**3GPP TSG- Meeting #**

**, , -**

|  |
| --- |
| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
|  |

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

|  |
| --- |
|  |
| ***Title:***  | (NR\_NTN\_solutions-Perf) CR to 38.181: Correction on FRCs in conducted demod requirement |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_NTN\_solutions-Perf  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | There are large number of errors in FRCs on conducted demod requirement while radiated demod requirement has correct FRCs specified.  Also, non-existing FRC is specified in repetition test cases.  |
|  |  |
| ***Summary of change:*** | * 8.2.1
	+ Incorrect, A3-3 (15 kscs/5M BW) used for 30 kscs/10M BW
	+ Correction, A3-2 (30 kscs/10 M BW)
* 8.2.2
	+ Incorrect, A3-5/6 (precoding disabled) used for “precoding enabled”
	+ Correction, A3-3/4 (precoding enabled, 15k scs and 30 kscs)
* 8.2.3
	+ Incorrect, A3-2/4 (30k disabled, 30k enabled) used for where half RBs FRC
	+ Correction, A3-5/6 (precoding disabled, 15k scs/5M BW, 30k scs/10M BW)
* A.3A
	+ FRC number A3A-3 changed to A3A-2 to match requirement
	+ Correstion on Note text about additional DM-RS position and location
 |
|  |  |
| ***Consequences if not approved:*** | With incorrect specification, which doesn’t match with test objective, makes un-testable definition or no meaning on testing |
|  |  |
| ***Clauses affected:*** | 8.2.1, 8.2.2, 8.2.3, A.3A |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Changed where to modify, for 3A-2 (in 8.2.4 and 11.2.4) remains in requirement then FRC number 3A-3 changed to 3A-2 |

## 8.2 Performance requirements for PUSCH

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

#### 8.2.1.1 Definition and applicability

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

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

#### 8.2.1.2 Minimum Requirement

The minimum requirement is in TS 38.108 [2] clause 8.2.1.

#### 8.2.1.3 Test Purpose

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

#### 8.2.1.4 Method of test

##### 8.2.1.4.1 Initial Conditions

Test environment: Normal, see Annex B.2.

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

##### 8.2.1.4.2 Procedure

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

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

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

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 kHz | 5 | -86.5 dBm / 4.5MHz |
| 30 kHz | 10 | -83.6 dBm / 8.64MHz |
| NOTE: The AWGN power level contains an AWGN offset of 16dB by default. If needed for test purposes, the AWGN level can be reduced from the default by any value in the range 0dB to 16dB. Changing the AWGN level does not impact the validity of the test, as it reduces the effective base band SNR level. |

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

Table 8.2.1.4.2-2: Test parameters for testing PUSCH

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Disabled |
| 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 resource assignment | PUSCH mapping type | A, B |
| Start symbol | 0  |
| Allocation length | 14  |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth |
| Frequency hopping | Disabled |
| Code block group based PUSCH transmission | 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 8.2.1.5-1 to 8.2.1.5-4 is achieved at the SAN input.

6) For each of the reference channels in table 8.2.1.5-1 to 8.2.1.5-4 applicable for the base station, measure the throughput.

#### 8.2.1.5 Test Requirement

The throughput measured according to clause 8.2.1.4.2 shall not be below the limits for the SNR levels specified in table 8.2.1.5-1 to 8.2.1.5-4.

Table 8.2.1.5-1: Test requirements for PUSCH with 70% of maximum throughput, Type A, 5 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 70% | G-FR1-A3-1 | pos1 | 3.8 |
| Normal | NTN-TDLC5-200 Low | 70% | G-FR1-A3-1 | pos1 | 2.2 |
| 2 | Normal | NTN-TDLA100-200 Low | 70% | G-FR1-A3-1 | pos1 | -0.1 |
| Normal | NTN-TDLC5-200 Low | 70% | G-FR1-A3-1 | pos1 | -0.6 |

Table 8.2.1.5-2: Test requirements for PUSCH with 70% of maximum throughput, Type B, 5 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 70% | G-FR1-A3-1 | pos1 | 3.9 |
| Normal | NTN-TDLC5-200 Low | 70% | G-FR1-A3-1 | pos1 | 2.2 |
| 2 | Normal | NTN-TDLA100-200 Low | 70% | G-FR1-A3-1 | pos1 | 0.0 |
| Normal | NTN-TDLC5-200 Low | 70% | G-FR1-A3-1 | pos1 | -0.6 |

