufacturer shall declare the maximum power dynamic range it could support with a minimum of +6dB or +3dB as specified in clause 6.3.4 of TS 38.104 [2] (Note 5). | x |  |
| D.100 | PUSCH mapping type | Declaration of the supported PUSCH mapping type as specified in TS 38.211 [17], i.e., type A, type B or both. | x | x |
| D.101 | PUSCH additional DM-RS positions | Declaration of the supported additional DM-RS position(s), i.e., pos0, pos1 or both. |  |  |
| D.102 | PUCCH format | Declaration of the supported PUCCH format(s) as specified in TS 38.211 [17], i.e., format 0, format 1, format 2, format 3, format 4. | x | x |
| D.103 | PRACH format and SCS | Declaration of the supported PRACH format(s) as specified in TS 38.211 [17], i.e., format: 0, A1, A2, A3, B4, C0, C2.  Declaration of the supported SCS(s) per supported PRACH format with short sequence, as specified in TS 38.211 [17], i.e., 15 kHz, 30 kHz or both. | x | x |
| D.104 | Additional DM-RS for PUCCH format 3 | Declaration of the supported additional DM-RS for PUCCH format 3: without additional DM-RS, with additional DM-RS or both. | x | x |
| D.105 | Additional DM-RS for PUCCH format 4 | Declaration of the supported additional DM-RS for PUCCH format 4: without additional DM-RS, with additional DM-RS or both. | x | x |
| D.106 | PUCCH multi-slot | Declaration of multi-slot PUCCH support. | x | x |
| D.107 | UL CA | For the highest supported SCS, declaration of the carrier combination with the largest aggregated bandwidth. If there is more than one combination, the carrier combination with the largest number of carriers shall be declared. | x | x |
| D.108 | High speed train | Declaration of high speed train scenario support, i.e. HST support or no HST support | x | x |
| D.109 | Maximum speed of high speed train for PUSCH | Declaration of supported maximum speed for high speed train scenario, i.e. 350 km/h or 500 km/h.  This declaration is applicable to PUSCH for high speed train and UL timing adjustment only if BS declares to support high speed train in D.108. | x | X |
| D.110 | PRACH format for high speed train | Declaration of supported PRACH format(s) for high speed train scenario, i.e. format 0 restricted set type A, format 0 restricted set type B, format A2, format B4, format C2.  This declaration is applicable to PRACH for high speed train only if BS declares to support high speed train in D.108. | x | x |
| D.111 | Interlaced formats | Declaration of support of interlaced PUSCH and PUCCH formats. | x | x |
| D.112 | PRACH format with LRA = 1151 for 15 kHz SCS and LRA = 571 for 30 kHz SCS | Declaration of the supported PRACH format(s) as specified in TS 38.211 [17], i.e., format: A2, B4, C2.    Declaration of the supported SCS(s) per supported PRACH format as specified in TS 38.211 [17], i.e., 15 kHz, 30 kHz or both. | x | x |
| D.113 | CG-UCI | Declaration of support of GC-UCI multiplexed on PUSCH as specified in TS 38.211 [17]. | x | x |
| D.114 | 2-step RA | Declaration of support of 2-step RA type. | x | x |
| D.115 | PUSCH 256QAM | Declaration of PUSCH 256QAM support | x | x |
| NOTE 1: If a BS is capable of 256QAM DL operation then two rated output power declarations may be made. One declaration is applicable when configured for 256QAM transmissions and the other declaration is applicable when not configured for 256QAM transmissions.  NOTE 2: Parameters for contiguous or non-contiguous spectrum operation in the operating band are assumed to be the same unless they are separately declared. When separately declared, they shall still use the same declaration identifier.  NOTE 3: If BS is declared to support Band n20 (D.3), the manufacturer shall declare if the BS may operate in geographical areas allocated to broadcasting (DTT). Additionally, related declarations of the emission levels and maximum output power shall be declared.  NOTE 4: This manufacturer declaration is optional.  NOTE 5: This manufacturer may declare two values, one with a minimum of +6dB and the other with a minimum of +3dB.  NOTE 6: If BS is declared to support Band n24 (D.3), the manufacturer shall declare if the BS may operate in geographical areas where FCC regulations apply. Additionally, related declarations of the emission levels and maximum output power shall be declared. | | | | |

