**3GPP TSG-RAN4 Meeting #104-e *<R4-22XXXXX>***

**Online, 15th Aug - 26th Aug, 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.141-2** | **CR** | **<->** | **rev** | **<->** | **Current version:** | **16.12.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

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|  |
| ***Title:***  | Big CR for TS 38.141-2 Maintenance Demod part (Rel-16, CAT F)  |
|  |  |
| ***Source to WG:*** | MCC, Samsung |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_newRAT-PerfNR\_HST-Perf |  | ***Date:*** | 2022-08-30 |
|  |  |  |  |  |
| ***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 canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | This big CR merges endorsed draft CR to 38.141-2 in RAN4#104-e. The reason for change in endorsed draft CR is copied below* R4-2213920

SNR description in Clause 8 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.* R4-2213828

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* R4-2214829:

Applicability rule for PRACH requirement tests for high speed train PRACH formats (D.111) are not defined.Wrong manufacturer’s declaration reference.Wrong reference to BS type 1-C in OTA requirements.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 periodicityAgreementsThe 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.* R4-2214858

Correct reference in FRC. |
|  |  |
| ***Summary of change:*** | The summary of change in endorsed draft CR is copied as below:* R4-2213920

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.* R4-2213828:

Delate all the test parameters and description about intra slot frequency hopping for PF2 test with ACK miss detection requirements* R4-2214829:

Applicability rule for PRACH requirement test for is speed train is added. Wrong references are fixed.Updated the SRS TSRS in test parameters for testing UL timing adjustment* R4-2214858

For reference correction, update clause A.1, A.3, A.4, A.5, A.8 |
|  |  |
| ***Consequences if not approved:*** | The consequences if not approved for endorsed draft CR are coppied as below.* R4-2213920

Without this clarification, it’s possible to misinterpret requirement then resulted noise density lower than requirement value (higher SNR).* R4-2213828

The test parameters of PF2 are confusing.* R4-2214829:

Wrong UL timing adjustment requirements paramters.Not all of the declared high speed train PRACH formats may be tested.* R4-2214858

There will be still inconsistance between RAN4 agreement and specification |
|  |  |
| ***Clauses affected:*** | 8.1.0, 8.1.2.3, 8.1.2.4, 8.2.5, 8.3.3A.1, A.3, A.4, A.5, A.8 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

<Start Of Change R4-2213920>

### 8.1.0 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 and propagation conditions defined in TS 38.104 [2] annex A and annex J, respectively. 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 *demodulations branches* as described in clause 8.1.1. 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: 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 between the BS and the signal generator, to enable correct timing of the wanted signal.

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.

<End of Change R4-2213920>

<Start Of Change R4-2214829>

#### 8.1.2.3 Applicability of PRACH performance requirements

##### 8.1.2.3.1 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.103 in table 4.6-1).

Unless otherwise stated, PRACH requirement tests for high speed train shall apply only for each PRACH formats declared to be supported (see D.111 in table 4.6-1).

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

Unless otherwise stated, for each PRACH format with short sequence declared to be supported, for each FR, the tests shall apply only for the smallest supported subcarrier spacing in the FR (see D.103 in table 4.6-1).

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

Unless otherwise stated, for the subcarrier spacing to be tested, the test requirements shall apply only for anyone channel bandwidth declared to be supported (see D.7 in table 4.6-1).

##### 8.1.2.3.4 Applicability of requirements for different restricted set types of long PRACH format 0

Unless otherwise stated, PRACH requirement tests for long PRACH preamble format 0 with restricted set Type A and B shall apply only for the restricted set type declared to be supported (see D.111 in table 4.6-1). If both restricted set type A and type B are declared to be supported, the tests shall be done for type B; the same chosen mapping type shall then be used for all tests.

#### 8.1.2.4 Applicability of PUSCH for high speed train performance requirements

##### 8.1.2.4.1 Applicability of requirements for different speeds

Unless otherwise stated, a BS that declares to support 500km/h (see D.110 in table 4.6-1) and passes the tests for 500km/h, can also consider the tests for 350km/h as passed.

##### 8.1.2.4.2 Applicability of requirements for 1T1R

In high speed train requirements, unless otherwise stated, for a BS supporting different numbers of TAB connectors for BS type 1-H (see D.37 in table 4.6-1), if the BS supports 1RX, the tests with low MIMO correlation level shall apply only for either one connector or the second lowest number of supported connectors, in addition to the highest numbers of supported connectors, and the specific connectors used for testing are based on manufacturer declaration.

If the BS doesn't support 1RX, the tests with low MIMO correlation level shall apply only for the lowest and highest numbers of supported connectors, and the specific connectors used for testing are based on manufacturer declaration.

