**3GPP TSG-RAN WG4 Meeting #100-e *R4-2115858***

**Electronic meeting, August 16-27, 2021**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.141-1** | **CR** | **xxxx** | **rev** | **1** | **Current version:** | **16.8.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Big CR to TS 38.141-1 Maintenance Demod part(Rel-16, CAT F) | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | MCC, Ericsson | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Perf  NR\_HST-Perf  NR\_unlic-Perf | | | | |  | ***Date:*** | | | 2021-08-29 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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 CRs merge the endorsed draf CR. The reason for change in each endorsed draft CR is copied below.  R4-2112835 Draft CR to 38.141-1: BS UL TA test condition AWGN level correction (8.2.5)  There is error in TS38.141-1 Rel-16 document 8.2.5 UL TA test, AWGN level for 30kHz SCS/10MHz CBW case is with error. This must be originated by typo. AWGN level is not aligned with other cases with normalizing defined noise Bandwidth, which should be the same. For example, taking current value -86.3 dBm/8.64MHz then re-calculate for other Noise BW, 4.5M, 9.36M, 38.16M becomes -89.3, -85.9, -80.0 doesn’t match with defined number for other BW. -86.3 dBm/8.64MHz should be -83.6 dBm/8.64MHz. this number aslo matches with other noise BW.  R4-2113253 DraftCR NR-U BS demod conducted performance requirements 38.141-1  Update and correction of BS demod of PRACH radiated performance requirements with LRA=1151 and LRA=571.  R4-2113758 draftCR: UCI overhead for channel bits calculation in PUSCH FRC in TS 38.141-1 (Rel-16)  The UCI overhead are not taken into account for the calculation of “Total number of bits per slot” and “Total symbols per slot” in the PUSCH FRCs for UCI multiplexed on PUSCH requirements, but they are rate matched during the data mapping.  R4-2115688 Correction on PUCCH format2 and format3 performance requirement for TS 38.141-1  PUCCH requirements with interlaced design have been introduced in Rel-16 NR-U WI  R4-2115690 draft CR for 38.141-1 for NR-U PUCCH format 0 and 1 and CG-UCI multiplexing on PUSCH  The brackests of SNR should be removed based on agreements in previous meeting.  R4-2115694 draftCR: Updates to interlaced PUSCH performance requirements in TS 38.141-1 (Rel-16)  Square brackets still exist  As per the agreement about the overhead of CSI part 1 and CSI part 2 for PUSCH FRCs calculation, one Note needs to be added  R4-2112653 Draft CR to 38.141-1: FRC table and parameter update for Table A.4-2A, G-FR1-A4-29A  Correcting FRC parameter table A.4-2A, G-FR1-A4-29A | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The summary of change in each each endorsed draft CR is copied below.  R4-2112835 Draft CR to 38.141-1: BS UL TA test condition AWGN level correction (8.2.5)  In Table 8.2.5.4.2-1, AWGN power level should be -83.6 dBm / 8.64 MHz  R4-2113253 DraftCR NR-U BS demod conducted performance requirements 38.141-1  -Update and removal of square brackets for PRACH performance requirements  -Removal of square brackets for manufacturer declarations  -Fix of typos.  R4-2113758 draftCR: UCI overhead for channel bits calculation in PUSCH FRC in TS 38.141-1 (Rel-16)  Added one note to clarify that “Total number of bits per slot” and “Total symbols per slot” do include the REs taken up by CSI part 1 and CSI part 2 for PUSCH FRCs for UCI multiplexed on PUSCH requirements  R4-2115688 Correction on PUCCH format2 and format3 performance requirement for TS 38.141-1  Update the requirements based on the latest simulation summary R4-2113770  Remove [] for requirement of PUCCH format 2 and format 3  Minor correction on the spelling in section 8.3.9.1/8.3.10.1  Add the note for AWGN level setting  R4-2115690 draft CR for 38.141-1 for NR-U PUCCH format 0 and 1 and CG-UCI multiplexing on PUSCH  Remove SNR brackest and update values for CG-UCI multiplexing on PUSCH.  Remove SNR brackest for interlaced PUCCH format 0 and 1.  Editoral corrections.  R4-2115694 draftCR: Updates to interlaced PUSCH performance requirements in TS 38.141-1 (Rel-16)  Removed the square brackets for interlaced PUSCH performance requirements  Added one note to specify the overhead of CSI part 1 and CSI part 2 is not considered in the REs per slot and bits per slot.  R4-2112653 Draft CR to 38.141-1: FRC table and parameter update for Table A.4-2A, G-FR1-A4-29A  Updating Table A.4-2A, column for G-FR1-A4-29A | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The consequences if not approved for each endorsed draft CR are coppied below.  R4-2112835 Draft CR to 38.141-1: BS UL TA test condition AWGN level correction (8.2.5)  Without this correction, incorrect value remain as test condition for UL TA test  R4-2113253 DraftCR NR-U BS demod conducted performance requirements 38.141-1  Incomplete BS demod requirements for NR-U.  R4-2113758 draftCR: UCI overhead for channel bits calculation in PUSCH FRC in TS 38.141-1 (Rel-16)  Confusions will still exist in the specification.  R4-2115688 Correction on PUCCH format2 and format3 performance requirement for TS 38.141-1  The Rel-16 PUCCH requirement with interlaced design can not be verfied  R4-2115690 draft CR for 38.141-1 for NR-U PUCCH format 0 and 1 and CG-UCI multiplexing on PUSCH  The requirement value will not be finalized.  R4-2115694 draftCR: Updates to interlaced PUSCH performance requirements in TS 38.141-1 (Rel-16)  The interlaced PUSCH performance requirements will still be incomplete.  R4-2112653 Draft CR to 38.141-1: FRC table and parameter update for Table A.4-2A, G-FR1-A4-29A  Code block CRC size, Number of code blocks- C, Code block size parameters are wrong, need to be corrected | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | R4-2112835 Draft CR to 38.141-1: BS UL TA test condition AWGN level correction (8.2.5)  8.2.5  R4-2113253 DraftCR NR-U BS demod conducted performance requirements 38.141-1  4.6.1, 8.1.2, 8.4.1.7  R4-2113758 draftCR: UCI overhead for channel bits calculation in PUSCH FRC in TS 38.141-1 (Rel-16)  A.4  R4-2115688 Correction on PUCCH format2 and format3 performance requirement for TS 38.141-1  8.3.9, 8.3.10  R4-2115690 draft CR for 38.141-1 for NR-U PUCCH format 0 and 1 and CG-UCI multiplexing on PUSCH  8.2.11, 8.3.7, 8.3.8  R4-2115694 draftCR: Updates to interlaced PUSCH performance requirements in TS 38.141-1 (Rel-16)  8.2.10, Table A.5-3  R4-2112653 Draft CR to 38.141-1: FRC table and parameter update for Table A.4-2A, G-FR1-A4-29A  Table A.4-2A | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  |  | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS 38.141-2 ... | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