/\*\*\*\*\*\*\*\*\*\* End of the Changes from R4-2200132 \*\*\*\*\*\*\*\*\*\*/

/\*\*\*\*\*\*\*\*\*\* Start of the Changes from R4-2205810 \*\*\*\*\*\*\*\*\*\*/

## 8.2 Performance requirements for PUSCH

### 8.2.1 Performance requirements for PUSCH with transform precoding disabled

#### 8.2.1.1 Definition and applicability

The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ re-transmissions.

Which specific test(s) are applicable to BS is based on the test applicability rules defined in clause 8.1.2.1.

#### 8.2.1.2 Minimum Requirement

The minimum requirement is in TS 38.104 [2] clause 8.2.1.

#### 8.2.1.3 Test Purpose

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

#### 8.2.1.4 Method of test

##### 8.2.1.4.1 Initial Conditions

Test environment: Normal, see annex B.2.

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

RF channels to be tested for carrier aggregation: MBW Channel CA; see clause 4.9.1.

##### 8.2.1.4.2 Procedure

1) Connect the BS tester generating the wanted signal, multipath fading simulators and AWGN generators to all BS antenna connectors for diversity reception via a combining network as shown in annex D.5 and D.6 for *BS type 1-C* and *type 1-H* respectively.

2) Adjust the AWGN generator, according to the channel bandwidth, defined in table 8.2.1.4.2-1.

Table 8.2.1.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
|  | 5 | -86.5 dBm / 4.5MHz |
| 15 kHz | 10 | -83.3 dBm / 9.36MHz |
|  | 20 | -80.2 dBm / 19.08MHz |
|  | 10 | -83.6 dBm / 8.64MHz |
| 30 kHz | 20 | -80.4 dBm / 18.36MHz |
|  | 40 | -77.2 dBm / 38.16MHz |
|  | 100 | -73.1 dBm / 98.28MHz |
| NOTE: 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. | | |

3) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A and the test parameters in table 8.2.1.4.2-2.

Table 8.2.1.4.2-2: Test parameters for testing PUSCH

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| Transform precoding | | Disabled |
| Default TDD UL-DL pattern (Note 1) | | 15 kHz SCS:  3D1S1U, S=10D:2G:2U  30 kHz SCS:  7D1S2U, S=6D:4G:4U |
| HARQ | Maximum number of HARQ transmissions | 4 |
|  | RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
|  | DM-RS duration | single-symbol DM-RS |
|  | Additional DM-RS position | pos1 |
|  | Number of DM-RS CDM group(s) without data | 2 |
|  | Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
|  | DM-RS port(s) | {0}, {0, 1} |
|  | DM-RS sequence generation | NID0=0, nSCID =0 |
| Time domain resource assignment | PUSCH mapping type | A, B |
|  | Start symbol | 0 |
|  | Allocation length | 14 |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth |
|  | Frequency hopping | Disabled |
| TPMI index for 2Tx two layer spatial multiplexing transmission | | 0 |
| Code block group based PUSCH transmission | | Disabled |
| NOTE 1: The same requirements are applicable to FDD and TDD with different UL-DL patterns. | | |

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

5) Adjust the equipment so that required SNR specified in table 8.2.1.5-1 to 8.2.1.5-18 is achieved at the BS input.

6) For each of the reference channels in table 8.2.1.5-1 to 8.2.1.5-18 applicable for the base station, measure the throughput.

#### 8.2.1.5 Test Requirement

The throughput measured according to clause 8.2.1.4.2 shall not be below the limits for the SNR levels specified in table 8.2.1.5-1 to 8.2.1.5-18.