Note: The highest number of connectors can simultaneously be second lowest number.

<End of Change R4-2214829>

<Start Of Change R4-2214829>

*(unchanged part skipped)*

### 8.2.5 Performance requirements for UL timing adjustment

#### 8.2.5.1 Definition and applicability

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 J.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.

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

#### 8.2.5.2 Minimum Requirement

The minimum requirement is in TS 38.104 [2] clause 12.2.1.5.

#### 8.2.5.3 Test Purpose

The test shall verify the receiver's ability to achieve throughput measured for the moving UE at given SNR under moving propagation conditions.

#### 8.2.5.4 Method of test

##### 8.2.5.4.1 Initial Conditions

Test environment: Normal, see annex B.2.

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

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

Direction to be tested: OTA REFSENS *receiver target reference direction* (see D.54 in table 4.6-1).

##### 8.2.5.4.2 Procedure

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex E.3.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Set the BS in the declared direction to be tested.

4) Connect the BS tester generating the wanted signal, multipath fading simulators and AWGN generators to a test antenna via a combining network in OTA test setup, as shown in annex E.3. Each of the demodulation branch signals should be transmitted on one polarization of the test antenna(s).

5) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A, and according to additional test parameters listed in table 8.2.5.4.2-1.

Table 8.2.5.4.2-1 Test parameters for testing UL timing adjustment

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Disabled |
| Uplink-downlink allocation for TDD | 15 kHz SCS:3D1S1U, S=10D:2G:2U30 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 | 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} |
|  | DM-RS sequence generation | NID0=0, nSCID =0 for moving UENID0=1, nSCID =1 for stationary UE |
| Time domain | PUSCH mapping type | A,B |
| resource assignment | Allocation length | 14  |
| Frequency domain resource assignment | RB assignment | 5 MHz CBW/15kHz: 12 RB for each UE10MHz CBW/15kHz SCS: 25 RB for each UE10MHz CBW/30kHz: 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 CBW/15kHz SCS, 25 for 10 MHz CBW/15kHz SCS, 12 for 10MHz CBW/30kHz SCS and 50 for 40 MHz CBW/30kHz SCS |
|  | Frequency hopping | Disabled |
| SRS resource allocation | Slots in which sounding RS is transmitted (Note 1) | For FDD: slot #1 in radio framesFor 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 RB30 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 15kHz SCS, TSRS = 20 for 30kHz SCS respectively. |

 The multipath fading emulators shall be configured according to the corresponding channel model defined in annex J. Unless stated otherwise, the MIMO correlation matrices for the gNB are defined in annex J for low correlation.

7) Adjust the test signal mean power so the calibrated radiated SNR value at the BS receiver is as specified in clause 8.2.5.5 for high speed train and clause 8.2.5.6 for normal mode and that the SNR at the BS receiver is not impacted by the noise floor.

 The power level for the transmission may be set such that the AWGN level at the RIB is equal to the AWGN level in table 8.2.5.4.2-2.

Table 8.2.5.4.2-2: AWGN power level at the BS input

|  |  |  |  |
| --- | --- | --- | --- |
| BS type | Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 1-O (NOTE 2) | 15 | 5 | -86.5dBm - ΔOTAREFSENS dBm / 4.5MHz |
| 10 | -83.3 - ΔOTAREFSENS dBm / 9.36 MHz |
| 30 | 10 | -83.6 dBm - ΔOTAREFSENS dBm / 8.64MHz |
| 40 | -77.2 - ΔOTAREFSENS dBm / 38.16 MHz |
| NOTE 1: ΔOTAREFSENS as declared in D.53 in table 4.6-1 and clause 7.1.NOTE 2: 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. |

8) For reference channels applicable to the BS, measure the throughput.

<End of Change R4-2214829>

<Start Of Change R4-2213828>

### Performance requirements for PUCCH format 2

#### 8.3.3.1 ACK missed detection performance requirements

##### 8.3.3.1.1 Definition and applicability

The performance requirement of PUCCH format 2 for ACK missed detection is determined by the two parameters: probability of false detection of the ACK and the probability of detection of ACK on the wanted signal. 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.

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

##### 8.3.3.1.2 Minimum Requirement

For *BS type 1-O*, the minimum requirement is in TS 38.104 [2] clause 11.3.1.4.

For *BS type 2-O*, the minimum requirement is in TS 38.104 [2] clause 11.3.2.4.

##### 8.3.3.1.3 Test Purpose

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

##### 8.3.3.1.4 Method of test

8.3.3.1.4.1 Initial conditions

Test environment: Normal, see clause B.2.