Table 8.2.1.5-3: Test requirements for PUSCH with 70% of maximum throughput, Type A, 10 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-2 | pos1 | 3.5 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-2 | pos1 | 2.0 |
| 2 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-2 | pos1 | -0.4 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-2 | pos1 | -0.8 |

Table 8.2.1.5-4: Test requirements for PUSCH with 70% of maximum throughput, Type B, 10 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-2 | pos1 | 3.5 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-2 | pos1 | 1.9 |
| 2 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-2 | pos1 | -0.4 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-2 | pos1 | -0.8 |

### 8.2.2 Performance requirements for PUSCH with transform precoding enabled

#### 8.2.2.1 Definition and applicability

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

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

#### 8.2.2.2 Minimum Requirement

The minimum requirement is in TS 38.108 [2] clause 8.2.2.

#### 8.2.2.3 Test Purpose

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

#### 8.2.2.4 Method of test

##### 8.2.2.4.1 Initial Conditions

Test environment: Normal, see Annex B.2.

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

##### 8.2.2.4.2 Procedure

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

2) Adjust the AWGN generator, according to the SCS and channel bandwidth, defined in table 8.2.2.4.2-1.

Table 8.2.2.4.2-1: AWGN power level at the SAN input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15  | 5 | -86.5 dBm / 4.5MHz |
| 30  | 10 | -83.6 dBm / 8.64MHz |
| 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 8.2.2.4.2-2.

Table 8.2.2.4.2-2: Test parameters for testing PUSCH

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Enabled |
| 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, group hopping and sequence hopping are disabled |
| Time domain resource assignment | PUSCH mapping type | A, B |
| Start symbol | 0 |
| Allocation length | 14 |
| Frequency domain resource assignment | RB assignment | 15 kHz SCS: 25 PRBs in the middle of the test bandwidth 30 kHz SCS: 24 PRBs in the middle of the test bandwidth |
| Frequency hopping | Disabled |
| Code block group based PUSCH transmission | 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 8.2.2.5-1 to 8.2.2.5-4 is achieved at the SAN input.

6) For each of the reference channels in table 8.2.2.5-1 to 8.2.2.5-4 applicable for the base station, measure the throughput.

#### 8.2.2.5 Test Requirement

The throughput measured according to clause 8.2.2.4.2 shall not be below the limits for the SNR levels specified in table 8.2.2.5-1 to 8.2.2.5-4.

Table 8.2.2.5-1: Test requirements for PUSCH with 70% of maximum throughput, Type A, 5 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-3 | pos1 | 4.3 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-3 | pos1 | 2.2 |
| 2 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-3 | pos1 | 0.1 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-3 | pos1 | -0.6 |

Table 8.2.2.5-2: Test requirements for PUSCH with 70% of maximum throughput, Type B, 5 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-3 | pos1 | 4.3 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-3 | pos1 | 2.2 |
| 2 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-3 | pos1 | 0.1 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-3 | pos1 | -0.6 |

Table 8.2.2.5-3: Test requirements for PUSCH with 70% of maximum throughput, Type A, 10 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-4 | pos1 | 4.1 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-4 | pos1 | 1.9 |
| 2 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-4 | pos1 | -0.1 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-4 | pos1 | -0.8 |

Table 8.2.2.5-4: Test requirements for PUSCH with 70% of maximum throughput, Type B, 10 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (annex G) | Fraction of maximum throughput | FRC(annex A) | Additional DM-RS position | SNR(dB) |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-4 | pos1 | 4.1 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-4 | pos1 | 1.9 |
| 2 | Normal | NTN-TDLA100-200 Low | 70% |  G-FR1-A3-4 | pos1 | -0.1 |
| Normal | NTN-TDLC5-200 Low | 70% |  G-FR1-A3-4 | pos1 | -0.8 |

### 8.2.3 Performance requirements for UL timing adjustment

#### 8.2.3.1 Definition and applicability

The performance requirement of UL timing adjustment is determined by a minimum required throughput measured for the moving UE at given SNR. The performance requirements assume HARQ retransmissions.

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.3-1 are applied for both UEs. The received power for both UEs is the same. The resource blocks allocated for both UEs are consecutive.

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

#### 8.2.3.2 Minimum Requirement

The minimum requirement is in TS 38.108 [2] clause 8.2.3.

#### 8.2.3.3 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.

#### 8.2.3.4 Method of test

##### 8.2.3.4.1 Initial Conditions

Test environment: Normal, see Annex B.2.

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

##### 8.2.3.4.2 Procedure

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

2) Adjust the AWGN generator, according to combination of SCS and channel bandwidth defined in table 8.2.3.4.2-1.