Table 8.2.1.5-1: Test 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 | -1.7 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 10.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 12.9 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-1 | pos1 | 19.7 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -5.2 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 6.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 9.4 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-1 | pos1 | 16.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -8.1 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 3.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 6.2 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-1 | pos1 | 13.0 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | 1.8 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 19.0 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | -1.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 11.8 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | -4.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 7.6 |

Table 8.2.1.5-2: Test 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 | -1.9 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 10.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 12.8 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-2 | pos1 | 20.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -5.4 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 6.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 9.2 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-2 | pos1 | 16.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -8.1 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 3.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 6.1 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-2 | pos1 | 13.2 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | 2.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 19.1 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | -1.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 12.0 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | -4.7 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 7.6 |

Table 8.2.1.5-3: Test 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 | -1.5 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 10.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 13.0 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -4.9 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 6.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 9.2 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -7.9 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 3.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 6.1 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | 2.9 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 19.1 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | -1.0 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 11.9 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | -4.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 7.7 |

Table 8.2.1.5-4: Test 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 | -1.7 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 10.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 13.4 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-3 | pos1 | 19.9 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -5.0 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 7.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 9.2 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-3 | pos1 | 16.2 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -8.0 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 3.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 6.1 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-3 | pos1 | 13.2 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | 2.1 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 19.2 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | -1.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 12.0 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | -4.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 7.8 |

Table 8.2.1.5-5: Test 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 | -2.3 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 10.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 13.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -5.4 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 7.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 9.2 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -8.2 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 3.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 6.1 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | 2.1 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 18.9 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | -1.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 12.1 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | -4.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 7.7 |

Table 8.2.1.5-6: Test 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 | -1.9 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 10.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 13.0 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-4 | pos1 | 20.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -5.2 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 6.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 9.1 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-4 | pos1 | 16.7 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -8.1 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 3.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 6.0 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-4 | pos1 | 13.2 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | 2.1 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 20.3 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | -1.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 12.1 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | -4.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 7.7 |

Table 8.2.1.5-7: Test 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 | -2.2 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 10.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 13.6 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-5 | pos1 | 21.7 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -5.2 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 7.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 9.6 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-5 | pos1 | 17.3 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -8.1 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 3.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 6.4 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-5 | pos1 | 13.7 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | 2.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 20.0 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | -1.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 12.4 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | -4.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 7.9 |

Table 8.2.1.5-8: Test 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 | -1.7 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 10.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 13.1 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-1 | pos1 | 19.7 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -5.1 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 6.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 9.5 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-1 | pos1 | 16.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-8 | pos1 | -8.1 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-8 | pos1 | 3.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-8 | pos1 | 6.3 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-1 | pos1 | 12.9 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | 2.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 19.1 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | -1.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 11.9 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-22 | pos1 | -4.6 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-22 | pos1 | 7.6 |

Table 8.2.1.5-9: Test 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 | -1.7 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 11.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 13.2 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-2 | pos1 | 20.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -5.1 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 7.1 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 9.5 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-2 | pos1 | 16.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-9 | pos1 | -8.4 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-9 | pos1 | 3.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-9 | pos1 | 6.4 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-2 | pos1 | 13.1 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | 2.8 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 19.5 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | -1.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 12.1 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-23 | pos1 | -4.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-23 | pos1 | 7.8 |

Table 8.2.1.5-10: Test 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 | -1.5 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 11.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 12.9 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -5.1 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 6.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 9.4 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-10 | pos1 | -7.9 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-10 | pos1 | 3.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-10 | pos1 | 6.3 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | 2.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 18.9 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | -1.2 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 12.0 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-24 | pos1 | -4.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-24 | pos1 | 7.7 |

Table 8.2.1.5-11: Test 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 | -1.8 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 10.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 13.1 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-3 | pos1 | 19.8 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -5.1 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 7.0 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 9.2 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-3 | pos1 | 16.3 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-11 | pos1 | -8.2 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-11 | pos1 | 3.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-11 | pos1 | 6.2 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-3 | pos1 | 13.0 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | 1.9 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 19.3 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | -1.7 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 12.1 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-25 | pos1 | -4.8 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-25 | pos1 | 7.8 |

