**3GPP TSG- Meeting #**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

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| ***Title:*** | Big CR for TS 38.104 Maintenance Demod part (Rel-16, CAT F) | | | | | | | | | |
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| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | |  |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories 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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | [R4-2214827]  At RAN4#103-e at was agreed that corrections in SRS configuration in UL timing adjustment requirements parameters are needed [R4-2210655]:  Issue 3-1-2: SRS Transmission periodicity  Agreements  The intention of the prior agreements was to have SRS sent once per radio frame, in the last symbol of the first special slot of the radio frame. The slot-based value of TSRS in NOTE1 of the “Test parameters for testing UL timing adjustment” table shall be scaled accordingly with the SCS, i.e., 15 kHz: TSRS =10, 30 kHz: TSRS =20, 60 kHz: TSRS =40, 120 kHz: TSRS =80.  It is recommended to also add this correction in Rel-16 maintenance.  Some of the FRCs for in UL timing adjustment requirements are missing.  Some of references in the talbes are wrong.  [R4-2213822]  There is no intra slot frequency hopping configured in PF2 test with ACK miss detection requirements, but the test parameters of intra slot hopping are still existing  [R4-2214856]  Remove square brackets for FR2 PUSCH requirements  [R4-2213918]  SNR description in Clause 8 and 11 General section has mis-leading expression which could leads to higher SNR than defined requirement. For N (noise energy) to calculate SNR, it needs to take noise energy where wanted signal (S) exists. However, current text can be interpret as total noise energy of entire one slot which, in some cases, is longer period than where wanted signal exists especially cases like PRACH as example. This interpretation makes noise energy density lower than defined requirement. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | [R4-2214827]  Updated the SRS TSRS in test parameters for testing UL timing adjustment  Added missing FRCs for UL timing adjustment requirements  Changed wrong references in the tables.  [R4-2213822]  Deleted all the test parameters and description about intra slot frequency hopping for PF2 test with ACK miss detection requirements  [R4-2214856]  For square brackets for FR2 PUSCH requirements, update clause 11.2.2.1.2.  [R4-2213918]  Description of N is updated to clarify noise energy to calculate SNR is where wanted signal energy exists in time domain as well as frequency domain | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | [R4-2214827]  Some of UL timing adjustment requirements cannot be tested  [R4-2213822]  The test parameters for PF2 are confusing.  [R4-2214856]  There will be still inconsistance between RAN4 agreement and specification  [R4-2213918]  Without this clarification, it’s possible to misinterpret requirement then resulted noise density lower than requirement value (higher SNR). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | [R4-2214827]  8.2.5, A.4  [R4-2213822]  8.3.4.1, 11.3.2.4.1  [R4-2214856]  11.2.2.1.2  [R4-2213918]  8.1.1, 11.1.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS 38.141-1, 38.141-2 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

***<Start of change 1 [R4-2213918]>***

### 8.1.1 Scope and definitions

Conducted performance requirements specify the ability of the *BS type 1-C* or *BS type 1-H* to correctly demodulate signals in various conditions and configurations. Conducted performance requirements are specified at the *antenna connector(s)* (for *BS type 1-C*) and at the *TAB connector(s)* (for *BS type 1-H*).

Conducted performance requirements for the BS are specified for the fixed reference channels defined in annex A and the propagation conditions in annex G. The requirements only apply to those FRCs that are supported by the base station.

Unless stated otherwise, performance requirements apply for a single carrier only. Performance requirements for a BS supporting *carrier aggregation* are defined in terms of single carrier requirements.

For FDD operation the requirements in clause 8 shall be met with the transmitter units associated with *antenna connectors* (for *BS type 1-C*) or *TAB connectors* (for *BS type 1-H*) in the *operating* *band* turned ON.

NOTE: In normal operating conditions, *antenna connector*s (for *BS type 1-C*) or *TAB connectors* (for *BS type 1-H*) in FDD operation are configured to transmit and receive at the same time. The associated transmitter unit(s) may be OFF for some of the tests as specified in TS 38.141-1 [5].

The SNR used in this clause is specified based on a single carrier and defined as:

SNR = S / N

Where:

S is the total signal energy in the slot on a single *antenna connector* (for *BS type 1-C*) or on a single *TAB connector* (for *BS type 1-H*).

N is the noise energy in a bandwidth corresponding to the *transmission bandwidth* over the same duration where signal energy exists on a single *antenna connector* (for *BS type 1-C*) or on a single *TAB connector* (for *BS type 1-H*).