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

Direction to be tested: OTA REFSENS *receiver target reference direction* (see D.54 in table.4.6-1).

8.3.3.1.4.2 Procedure

1) Place the BS with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex E.3.

2) Align the manufacturer declared coordinate system orientation of the BS with the test system.

3) Set the BS in the declared direction to be tested.

4) Connect the BS tester generating the wanted signal, multipath fading simulators and AWGN generators to a test antenna via a combining network in OTA test setup, as shown in annex E.3. Each of the demodulation branch signals should be transmitted one polarization of the test antenna(s).

5) The characteristics of the wanted signal shall be configured according to TS 38.211 [20], and according to additional test parameters listed in table 8.3.3.1.4.2-1.

Table 8.3.3.1.4.2-1: Test parameters

|  |  |
| --- | --- |
| Parameter | Value |
| Modulation order | QPSK |
| 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 |

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

7) Adjust the test signal mean power so the calibrated radiated SNR value at the BS receiver is as specified in clause 8.3.3.1.5.1 and 8.3.3.1.5.2 for *BS type 1-O* and *BS type 2-O* respectively, and that the SNR at the BS receiver is not impacted by the noise floor.

 The power level for the transmission may be set such that the AWGN level at the RIB is equal to the AWGN level in table 8.3.3.1.4.2-2.

Table 8.3.3.1.4.2-2: AWGN power level at the BS input

|  |  |  |  |
| --- | --- | --- | --- |
| BS type | Sub-carrier spacing(kHz) | Channel bandwidth(MHz) | AWGN power level |
| BS type 1-O (Note 4) | 15 kHz | 5 | -83.5 - ΔOTAREFSENS dBm / 4.5 MHz |
|  |  | 10 | -80.3 - ΔOTAREFSENS dBm / 9.36 MHz |
|  |  | 20 | -77.2 -ΔOTAREFSENS dBm / 19.08 MHz |
|  | 30 kHz | 10 | -80.6 - ΔOTAREFSENS dBm / 8.64 MHz |
|  |  | 20 | -77.4 - ΔOTAREFSENS dBm / 18.36 MHz |
|  |  | 40 | -74.2 - ΔOTAREFSENS dBm / 38.16 MHz |
|  |  | 100 | -70.1 - ΔOTAREFSENS dBm / 98.28 MHz |
| BS type 2-O (Note 5) | 60 kHz | 50 | EISREFSENS\_50M + ΔFR2\_REFSENS + 15 dBm / 47.52MHz |
|  |  | 100 | EISREFSENS\_50M + ΔFR2\_REFSENS + 18 dBm / 95.04 MHz  |
|  | 120 kHz | 50 | EISREFSENS\_50M + ΔFR2\_REFSENS + 15 dBm / 46.08 MHz  |
|  |  | 100 | EISREFSENS\_50M + ΔFR2\_REFSENS + 18 dBm / 95.04 MHz  |
|  |  | 200 | EISREFSENS\_50M + ΔFR2\_REFSENS + 21 dBm / 190.08 MHz  |
| NOTE 1: ΔOTAREFSENS as declared in D.53 in table 4.6-1 and clause 7.1.NOTE 2: ΔFR2\_REFSENS = -3 dB as declared in clause 7.1, since the OTA REFSENS receiver target reference direction (as declared in D.54 in table 4.6-1) is used for testing.NOTE 3: EISREFSENS\_50M as declared in D.28 in table 4.6-1.NOTE 4: 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.NOTE 5: The AWGN power level contains an AWGN offset of 15dB by default. If needed for test purposes, the AWGN level can be reduced from the default by any value in the range 0dB to 15dB. Changing the AWGN level does not impact the validity of the test, as it reduces the effective base band SNR level. |

8) The signal generator sends a test pattern with pattern outlined in figure 8.3.3.1.4.2-1. The following statistics are kept: the number of ACK bits detected in the idle periods and the number of missed ACKs.



Figure 8.3.3.1.4.2-1: Test signal pattern for PUCCH format 2 demodulation tests

##### 8.3.3.1.5 Test requirement

8.3.3.1.5.1 Requirements for BS type 1-O

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 8.3.3.1.5.1-1 and table 8.3.3.1.5.1-2.