***<Start of change1 From R4-2113253 >***

## 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). | 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 |
| 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. | | | | |

***<End of change1>***

***<Start of change2 From R4-2113253 >***

#### 8.1.2.5 Applicability of interlaced PUSCH performance requirements

##### 8.1.2.5.1 General applicability of interlaced PUSCH performance requirements

Interlaced PUSCH requirement tests shall apply only for a BS declaring support of interlaced formats (see D.111 in table 4.6-1).

##### 8.1.2.5.2 Applicability of requirements for different subcarrier spacings

Unless otherwise stated, PUSCH requirement tests shall apply only for each subcarrier spacing declared to be supported (see D.14 in table 4.6-1).

Unless otherwise stated, for each subcarrier-spacing declared to be supported for interlaced PUSCH, the tests shall apply only for the supported subcarrier spacing. If both 15kHz and 30kHz SCS are declared to be supported, the tests shall be done for 30kHz SCS (see D.14 in table 4.6-1).

##### 8.1.2.5.3 Applicability of requirements for different channel bandwidths

For each subcarrier spacing declared to be supported, the tests for a specific channel bandwidth shall apply only if the BS supports it (see D.14 in table 4.6-1).

Unless otherwise stated, for each subcarrier spacing declared to be supported, the tests shall be done only for the widest supported channel bandwidth. If performance requirement is not specified for this widest supported channel bandwidth, the tests shall be done by using performance requirement defined for 20 MHz channel bandwidth. For 15kHz subcarrier spacing, the tested RB’s are uniformly spaced over the channel bandwidth at RB index {110, 120, …, 210}. For 30kHz subcarrier spacing, the tested RB’s are uniformly spaced over the channel bandwidth at RB index {55, 60,…, 105}.

##### 8.1.2.5.4 Applicability of requirements for different configurations

Unless otherwise stated, PUSCH requirement tests shall apply only for the mapping type declared to be supported (see D.100 in table 4.6-1). If both mapping type A and type B are declared to be supported, the tests shall be done for either type A or type B; the same chosen mapping type shall then be used for all tests.

##### 8.1.2.5.5 Applicability of CG-UCI multiplexed on PUSCH requirements

Unless otherwise stated, interlaced CG-UCI multiplexed on interlaced PUSCH requirements shall apply only for a BS declaring support of CG-UCI (see D.113 in table 4.6-1).

#### 8.1.2.6 Applicability of interlaced PUCCH performance requirements

##### 8.1.2.6.1 General applicability of interlaced PUCCH performance requirements

Interlaced PUCCH requirement tests shall apply only for a BS declaring support of interlaced formats (see D.111 in table 4.6-1).

##### 8.1.2.6.2 Applicability of requirements for different formats

Unless otherwise stated, interlaced PUCCH requirement tests shall apply only for each interlaced PUCCH format declared to be supported (see D.102 in table 4.6-1).

##### 8.1.2.6.3 Applicability of requirements for different subcarrier spacings

Unless otherwise stated, PUCCH requirement tests shall apply only for each subcarrier spacing declared to be supported (see D.14 in table 4.6-1).

##### 8.1.2.6.4 Applicability of requirements for different channel bandwidths

For each subcarrier spacing declared to be supported by the BS, the tests for a specific channel bandwidth shall apply only if the BS supports it (see D.14 in table 4.6-1).

Unless otherwise stated, for each subcarrier spacing declared to be supported, the tests shall be done only for the widest supported channel bandwidth. If performance requirement is not specified for this widest supported channel bandwidth, the tests shall be done by using performance requirement defined for 20 MHz channel bandwidth. For 15kHz subcarrier spacing, the tested RB’s are uniformly spaced over the channel bandwidth at RB index {110, 120, …, 210} for PUCCH formats 0, 1, and 2, and {110, 120, …, 200} for PUCCH format 3. For 30kHz subcarrier spacing, the tested RB’s are uniformly spaced over the channel bandwidth at RB index {55, 60, …, 105} for PUCCH formats 0, 1, and 2, and {55, 60, …, 100} for PUCCH format 3.