***<End of change 1>***

***<Start of change 2 [R4-2214827]>***

### 8.2.5 Requirements for UL timing adjustment

The performance requirement of UL timing adjustment is determined by a minimum required throughput for the moving UE at given SNR. The performance requirements assume HARQ retransmissions. The performance requirements for UL timing adjustment scenario Y and scenario Z defined in Annex G.4 are optional.

In the tests for UL timing adjustment, two signals are configured, one being transmitted by a moving UE and the other being transmitted by a stationary UE. The transmission of SRS from UE is optional. FRC parameters in Table A.4-2B are applied for both UEs. The received power for both UEs is the same. The resource blocks allocated for both UEs are consecutive. In scenario Y and scenario Z, Doppler shift is not taken into account.

Table 8.2.5-1 Test parameters for testing UL timing adjustment

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| Transform precoding | | Disabled |
| Uplink-downlink allocation for TDD | | 15 kHz SCS:  3D1S1U, S=10D:2G:2U  30 kHz SCS:  7D1S2U, S=6D:4G:4U |
| Channel bandwidth | | 15 kHz SCS: 5MHz, 10 MHz  30 kHz SCS: 10MHz, 40 MHz |
| MCS | | 16 |
| 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 |
|  | DM-RS position (*l0*) | 2 |
|  | Additional DM-RS position | pos2 |
|  | Number of DM-RS CDM group(s) without data | 2 |
|  | Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
|  | DM-RS port | {0} |
| Time domain resource assignment | DM-RS sequence generation | NID0=0, nSCID =0 for moving UE  NID0=1, nSCID =1 for stationary UE |
|  | PUSCH mapping type | Both A and B |
|  | Allocation length | 14 |
| Frequency domain resource assignment | RB assignment | 5 MHz CBW/15kHz SCS: 12 RB for each UE  10MHz CBW/15kHz SCS: 25 RB for each UE  10MHz CBW/30kHz SCS: 12 RB for each UE  40MHz CBW/30kHz SCS: 50 RB for each UE |
|  | Starting PRB index | Moving UE: 0  Stationary UE: 12 for 5MHz, 25 for 10 MHz CBW for SCS 15kHz, and 12 for 10MHz, 50 for 40 MHz CBW for SCS 30kHz |
|  | Frequency hopping | Disabled |
| SRS resource allocation | Slots in which sounding RS is transmitted (Note 1) | For FDD: slot #1 in radio frames  For TDD:  - last symbol in slot #3 in radio frames for 15KHz  - last symbol in slot #7 in radio frames for 30KHz |
|  | SRS resource allocation | 15 kHz SCS:  CSRS = 5, BSRS =0, for 20 RB  CSRS = 11, BSRS =0, for 40 RB  30 kHz SCS:  CSRS =5, BSRS =0, for 20 RB  CSRS = 21, BSRS =0, for 80 RB |
| NOTE 1. The transmission of SRS is optional. And the transmission comb and SRS periodicity are configured as KTC = 2, and TSRS = 10 for 15 kHz SCS, TSRS = 20 for 30 kHz SCS respectively. | | |

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

***<Start of change 3 [R4-2213822]>***

8.3.4 Performance requirements for PUCCH format 2

8.3.4.1 ACK missed detection requirements

8.3.4.1.1 General

The ACK missed detection probability is the probability of not detecting an ACK when an ACK was sent.

The ACK missed detection requirement only applies to the PUCCH format 2 with 4 UCI bits.

**Table 8.3.4.1.1-1: Test Parameters**

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Modulation order | QSPK |
| Starting RB location | 0 |
| Intra-slot frequency hopping | N/A |
| Number of PRBs | 4 |
| Number of symbols | 1 |
| The number of UCI information bits | 4 |
| First symbol | 13 |
| DM-RS sequence generation | *NID*0=0 |

8.3.4.1.2 Minimum requirements

The ACK missed detection probability shall not exceed 1% at the SNR given in table 8.3.4.1.2-1 and table 8.3.4.1.2-2 for 4UCI bits.