Table 8.3.3.1.5.1-1: Required SNR for PUCCH format 2 with 15 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of | Number of | Cyclic | Propagation | Channel bandwidth / SNR (dB) |
| TX antennas | demodulation branches | Prefix | conditions and correlation matrix (annex J) | 5 MHz | 10 MHz | 20 MHz |
| 1 | 2 | Normal | TDLC300-100 Low | 6.4 | 6.2 | 6.5 |

Table 8.3.3.1.5.1-2: Required SNR for PUCCH format 2 with 30 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of | Number of | Cyclic | Propagation | Channel bandwidth/ SNR (dB) |
| TX antennas | demodulation branches | Prefix | conditions and correlation matrix (annex J) | 10MHz | 20MHz | 40MHz | 100MHz |
| 1 | 2 | Normal | TDLC300-100 Low | 6.1 | 6.2 | 6.1 | 6.3 |

8.3.3.1.5.2 Requirements for BS type 2-O

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 8.3.3.1.5.2-1 and table 8.3.3.1.5.2.-2

Table 8.3.3.1.5.2-1: Required SNR for PUCCH format 2 with 60 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of | Number of | Cyclic | Propagation | Channel bandwidth / SNR (dB) |
| TX antennas | demodulation branches | Prefix | conditions and correlation matrix (annex J) | 50 MHz | 100 MHz |
| 1 | 2 | Normal | TDLA30-300 Low | 7.3 | 7.8 |

Table 8.3.3.1.5.2-2: Required SNR for PUCCH format 2 with 120 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of | Number of | Cyclic | Propagation | Channel bandwidth / SNR (dB) |
| TX antennas | demodulation branches | Prefix | conditions and correlation matrix (annex J) | 50 MHz | 100 MHz | 200 MHz |
| 1 | 2 | Normal | TDLA30-300 Low | 7.2 | 6.9 | 7.2 |

<End of Change R4-2213828>

<Start Of Change R4-2214829>

*(unchanged part skipped)*

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 [20].NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [19]. |

<End of Change R4-2214829>

<Start Of Change R4-2214858>

A.1 Fixed Reference Channels for OTA sensitivity, OTA reference sensitivity level, OTA ACS, OTA in-band blocking, OTA out-of-band blocking, OTA receiver intermodulation and OTA in-channel selectivity (QPSK, R=1/3)

*(unchanged part skipped)*

**Table A.1-1a: FRC parameters for band n46 and n96 OTA sensitivity, for BS Type 1-H**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Reference channel** | **G-FR1-A1-12** | **G-FR1-A1-13** | **G-FR1-A1-14** | **G-FR1-A1-15** | **G-FR1-A1-16** | **G-FR1-A1-17** | **G-FR1-A1-18** | **G-FR1-A1-19** |
| Channel bandwidth (MHz) | 10 | 10 | 20 | 20 | 40 | 40 | 60 | 80 |
| Subcarrier spacing (kHz) | 15 | 30 | 15 | 30 | 15 | 30 | 30 | 30 |
| Allocated resource blocks | 5 | 4 | 10 | 10 | 21 | 21 | 32 | 43 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 432 | 352 | 888 | 888 | 1864 | 1864 | 2792 | 3752 |
| Transport block CRC (bits) | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| Code block CRC size (bits) | - | - | - | - | - | - | - | - |
| Number of code blocks - C | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Code block size including CRC (bits) (Note 3) | 448 | 368 | 904 | 904 | 1880 | 1880 | 2808 | 3768 |
| Total number of bits per slot | 1440 | 1152 | 2880 | 2880 | 6048 | 6048 | 9216 | 12384 |
| Total symbols per slot | 720 | 576 | 1440 | 1440 | 3024 | 3024 | 4608 | 6192 |
| NOTE 1: *UL-DMRS-config-type* = 1 with *UL-DMRS-max-len* = 1, *UL-DMRS-add-pos* = 1 with = 2, = 11 as per table 6.4.1.1.3-3 of TS 38.211 [20].NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity and in-channel selectivityNOTE 3: Code block size including CRC (bits) equals to  in sub-clause 5.2.2 of TS 38.212 [19].NOTE 4: For reference channel A1-12, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+10, N+20, N+30, N+40 where N={0,1,2,3,4,…,9}. NOTE 5: For reference channel A1-13, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5, N+10, N+15 where N={0,1,2,3,4}.NOTE 7: For reference channel A1-14, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+10,N+20,..N+90 where N={0,1,2,3,...,9}.NOTE 8: For reference channel A1-15, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5,N+10,..,N+45 where N={0,1,2,3,4}.NOTE 10: For reference channel A1-16, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+10,N+20,...,N+200 where N={0,1,2,3,4,...,9}.NOTE 11: For reference channel A1-17, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5, N+10, ..., N+100 where N={0,1,2,3,4}.NOTE 12: For reference channel A1-18, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5,N+10,...,N+155 where N={0,1,2,3,4}.NOTE 13: For reference channel A1-19, the allocated RB’s are uniformly spaced over the channel bandwidth at RB index N, N+5,N+10,...,N+210 where N={0,1,2,3,4}. |