#### 8.1.2.7 Applicability of performance requirements for PRACH with LRA =1151 and LRA =571

##### 8.1.2.7.1 Applicability of requirements for different formats

Unless otherwise stated, PRACH requirement tests shall apply only for each PRACH format declared to be supported (see D.112 in table 4.6-1).

##### 8.1.2.7.2 Applicability of requirements for different subcarrier spacings

Unless otherwise stated, for each PRACH format with LRA =1151 and LRA =571 declared to be supported, the tests shall apply only for the supported subcarrier spacing. If both 15kHz and 30kHz SCS are declared to be supported, the tests shall be done for 30kHz SCS (see D.112 in table 4.6-1).

##### 8.1.2.7.3 Applicability of requirements for different channel bandwidths

Unless otherwise stated, for the subcarrier spacing to be tested, the tests shall apply only for anyone channel bandwidth declared to be supported (see D.14 in table 4.6-1).

***<End of change2>***

***<Start of change3 From R4-2112835 >***

##### 8.2.5.4.2 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 combination of SCS and channel bandwidth defined in table 8.2.5.4.2-1.

Table 8.2.5.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 5 | -86.5 dBm / 4.5MHz |
|  | 10 | -83.3 dBm / 9.36MHz |
| 30 | 10 | -83.6 dBm / 8.64MHz |
|  | 40 | -77.2 dBm / 38.16MHz |
| 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. | | |

***<End of change3>***

***<Start of change4 From R4-2115694 >***

### 8.2.10 Requirements for interlaced PUSCH

#### 8.2.10.1 Definition and applicability

The performance requirement of PUSCH with interlace allocation 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 retransmissions.

Which specific test(s) are applicable to BS is based on the test applicability rules defined in clause 8.1.2.5.

#### 8.2.10.2 Minimum Requirement

The minimum requirement is in TS 38.104 [2] clause 8.2.10.

#### 8.2.10.3 Test Purpose

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

#### 8.2.10.4 Method of test

##### 8.2.10.4.1 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.

##### 8.2.10.4.2 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 8.2.10.4.2-1.

Table 8.2.10.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 20 | -80.2 dBm / 19.08MHz |
| 30 | 20 | -80.4 dBm / 18.36MHz |
| 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 8.2.10.4-2-2

Table 8.2.10.4.2-2: 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 |
|  | DM-RS sequence generation | NID0=0, nSCID =0 |
| Time domain | PUSCH mapping type | A, B |
| resource | Start symbol | 0 |
| assignment | Allocation length | 14 |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth.  Frist interlace with RBs 0,10,20,…,100 are allocated for tests with 15kHz and first interlace with RBs 0,5,10,…50 are allocated for tests with 30kHz. |
|  | Frequency hopping | Disabled |
| 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.

#### 8.2.10.5 Test Requirement

The throughput measured according to clause 8.2.10.4.2 shall not be below the limits for the SNR levels specified in tables 8.2.10.5-1 to 8.2.10.5-4.

Table 8.2.10.5-1: 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) |
| 1 | 2 | Normal | TDLA30-10 Low | 70% | G-FR1-A5-15 | pos1 | 12.9 |

Table 8.2.10.5-2: 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) |
| 1 | 2 | Normal | TDLA30-10 Low | 70% | G-FR1-A5-16 | pos1 | 12.8 |

Table 8.2.10.2-3: 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) |
| 1 | 2 | Normal | TDLA30-10 Low | 70% | G-FR1-A5-15 | pos1 | 12.9 |

Table 8.2.10.2-4: 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) |
| 1 | 2 | Normal | TDLA30-10 Low | 70% | G-FR1-A5-16 | pos1 | 12.8 |

***<End of change4>***

***<Start of change5 From R4-2115690 >***

### 8.2.11 Performance requirements for CG-UCI multiplexed on interlaced PUSCH

#### 8.2.11.1 Definition and applicability

The performance requirement of CG-UCI multiplexed on interlaced PUSCH is determined by the parameter: block error probability (BLER) of CG-UCI. The performance is measured by the required SNR at block error probability of CG-UCI not exceeding 1 %.

The CG-UCI BLER is defined as the probability of incorrectly decoding the CG-UCI information when the CG-UCI information is sent.

In the test of UCI multiplexed on interlaced PUSCH, the UCI information only contains CG-UCI information, there is no HACK/ACK, CSI part 1 or CSI part 2 information transmitted.

The 18 bits CG-UCI information is further defined with the bitmap [c0 c1 c2 … c17] as follows:

- HARQ process number: [c0 c1 c2 c3] = [ 0 0 0 1]

- RV sequence: [c4 c5] = [0 0]

- NDI: [c6] = [1]

- COT sharing information field: [c7 c8 … c17] = [0 0 0 0 0 0 0 0 0 0 0]

In the test, PUSCH data and CG-UCI are transmitted simultaneously.

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

#### 8.2.11.2 Minimum Requirements

The minimum requirements are in TS 38.104 [2] clause 8.2.11.

#### 8.2.11.3 Test purpose

The test shall verify the receiver's ability to detect CG-UCI multiplexed on interlaced PUSCH under multipath fading propagation conditions for a given SNR.