**Table 8.3.4.1.2-1: Minimum requirements for PUCCH format 2 with 15 kHz SCS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Number of** | **Number of** | **Cyclic Prefix** | **Propagation** | **Channel bandwidth / SNR (dB)** | | |
| **TX antennas** | **RX antennas** |  | **conditions and correlation matrix (Annex G)** | **5 MHz** | **10 MHz** | **20 MHz** |
|  | 2 | Normal | TDLC300-100 Low | 5.8 | 5.6 | 5.9 |
| 1 | 4 | Normal | TDLC300-100 Low | 0.4 | 0.5 | 0.3 |
|  | 8 | Normal | TDLC300-100 Low | -3.5 | -3.5 | -3.5 |

**Table 8.3.4.1.2-2: Minimum requirements for PUCCH format 2 with 30 kHz SCS**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Number of** | **Number of** | **Cyclic Prefix** | **Propagation** | **Channel bandwidth / SNR (dB)** | | | |
| **TX antennas** | **RX antennas** |  | **conditions and correlation matrix (Annex G)** | **10 MHz** | **20 MHz** | **40 MHz** | **100 MHz** |
|  | 2 | Normal | TDLC300-100 Low | 5.5 | 5.6 | 5.5 | 5.7 |
| 1 | 4 | Normal | TDLC300-100 Low | 0.3 | 0.2 | 0.3 | 0.4 |
|  | 8 | Normal | TDLC300-100 Low | -3.6 | -3.6 | -3.5 | -3.3 |

***<End of change 3>***

***<Start of change 4 [R4-2213918]>***

### 11.1.1 Scope and definitions

Radiated performance requirements specify the ability of the *BS type 1-O* or *BS type 2-O* to correctly demodulate radiated signals in various conditions and configurations. Radiated performance requirements are specified at the RIB.

Radiated performance requirements for the BS are specified for the fixed reference channels defined in annex A and the propagation conditions in annex G. The requirements only apply to those FRCs that are supported by the BS.

The radiated performance requirements for *BS type 1-O* and for the *BS type 2-O* are limited to two OTA *demodulation branches* as described in clause 11.1.2. Conformance requirements can only be tested for 1 or 2 *demodulation branches* depending on the number of polarizations supported by the BS, with the required SNR applied separately per polarization.

NOTE 1: The BS can support more than 2 *demodulation branches*, however OTA conformance testing can only be performed for 1 or 2 *demodulation branches*.

Unless stated otherwise, radiated performance requirements apply for a single carrier only. Radiated performance requirements for a BS supporting CA are defined in terms of single carrier requirements.

For *BS type 1-O* in FDD operation the requirements in clause 8 shall be met with the transmitter units associated with the RIB in the *operating* *band* turned ON.

NOTE 2: *BS type 1-O* in normal operating conditions in FDD operation is configured to transmit and receive at the same time. The transmitter unit(s) associated with the RIB may be OFF for some of the tests.

In tests performed with signal generators a synchronization signal may be provided from the BS to the signal generator, to enable correct timing of the wanted signal.

Whenever the "RX antennas" term is used for the radiated performance requirements description, it shall refer to the *demodulation branches* (i.e. not physical antennas of the antenna array).

The SNR used in this clause is specified based on a single carrier and defined as:

SNR = S / N

Where:

S is the total signal energy in a slot on a RIB.

N is the noise energy in a bandwidth corresponding to the *transmission bandwidth* over the same duration where signal energy exists on a RIB.

***<End of change 4>***

***<Start of change 5 [R4-2214856]>***

11.2.2.1.2 Minimum requirements

*(unchanged part skipped)*

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Number of TX antennas** | **Number of demodulation branches** | **Cyclic prefix** | **Propagation conditions and correlation matrix (Annex G)** | **Fraction of maximum throughput** | **FRC (Annex A)** | **Additional DM-RS position** | **PT-RS** | **SNR**  **(dB)** |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-4 | pos0 | No | -2.4 |
|  |  |  |  |  | G-FR2-A3-16 | pos1 | No | -2.5 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A4-4 | pos0 | Yes | 11.9 |
|  |  |  |  |  |  |  | No | 10.5 |
| 1 |  |  |  |  | G-FR2-A4-14 | pos1 | Yes | 11.1 |
|  |  |  |  |  |  |  | No | 10.5 |
|  | 2 | Normal | TDLA30-75 Low | 70 % | G-FR2-A5-4 | pos0 | Yes | 13.5 |
|  |  |  |  |  |  |  | No | 12.9 |
|  |  |  |  |  | G-FR2-A5-9 | pos1 | Yes | 13.4 |
|  |  |  |  |  |  |  | No | 12.8 |
|  |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A3-9 | pos0 | No | 1.4 |
|  |  |  |  |  | G-FR21-A3-21 | pos1 | No | 1.2 |
| 2 |  | Normal | TDLA30-300 Low | 70 % | G-FR2-A7-4 | pos0 | Yes | 13.9 |
|  |  |  |  |  |  |  | No | 13.2 |
|  |  |  |  |  | G-FR2-A7-9 | pos1 | Yes | 13.5 |
|  |  |  |  |  |  |  | No | 12.9 |

***<End of change 5>***

***<Start of change 6 [R4-2213822]>***

#### 11.3.2.4 Performance requirements for PUCCH format 2

##### 11.3.2.4.1 ACK missed detection requirements

###### 11.3.2.4.1.1 General

The ACK missed detection probability is the probability of not detecting an ACK when an ACK was sent.