Table 8.2.1.5-12: Test 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 | -2.3 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 10.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 13.1 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -5.4 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 6.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 9.2 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-12 | pos1 | -8.4 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-12 | pos1 | 3.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-12 | pos1 | 6.2 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | 2.1 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 19.0 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | -1.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 12.0 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-26 | pos1 | -4.6 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-26 | pos1 | 7.8 |

Table 8.2.1.5-13: Test 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 | -1.9 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 10.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 13.1 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-4 | pos1 | 20.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -5.2 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 6.8 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 9.3 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-4 | pos1 | 16.6 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-13 | pos1 | -8.2 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-13 | pos1 | 3.6 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-13 | pos1 | 6.1 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-4 | pos1 | 13.3 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | 2.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 19.5 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | -1.3 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 12.0 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-27 | pos1 | -4.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-27 | pos1 | 7.7 |

Table 8.2.1.5-14: Test 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 | -1.9 |
|  | 2 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 10.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 13.7 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-5 | pos1 | 21.7 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -5.2 |
| 1 | 4 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 6.9 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 9.8 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-5 | pos1 | 17.5 |
|  |  | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-14 | pos1 | -8.1 |
|  | 8 | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-14 | pos1 | 3.7 |
|  |  | Normal | TDLA30-10 Low | 70 % | G-FR1-A5-14 | pos1 | 6.5 |
|  |  | Normal | TDLA30-10 Low | 70% | G-FR1-A8-5 | pos1 | 13.8 |
|  | 2 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | 2.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 20.1 |
| 2 | 4 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | -1.4 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 12.4 |
|  | 8 | Normal | TDLB100-400 Low | 70 % | G-FR1-A3-28 | pos1 | -4.5 |
|  |  | Normal | TDLC300-100 Low | 70 % | G-FR1-A4-28 | pos1 | 7.9 |

Table 8.2.1.5-15: Test requirements for PUSCH with 30% 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) |
| 1 | 2 | Normal | TDLC300-100 Low | 30 % | G-FR1-A4-8 | pos1 | 3.5 |

Table 8.2.1.5-16: Test requirements for PUSCH with 30% 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) |
| 1 | 2 | Normal | TDLC300-100 Low | 30 % | G-FR1-A4-11 | pos1 | 3.4 |

Table 8.2.1.5-17: Test requirements for PUSCH with 30% 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) |
| 1 | 2 | Normal | TDLC300-100 Low | 30 % | G-FR1-A4-8 | pos1 | 3.4 |

Table 8.2.1.5-18: Test requirements for PUSCH with 30% 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) |
| 1 | 2 | Normal | TDLC300-100 Low | 30 % | G-FR1-A4-11 | pos1 | 3.5 |

/\*\*\*\*\*\*\*\*\*\* End of the Changes from R4-2205810 \*\*\*\*\*\*\*\*\*\*/

/\*\*\*\*\*\*\*\*\*\* Start of the Changes from R4-2203550 \*\*\*\*\*\*\*\*\*\*/

# A.7 Fixed Reference Channels for performance requirements (QPSK, R=157/1024)

# A.8 Fixed Reference Channels for performance requirements (256QAM, R=682.5/1024)

The parameters for the reference measurement channels are specified in table A.8-1 for FR1 PUSCH performance requirements:

- FRC parameters are specified in table A.8-1 for FR1 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

Table A.8-1: 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-A8-1 | G-FR1-A8-2 | G-FR1-A8-3 | G-FR1-A8-4 | G-FR1-A8-5 |
| 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) | 682.5/1024 | 682.5/1024 | 682.5/1024 | 682.5/1024 | 682.5/1024 |
| 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 the Changes from R4-2203550 \*\*\*\*\*\*\*\*\*\*/