#### 8.2.11.4 Method of test

##### 8.2.11.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

##### 8.2.11.4.2 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 combination of SCS and channel bandwidth defined in table 8.2.11.4.2-1.

Table 8.2.11.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 20 | -80.2 dBm / 19.08MHz |
| 30 | 20 | -80.4 dBm / 18.36 MHz |

3) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A and the specific test parameters are configured as below. The CG-UCI information bit payload per slot is equal to 18 bits.

Table: 8.2.11.4.2-2: Test parameters for testing CG-UCI multiplexed on interlaced PUSCH

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| Transform precoding | | Disabled |
| Default TDD UL-DL pattern | | 15 kHz SCS:  3D1S1U, S=10D:2G:2U  30 kHz SCS:  7D1S2U, S=6D:4G:4U |
| HARQ | Maximum number of HARQ transmissions | 1 |
| RV sequence | 0 |
| 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} |
| 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. First interlace with RBs 0, 10, 20, …, 100 are allocated for tests with 15kHz SCS and first interlace with RBs 0, 5, 10, …, 50 are allocated for tests with 30kHz SCS. |
| Frequency hopping | Disabled |
| Code block group based PUSCH transmission | | Disabled |
| CG-UC | *Number of CG-UCI information bits* | 18 |
| Scaling | 1 |
| *betaOffsetCG-UCI-Index1* | 8 |
| UCI pattern for frequency hopping | Disabled |

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 8.2.11.5-1 to 8.2.11.5-4 is achieved at the BS input during the CG-UCI multiplexed on interlaced PUSCH transmissions.

6) The signal generators send a test pattern where CG-UCI can be multiplexed on interlaced PUSCH. The following statistics are kept: the number of incorrectly decoded CG-UCI information during UCI multiplexed on PUSCH transmission.

#### 8.2.11.5 Test Requirement

The fractional of incorrectly decoded CG-UCI according to clause 8.2.11.4.2 shall be less than 1 % for SNR listed in table 8.2.11.5-1 to table 8.2.11.5-4.

Table 8.2.11.5-1: Test requirements for CG-UCI multiplexed on interlace PUSCH, 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) | CG-UCI bits | Additional DM-RS position | FRC  (Annex A) | SNR (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 18 | pos1 | G-FR1-A5-15 | 5.2 |

Table 8.2.11.5-2: Test requirements for CG-UCI multiplexed on interlaced PUSCH, 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) | CG-UCI bits | Additional DM-RS position | FRC  (Annex A) | SNR (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 18 | pos1 | G-FR1-A5-16 | 5.3 |

Table 8.2.11.5-3: Test requirements for CG-UCI multiplexed on interlaced PUSCH, 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) | CG-UCI bits | Additional DM-RS position | FRC  (Annex A) | SNR (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 18 | pos1 | G-FR1-A5-15 | 5.2 |

Table 8.2.11.5-4: Test requirements for CG-UCI multiplexed on interlaced PUSCH, 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) | CG-UCI bits | Additional DM-RS position | FRC  (Annex A) | SNR (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 18 | pos1 | G-FR1-A5-16 | 5.6 |

***<End of change5>***

***<Start of change6 From R4-2115690 >***

### 8.3.7 Performance requirements for interlaced PUCCH format 0

#### 8.3.7.1 Definition and applicability

The performance requirement of single user interlaced PUCCH format 0 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.

The ACK missed detection requirement only applies to the PUCCH format 0 with 1 UCI bits. The UCI information only contains ACK information

The 1bit UCI information is further defined with bitmap as [1].

Which specific test(s) are applicable to BS is based on the test applicability rules defined in clause 8.1.2.6.

#### 8.3.7.2 Minimum Requirement

The minimum requirements are in TS 38.104 [2] clause 8.3.8.

#### 8.3.7.3 Test purpose

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

#### 8.3.7.4 Method of test

##### 8.3.7.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

##### 8.3.7.4.2 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 and sub-carrier spacing defined in table 8.3.7.4.2-1.

Table 8.3.7.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Subcarrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 20 | -77.2 dBm / 19.08 MHz |
| 30 | 20 | -77.4 dBm / 18.36 MHz |

3) The characteristics of the wanted signal shall be configured according to TS 38.211 [17] and the specific test parameters are configured as mentioned in table 8.3.7.4.2-2:

Table 8.3.7.4.2-2: Test Parameters

|  |  |
| --- | --- |
| Parameter | Test |
| Number of UCI information bits | 1 |
| Number of symbols | 1 |
| Intra-slot frequency hopping | N/A |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Initial cyclic shift | 0 |
| First symbol | 13 |
| Number of interlaces | 1 |
| Interlace index | 0Note1 |
| NOTE 1: RBs 0, 10, 20, …, 100 are allocated for 15kHz SCS and RBs 0, 5, 10, …, 50 are allocated for 30kHz SCS. | |

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

5) Adjust the equipment so that the SNR specified in table 8.3.7.5-1 or table 8.3.7.5-2 is achieved at the BS input during the ACK transmissions.

6) The signal generator sends a test pattern with the pattern outlined in figure 8.3.7.4.2-1. The following statistics are kept: the number of ACKs detected in the idle periods and the number of missed ACKs.



Figure 8.3.7.4.2-1: Test signal pattern for single user interlaced PUCCH format 0 demodulation tests

#### 8.3.7.5 Test Requirement

The fraction of falsely detected ACKs shall be less than 1% and the fraction of correctly detected ACKs shall be larger than 99% for the SNR listed in table 8.3.7.5-1.