The ACK missed detection requirement only applies to the PUCCH format 2 with 4 UCI bits.

Table 11.3.2.4.1.1-1: Test Parameters

|  |  |
| --- | --- |
| Parameter | Value |
| Modulation order | QSPK |
| Starting RB location | 0 |
| Intra-slot frequency hopping | N/A |
| Number of PRBs | 4 |
| Number of symbols | 1 |
| The number of UCI information bits | 4 |
| First symbol | 13 |
| DM-RS sequence generation | *NID*0=0 |

###### 11.3.2.4.1.2 Minimum requirements

The ACK missed detection probability shall not exceed 1% at the SNR given in table 11.3.2.4.1.2-1 and table 11.3.2.4.1.2-2 for 4UCI bits.

Table 11.3.2.4.1.2-1: Minimum requirements for PUCCH format 2 with 60 kHz SCS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number of TX | Number of Demodulation | Cyclic Prefix | Propagation conditions and correlation matrix | Channel bandwidth / SNR (dB) | |
| antennas | Branches |  | (Annex G) | 50 MHz | 100 MHz |
| 1 | 2 | Normal | TDLA30-300 Low | 6.7 | 7.2 |

Table 11.3.2.4.1.2-2: Minimum requirements for PUCCH format 2 with 120 kHz SCS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number | Number of | Cyclic | Propagation | Channel bandwidth / SNR (dB) | | |
| of TX antennas | Demodulation Branches | Prefix | conditions and correlation matrix (Annex G) | 50 MHz | 100 MHz | 200 MHz |
| 1 | 2 | Normal | TDLA30-300 Low | 6.6 | 6.3 | 6.6 |

***<End of change 6>***

***<Start of change 7 [R4-2214827]>***

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

The parameters for the reference measurement channels are specified in table A.4-2, table A.4-2A, table A.4-2B and table A.4-4 for FR1 PUSCH performance requirements:

- FRC parameters are specified in table A.4-2 for FR1 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

- FRC parameters are specified in table A.4-2A for FR1 PUSCH with transform precoding disabled, additional DM-RS position = pos 2 and 1 transmission layer.

- FRC parameters are specified in table A.4-2B for FR1 PUSCH with transform-precoding disabled, *Additional DM-RS position = pos2* and 1 transmission layer

- FRC parameters are specified in table A.4-4 for FR1 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 2 transmission layers.

The parameters for the reference measurement channels are specified in table A.4-5 to table A.4-8 for FR2 PUSCH performance requirements:

- FRC parameters are specified in table A.4-5 for FR2 PUSCH with transform precoding disabled, *Additional DM-RS position = pos0* and 1 transmission layer.

- FRC parameters are specified in table A.4-6 for FR2 PUSCH with transform precoding disabled, *Additional DM-RS position = pos0* and 2 transmission layers.

- FRC parameters are specified in table A.4-7 for FR2 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

- FRC parameters are specified in table A.4-8 for FR2 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 2 transmission layers.

Table A.4-1: Void

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 [9].  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. | | | | | | | |

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 | 8088 |
| 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 [9].  NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [15]. | | | | |

Table A.4-2B: 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-A4-31A | | G-FR1-A4-31 | G-FR1-A4-32A | | G-FR1-A4-32 |
| Subcarrier spacing [kHz] | | 15 | | 15 | 30 | | 30 |
| Allocated resource blocks | | 12 | | 25 | 12 | | 50 |
| 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) | | 4032 | | 8456 | 4032 | | 16896 |
| Transport block CRC (bits) | | 24 | | 24 | 24 | | 24 |
| Code block CRC size (bits) | | - | | 24 | - | | 24 |
| Number of code blocks - C | | 1 | | 2 | 1 | | 3 |
| Code block size including CRC (bits) (Note 2) | | 4056 | | 4264 | 4056 | | 5664 |
| Total number of bits per slot | | 6336 | | 13200 | 6336 | | 26400 |
| Total symbols per slot | | 1584 | | 3300 | 1584 | | 6600 |
| 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*, *l0* = 2 for PUSCH mapping type A, *l0* = 2 for PUSCH mapping type B, as per table 6.4.1.1.3-3 of TS 38.211 [9].  NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [15]. | | | | | | | |

Table A.4-3: Void

***<End of change 7>***