*(unchanged part skipped)*

A.3 Fixed Reference Channels for performance requirements (QPSK, R=193/1024)

*(unchanged part skipped)*

**Table A.3-13: FRC parameters for FR2 PUSCH performance requirements, transform precoding disabled, additional DM-RS position = pos1 and 1 transmission layer (QPSK, R=193/1024)**

|  |  |  |
| --- | --- | --- |
| **Reference channel** | **G-FR2-A3-25** | **G-FR2-A3-26** |
| Subcarrier spacing (kHz) | 60 | 120 |
| Allocated resource blocks | 2 | 2 |
| CP-OFDM Symbols per slot (Note 1) | 8 | 8 |
| Modulation | QPSK | QPSK |
| Code rate (Note 2) | 193/1024 | 193/1024 |
| Payload size (bits) | 72 | 72 |
| Transport block CRC (bits) | 16 | 16 |
| Code block CRC size (bits) | 0 | 0 |
| Number of code blocks - C | 1 | 1 |
| Code block size including CRC (bits) (Note 2) | 88 | 88 |
| Total number of bits per slot | 384 | 384 |
| Total symbols per slot | 192 | 192 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration* = *single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos1* with *l0= 2* and *l* = 10 as per Table 6.4.1.1.3-3 of TS 38.211 [20].NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [19]. |

*(unchanged part skipped)*

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

*(unchanged part 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 [20].NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [19].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. |

*(unchanged part skipped)*

**Table A.4-2B: FRC parameters for FR1 UL timing adjustment, PUSCH with 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 |
| 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) | 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 data bearing resource elements 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*, and *l0* = 2 for PUSCH mapping type A, *l0* = 0 for PUSCH mapping type B, as per table 6.4.1.1.3-3 of TS 38.211 [20].NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [19]. |

*(unchanged part skipped)*

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

*(unchanged part skipped)*

**Table A.5-5: FRC parameters for FR1interlaced 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 [20].NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [19].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. |

*(unchanged part skipped)*

A.8 Fixed Reference Channels for performance requirements (QPSK, R=157/1024)

The parameters for the reference measurement channels are specified in table A.8-1 and A.8-2 for FR1 PUSCH performance requirements for 2-step RA type with *Additional DM-RS position* equals to *pos2* and *pos1* respectively.

**Table A.8-1: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, additional DM-RS position = pos2 and 1 transmission layer (QPSK, R=193/1024)**

|  |  |  |
| --- | --- | --- |
| **Reference channel** | **G-FR1-A8-1** | **G-FR1-A8-2** |
| Subcarrier spacing [kHz] | 15 | 30 |
| Allocated resource blocks | 2 | 2 |
| CP-OFDM Symbols per slot (Note 1) | 11 | 11 |
| Modulation | QPSK | QPSK |
| Code rate (Note 2) | 157/1024 | 157/1024 |
| Payload size (bits) | 80 | 80 |
| Transport block CRC (bits) | 16 | 16 |
| Code block CRC size (bits) | 0 | 0 |
| Number of code blocks - C | 1 | 1 |
| Code block size including CRC (bits) (Note 2) | 96 | 96 |
| Total number of bits per slot | 528 | 528 |
| Total symbols per slot | 264 | 264 |
| 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* with *l0= 2* as per Table 6.4.1.1.3-3 of TS 38.211 [20].NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [19]. |

**Table A.8-2: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, additional DM-RS position = pos1 and 1 transmission layer (QPSK, R=193/1024)**

|  |  |  |
| --- | --- | --- |
| **Reference channel** | **G-FR1-A8-3** | **G-FR1-A8-4** |
| Subcarrier spacing [kHz] | 15 | 30 |
| Allocated resource blocks | 2 | 2 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 |
| Modulation | QPSK | QPSK |
| Code rate (Note 2) | 157/1024 | 157/1024 |
| Payload size (bits) | 88 | 88 |
| Transport block CRC (bits) | 16 | 16 |
| Code block CRC size (bits) | 0 | 0 |
| Number of code blocks - C | 1 | 1 |
| Code block size including CRC (bits) (Note 2) | 104 | 104 |
| Total number of bits per slot | 576 | 576 |
| Total symbols per slot | 288 | 288 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration* = *single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos1* with *l0= 2* as per Table 6.4.1.1.3-3 of TS 38.211 [20].NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [19]. |

<End of Change R4-2214858>