Table 8.3.7.5-1: Test requirements for interlaced PUCCH format 0 with 15 kHz SCS, 20MHz channel bandwidth

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of Tx antennas | Number of RX antennas | Propagation conditions and correlation matrix (Annex G) | Number of  OFDM symbols | SNR (dB) |
| 1 | 2 | TDLA30-10 Low | 1 | -2.2 |

Table 8.3.7.5-2: Test requirements for interlaced PUCCH format 0 with 30 kHz SCS, 20MHz channel bandwidth

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of Tx antennas | Number of RX antennas | Propagation conditions and correlation matrix (Annex G) | Number of  OFDM symbols | SNR (dB) |
| 1 | 2 | TDLA30-10 Low | 1 | -1.4 |

### 8.3.8 Performance requirements for interlaced PUCCH format 1

#### 8.3.8.1 NACK to ACK detection

##### 8.3.8.1.1 Definition and applicability

The performance requirement of interlaced PUCCH format 1 for NACK to ACK detection is determined by the two parameters: probability of false detection of the ACK and the NACK to ACK detection probability. The performance is measured by the required SNR at probability of the NACK to ACK detection equal to 0.1% or less. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK at particular bit position when input is only noise. Each false bit detection is counted as one error.

The NACK to ACK detection probability is the probability of detecting an ACK bit when a NACK bit was sent on particular bit position. Each NACK bit erroneously detected as ACK bit is counted as one error. Erroneously detected NACK bits in the definition do not contain the NACK bits which are mapped from DTX, i.e. NACK bits received when DTX is sent should not be considered.

The NACK to ACK detection requirement only applies to the PUCCH format 1 with 2 UCI bits. The UCI information only contains ACK/NACK information

The 2bits UCI information is further defined with bitmap as [0 1].

Which specific test(s) are applicable to BS is based on the test applicability rules defined in clause 8.1.2.6.

##### 8.3.8.1.2 Minimum Requirement

The minimum requirement is in TS 38.104 [2] clause 8.3.9.

##### 8.3.8.1.3 Test purpose

The test shall verify the receiver's ability not to falsely detect NACK bits as ACK bits under multipath fading propagation conditions for a given SNR.

##### 8.3.8.1.4 Method of test

###### 8.3.8.1.4.1 Initial Conditions

Test environment: Normal; see annex B.2.

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

###### 8.3.8.1.4.2 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 combinations of SCS and channel bandwidth defined in table 8.3.8.1.4.2-1.

Table 8.3.8.1.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 20 | -77.2 dBm / 19.08 MHz |
| 30 | 20 | -77.4 dBm / 18.36 MHz |

3) The characteristics of the wanted signal shall be configured according to TS 38.211 [17], and the specific test parameters are configured as below:

Table 8.3.8.1.4.2-2: Test parameters

|  |  |
| --- | --- |
| Parameter | Test |
| Number of information bits | 2 |
| Number of symbols | 14 |
| Intra-slot frequency hopping | N/A |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Initial cyclic shift | 0 |
| First symbol | 0 |
| Index of orthogonal cover code (*timeDomainOCC*) | 0 |
| Number of interlace | 1 |
| Interlace index | 0Note1 |
| NOTE 1: RBs 0, 10, 20, …, 100 are allocated for 15kHz SCS and RBs 0, 5, 10, …, 50 are allocated for 30kHz SCS. | |

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

5) Adjusting the equipment so that the SNR specified in table 8.3.8.1.5-1 and table 8.3.8.1.5-2 is achieved at the BS input during the transmissions.

6) The signal generator sends random codeword from applicable codebook, in regular time periods. The following statistics are kept: the number of ACK bits detected in the idle periods and the number of NACK bits detected as ACK.

##### 8.3.8.1.5 Test Requirement

The fraction of falsely detected ACK bits shall be less than 1% and the fraction of NACK bits falsely detected as ACK shall be less than 0.1% for the SNR listed in tables 8.3.8.1.5-1.

Table 8.3.8.1.5-1: Required SNR for interlaced PUCCH format 1 with 15 kHz SCS, 20MHz channel bandwidth

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of Tx antennas | Number of RX antennas | Cyclic-Prefix | Propagation conditions and correlation matrix (Annex G) | SNR (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | -13.2 |

Table 8.3.8.1.5-2: Required SNR for interlaced PUCCH format 1 with 30 kHz SCS, 20MHz channel bandwidth

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of Tx antennas | Number of RX antennas | Cyclic-Prefix | Propagation conditions and correlation matrix (Annex G) | SNR (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | -12.7 |

#### 8.3.8.2 ACK missed detection

##### 8.3.8.2.1 Definition and applicability

The performance requirement of interlaced PUCCH format 1 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a conditional probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as conditional probability of detection of the ACK when the signal is present.

The ACK missed detection requirement only applies to the PUCCH format 1 with 2 UCI bits. The UCI information only contains ACK/NACK information.

The 2bits UCI information is further defined with bitmap as [0 1].

Which specific test(s) are applicable to BS is based on the test applicability rules defined in clause 8.1.2.6.

##### 8.3.8.2.2 Minimum Requirement

The minimum requirement is in TS 38.104 [2] clause 8.3.9.

##### 8.3.8.2.3 Test purpose

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

##### 8.3.8.2.4 Method of test

###### 8.3.8.2.4.1 Initial Conditions

Test environment: Normal; see annex B.2.

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

###### 8.3.8.2.4.2 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 combinations of SCS and channel bandwidth defined in table 8.3.8.2.4.2-1.

Table 8.3.8.2.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 20 | -77.2 dBm / 19.08 MHz |
| 30 | 20 | -77.4 dBm / 18.36 MHz |

3) The characteristics of the wanted signal shall be configured according to TS 38.211 [17], and the specific test parameters are configured as below:

Table 8.3.8.2.4.2-2: Test parameters

|  |  |
| --- | --- |
| Parameter | Test |
| Number of information bits | 2 |
| Number of symbols | 14 |
| Intra-slot frequency hopping | N/A |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Initial cyclic shift | 0 |
| First symbol | 0 |
| Index of orthogonal cover code (*timeDomainOCC*) | 0 |
| Number of interlace | 1 |
| Interlace index | 0Note1 |
| NOTE 1: RBs 0, 10, 20, …, 100 are allocated for 15kHz SCS and RBs 0, 5, 10, …, 50 are allocated for 30kHz SCS. | |

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

5) Adjusting the equipment so that the SNR specified in table 8.3.8.2.5-1 and table 8.3.8.2.5-2 is achieved at the BS input during the transmissions.

6) The signal generator sends random codewords from applicable codebook, in regular time periods. The following statistics are kept: the number of ACK bits falsely detected in the idle periods and the number of missed ACK bits. Each falsely detected ACK bit in the idle periods is accounted as one error for the statistics of false ACK detection, and each missed ACK bit is accounted as one error for the statistics of missed ACK detection.

Note that the procedure described in this clause for ACK missed detection has the same condition as that described in clause 8.3.8.1.4.2 for NACK to ACK detection. Both statistics are measured in the same testing.

##### 8.3.8.2.5 Test Requirement

The fraction of falsely detected ACK bits shall be less than 1% and the fraction of correctly detected ACK bits shall be larger than 99% for the SNR listed in tables 8.3.8.2.5-1.

Table 8.3.8.2.5-1 Required SNR for interlaced PUCCH format 1 with 15 kHz SCS, 20MHz channel bandwidth

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of Tx antennas | Number of RX antennas | Cyclic-Prefix | Propagation conditions and correlation matrix (Annex G) | SNR (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | -13.8 |

Table 8.3.8.2.5-2 Required SNR for interlaced PUCCH format 1 with 30 kHz SCS, 20MHz channel bandwidth

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of Tx antennas | Number of RX antennas | Cyclic-Prefix | Propagation conditions and correlation matrix (Annex G) | SNR (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | -13.5 |

***<End of change6>***

***<Start of change7 From R4-2115688 >***

### 8.3.9 Performance requirements for interlaced PUCCH format 2

#### 8.3.9.1 Definition and applicability

The performance is measured by the required SNR at UCI block error probability not exceeding 1%.

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

The UCI block error probability performance requirement only applies to the PUCCH format 2 with 22 UCI bits.

The 22bits UCI information case is assumed random information bit selection.

Which specific test(s) are applicable to BS is based on the test applicability rules defines in clause 8.1.2.6

#### 8.3.9.2 Minimum requirement

The minimum requirement is in TS 38.104 [2] clause 8.3.10.

#### 8.3.9.3 Test purpose

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

#### 8.3.9.4 Method of test

##### 8.3.9.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

##### 8.3.9.4.2 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 *BS type 1-H* respectively.

2) Adjust the AWGN generator, according to the subcarrier spacing and channel bandwidth defined in table 8.3.9.4.2-1.

Table 8.3.9.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 20 | -77.2 dBm / 19.08 MHz |
| 30 | 20 | -77.4 dBm / 18.36 MHz |
| NOTE 1: 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 TS 38.211 [17]. The specific test parameters are configured as below:

Table 8.3.9.4.2-2: Test parameters

|  |  |
| --- | --- |
| Parameter | Value |
| Modulation order | QSPK |
| Intra-slot frequency hopping | N/A |
| Number of symbols | 1 |
| The number of UCI information bits | 22 |
| First symbol | 13 |
| DM-RS sequence generation | *NID*0=0 |
| Number of interlaces | 1 |
| Interlace index | 0(note 1) |
| OCC-length-r16 | Not configured |
| NOTE 1: RBs 0,10,20,…,100 are allocated for 15kHz SCS and RBs 0, 5, 10,…,50 are allocated for 30kHz SCS | |

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

5) Adjust the equipment so that the SNR specified in table 8.3.9.5-1 or table 8.3.9.5-2 is achieved at the BS input during the UCI transmissions.

6) The signal generator sends a test pattern with the pattern outlined in figure 8.3.9.4.2-1. The following statistics are kept: the number of incorrectly decoded UCI.



**Figure 8.3.9.4.2-1: Test signal pattern for interlaced PUCCH format 2 demodulation tests**

#### 8.3.9.5 Test requirement

The fraction of incorrectly decoded UCI is shall be less than 1% for the SNR listed in table 8.3.9.5-1 and table 8.3.9.5-2.

Table 8.3.9.5-1: Required SNR for interlaced PUCCH format 2 with 15 kHz SCS, 20 MHz channel bandwidth

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic Prefix | Propagation conditions and correlation matrix  (Annex G) | SNR(dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 4.1 |

Table 8.3.9.5-2: Required SNR for interlaced PUCCH format 2 with 30 kHz SCS, 20 MHz channel bandwidth

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic Prefix | Propagation conditions and correlation matrix  (Annex G) | SNR(dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 4.5 |

### 8.3.10 Performance requirements for interlaced PUCCH format 3

#### 8.3.10.1 Definition and applicability

The performance requirement of interlaced PUCCH format 3 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK. The performance is measured by the required SNR at probability of detection equal to 0.99. The probability of false detection of the ACK shall be 0.01 or less.

The probability of false detection of the ACK is defined as a probability of erroneous detection of the ACK when input is only noise.

The probability of detection of ACK is defined as probability of detection of the ACK when the signal is present.

The ACK missed detection requirement only applies to the PUCCH format 3 with 4 UCI bits. The UCI information only contains ACK information.

The 4bits UCI information case is further defined with the bitmap as [1 1 1 1].

Which specific test(s) are applicable to BS is based on the test applicability rules defines in clause 8.1.2.6

#### 8.3.10.2 Minimum requirement

The minimum requirement is in TS 38.104 [2] clause 8.3.11.

#### 8.3.10.3 Test purpose

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

#### 8.3.10.4 Method of test

##### 8.3.10.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

##### 8.3.10.4.2 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 *BS type 1-H* respectively.

2) Adjust the AWGN generator, according to the subcarrier spacing and channel bandwidth defined in table 8.3.10.4.2-1.

Table 8.3.10.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 20 | -77.2 dBm / 19.08 MHz |
| 30 | 20 | -77.4 dBm / 18.36 MHz |
| NOTE 1: 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 TS 38.211 [17]. The specific test parameters are configured as below:

Table 8.3.10.4.2-2: Test parameters

|  |  |
| --- | --- |
| Parameter | Value |
| Modulation order | QPSK |
| Intra-slot frequency hopping | N/A |
| Group and sequence hopping | Neither |
| Hopping ID | 0 |
| Number of symbols | 4 |
| The number of UCI information bits | 4 |
| Index of OCC | Not configured |
| Length of OCC | Not configured |
| Cyclic shift index for DMRS | 0 |
| Number of Interlace | 1 |
| Interlace index | 0(note 1) |
| NOTE 1: RBs 0,10,20,…,90 are allocated for 15kHz SCS and RBs 0,5,10,…,45 are allocated for 30kHz SCS | |

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

5) Adjust the equipment so that the SNR specified in table 8.3.10.5-1 or table 8.3.10.5-2 is achieved at the BS input during the UCI transmissions.

6) The signal generator sends a test pattern with the pattern outlined in figure 8.3.10.4.2-1. The following statistics are kept: the number of ACKs detected in the idle periods and the number of missed ACKs.



**Figure 8.3.10.4.2-1: Test signal pattern for interlaced PUCCH format 3 demodulation tests**

#### 8.3.10.5 Test requirement

The fraction of falsely detected ACKs shall be less than 1% and the fraction of correctly detected ACKs shall be larger than 99% for the SNR listed in table 8.3.10.5-1 and table 8.3.10.5-2.

Table 8.3.10.5-1: Required SNR for interlaced PUCCH format 3 with 15 kHz SCS, 20 MHz channel bandwidth

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic Prefix | Propagation conditions and correlation matrix  (Annex G) | Additional DM-RS configuration | SNR(dB) |
| 1 | 2 | Normal | TDLA30-10 Low | No additional DM-RS | -5.4 |

Table 8.3.10.5-2: Required SNR for interlaced PUCCH format 3 with 30 kHz SCS, 20 MHz channel bandwidth

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic Prefix | Propagation conditions and correlation matrix  (Annex G) | Additional DM-RS configuration | SNR(dB) |
| 1 | 2 | Normal | TDLA30-10 Low | No additional DM-RS | -4.8 |

***<End of change7>***

***<Start of change8 From R4-2113253 >***

#### 8.4.1.7 Test requirement for PRACH with LRA=1151 and LRA=571

Pfa shall not exceed 0.1%. Pd shall not be below 99% for the SNRs in tables 8.4.1.7-1 and 8.4.1.7-2.

Table 8.4.1.7-1: Missed detection requirements for PRACH with LRA=1151, 15 kHz SCS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of | Number of | Propagation | Frequency | SNR (dB) | | |
| TX antennas | RX antennas | conditions and correlation matrix (Annex G) | offset | Burst format A2 | Burst format B4 | Burst format C2 |
| 1 | 2 | AWGN | 0 | -20.8 | -24.8 | -20.8 |
|  |  | TDLA30-10 Low | 400 Hz | -14.5 | -17.7 | -14.6 |

Table 8.4.1.7-2: Missed detection requirements for PRACH with LRA=571, 30 kHz SCS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of | Number of | Propagation | Frequency | SNR (dB) | | |
| TX antennas | RX antennas | conditions and correlation matrix (Annex G) | offset | Burst format A2 | Burst format B4 | Burst format C2 |
| 1 | 2 | AWGN | 0 | -17.8 | -21.7 | -17.8 |
|  |  | TDLA30-10 Low | 400 Hz | -11.5 | -15.2 | -11.5 |

***<End of change8>***

***<Start of change9 From R4-2113758 >***

# A.4 Fixed Reference Channels for performance requirements (16QAM, R=658/1024)

<Unchanged Sections Skipped>

Table A.4-2: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer (16QAM, R=658/1024)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A4-8 | G-FR1-A4-9 | G-FR1-A4-10 | G-FR1-A4-11 (Note 3) | G-FR1-A4-12 | G-FR1-A4-13 | G-FR1-A4-14 |
| Subcarrier spacing [kHz] | 15 | 15 | 15 | 30 | 30 | 30 | 30 |
| Allocated resource blocks | 25 | 52 | 106 | 24 | 51 | 106 | 273 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |
| Code rate (Note 2) | 658/1024 | 658/1024 | 658/1024 | 658/1024 | 658/1024 | 658/1024 | 658/1024 |
| Payload size (bits) | 9224 | 19464 | 38936 | 8968 | 18960 | 38936 | 100392 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Number of code blocks - C | 2 | 3 | 5 | 2 | 3 | 5 | 12 |
| Code block size including CRC (bits) (Note 2) | 4648 | 6520 | 7816 | 4520 | 6352 | 7816 | 8392 |
| Total number of bits per slot | 14400 | 29952 | 61056 | 13824 | 29376 | 61056 | 157248 |
| Total symbols per slot | 3600 | 7488 | 15264 | 3456 | 7344 | 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].  NOTE 3: The calculation of the “Total number of bits per slot” and “Total symbols per slot” fields include the REs taken up by CSI part 1 and CSI part 2, if present. | | | | | | | |

***<End of change9>***

***<Start of change10 From R4-2112653 >***

Table A.4-2A: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, additional DM-RS position = pos2 and 1 transmission layer (16QAM, R=658/1024)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A4-29 | G-FR1-A4-29A | G-FR1-A4-30 | G-FR1-A4-30A |
| Subcarrier spacing (kHz)) | 15 | 15 | 30 | 30 |
| Allocated resource blocks | 52 | 25 | 106 | 24 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 11 | 11 | 11 | 11 |
| Modulation | 16QAM | 16QAM | 16QAM | 16QAM |
| Code rate (Note 2) | 658/1024 | 658/1024 | 658/1024 | 658/1024 |
| Payload size (bits) | 17424 | 8456 | 35856 | 8064 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 | 24 | - |
| Number of code blocks - C | 3 | 2 | 5 | 1 |
| Code block size including CRC (bits) (Note 2) | 5840 | 4264 | 7200 | 8080 |
| Total number of bits per slot | 27456 | 13200 | 55968 | 12672 |
| Total resource elements per slot | 6846 | 3300 | 13992 | 3168 |
| 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 = pos2*, and *l0*= 2 or 3 for PUSCH mapping type A, as per table 6.4.1.1.3-3 of TS 38.211 [17].  NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [16]. | | | | |

***<End of change10>***

***<Start of change11 From R4-2115694 >***

# A.5 Fixed Reference Channels for performance requirements (64QAM, R=567/1024)

The parameters for the reference measurement channels are specified in table A.5-2 for FR1 PUSCH performance requirements with transform precoding disabled, additional DM-RS position = pos1 and 1 transmission layer.

Table A.5-1: Void

Table A.5-2: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, additional DM-RS position = pos1 and 1 transmission layer (64QAM, R=567/1024)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A5-8 | G-FR1-A5-9 | G-FR1-A5-10 | G-FR1-A5-11 | G-FR1-A5-12 | G-FR1-A5-13 | G-FR1-A5-14 |
| Subcarrier spacing (kHz) | 15 | 15 | 15 | 30 | 30 | 30 | 30 |
| Allocated resource blocks | 25 | 52 | 106 | 24 | 51 | 106 | 273 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| Code rate (Note 2) | 567/1024 | 567/1024 | 567/1024 | 567/1024 | 567/1024 | 567/1024 | 567/1024 |
| Payload size (bits) | 12040 | 25104 | 50184 | 11528 | 24576 | 50184 | 131176 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Number of code blocks - C | 2 | 3 | 6 | 2 | 3 | 6 | 16 |
| Code block size including CRC (bits) (Note 2) | 6056 | 8400 | 8392 | 5800 | 8224 | 8392 | 8224 |
| Total number of bits per slot | 21600 | 44928 | 91584 | 20736 | 44064 | 91584 | 235872 |
| Total symbols per slot | 3600 | 7488 | 15264 | 3456 | 7344 | 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 [17].  NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [16]. | | | | | | | |

Table A.5-3: FRC parameters for FR1 interlaced PUSCH performance requirements, transform precoding disabled, *additional DM-RS position = pos1* and 1 transmission layer (64QAM, R=567/1024)

|  |  |  |
| --- | --- | --- |
| Reference channel | G-FR1-A5-15 | G-FR1-A5-16 |
| Subcarrier spacing [kHz] | 15 | 30 |
| Allocated resource blocks | 11 | 11 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 |
| Modulation | 64QAM | 64QAM |
| Code rate | 567/1024 | 567/1024 |
| Payload size (bits) | 5248 | 5248 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 |
| Number of code blocks - C | 1 | 1 |
| Code block size including CRC (bits) (Note 2) | 5272 | 5272 |
| Total number of bits per slot (Note 3) | 9504 | 9504 |
| Total symbols per slot (Note 3) | 1584 | 1584 |
| 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].  NOTE 3: The calculation of the “Total number of bits per slot” and “Total symbols per slot” fields include the REs taken up by CG-UCI, if present. | | |

***<End of change11>***