Table 8.2.3.4.2-1: AWGN power level at the SAN input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 5 | -86.5 dBm / 4.5MHz |
| 30 | 10 | -83.6 dBm / 8.64MHz |
| 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 signals (transmitted by moving UE) shall be configured according to the corresponding UL reference measurement channel defined in annex A and the test parameters in Table 8.2.3.4.2-2.

Table 8.2.3.4.2-2 Test parameters for testing UL timing adjustment

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Disabled |
| 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 for moving UENID0=1, nSCID =1 for stationary UE |
| Time domain resource assignment | PUSCH mapping type | A, B |
| Allocation length | 14  |
| Frequency domain resource assignment | RB assignment | 5 MHz CBW/15kHz SCS: 12 RB for each UE10MHz CBW/30kHz SCS: 12 RB for each UE  |
| Starting PRB index | Moving UE: 0 Stationary UE: 12 for 5MHz CBW/15kHz SCS,12 for 10MHz CBW/30kHz SCS |
| Frequency hopping | Disabled |
| SRS resource allocation | Slots in which sounding RS is transmitted (Note2) | For FDD: slot #1 in radio frames |
| SRS resource allocation | 15 kHz SCS:CSRS =5, BSRS =0, for 20 RB30 kHz SCS:CSRS =5, BSRS =0, for 20 RB |
| NOTE 2: The transmission of SRS is optional. And the transmission comb and SRS periodic are configured as KTC = 2, and TSRS = 10 for 15 kHz SCS, TSRS = 20 for 30 kHz SCS respectively.  |

4) The multipath fading emulators shall be configured according to the corresponding channel model defined in annex G.3.

5) Adjust the equipment so that required SNR specified in Table 8.2.3.5-1 to Table 8.2.3.5-2 is achieved at the SAN input for normal mode.

6) For each of the reference channels in Table 8.2.3.5-1 to Table 8.2.3.5-2 applicable for the base station, measure the throughput for normal mode.

#### 8.2.3.5 Test Requirement for Normal Mode

The throughput shall be ≥ 70% of the maximum throughput of the reference measurement channel as specified in annex A for the moving UE at the SNR given in table 8.2.3.5-1 for mapping type A and table 8.2.3.5-2 for mapping type B respectively.

Table 8.2.3.5-1: Test requirements for UL timing adjustment with mapping type A

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Channel Bandwidth [MHz] | SCS [kHz] | Moving propagation conditions and correlation matrix (Annex G) | FRC(Annex A) | SNR[dB] |
| 1 | 1 | Normal | 5 | 15 | Scenario X |  G-FR1-A3-5 | 4.7 |
|  | 10 | 30 | Scenario X |  G-FR1-A3-6 | 4.2 |
| 2 | Normal | 5 | 15 | Scenario X |  G-FR1-A3-5 | 0.3 |
|  | 10 | 30 | Scenario X |  G-FR1-A3-6 | 0.1 |

Table 8.2.3.5-2: Test requirements for UL timing adjustment with mapping type B

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Channel Bandwidth [MHz] | SCS [kHz] | Moving propagation conditions and correlation matrix (Annex G) | FRC(Annex A) | SNR[dB] |
| 1 | 1 | Normal | 5 | 15 | Scenario X |  G-FR1-A3-5 | 4.8 |
|  | 10 | 30 | Scenario X |  G-FR1-A3-6 | 4.2 |
| 2 | Normal | 5 | 15 | Scenario X |  G-FR1-A3-5 | 0.3 |
|  | 10 | 30 | Scenario X |  G-FR1-A3-6 | 0.2 |

**<< Skip un-modified clauses >>**

A.3A Fixed Reference Channels for performance requirements (QPSK, R=99/1024)

The parameters for the reference measurement channel are specified in table A.3A-1 for FR1 PUSCH performance requirements:

- FRC parameters are specified in table A.3A-1 for FR1 PUSCH with transform precoding disabled, additional DM-RS position = pos1 and 1 transmission layer.

Table A.3A-1: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, additional DM-RS position = pos1 and 1 transmission layer (QPSK, R=99/1024)

|  |  |  |
| --- | --- | --- |
| Reference channel | G-FR1-A3A-1 | G-FR1-A3A-2 |
| Subcarrier spacing (kHz) | 15 | 30 |
| Allocated resource blocks | 25 | 24 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 |
| MCS table | 64QAMLowSE | 64QAMLowSE |
| Modulation | QPSK | QPSK |
| Code rate (Note 2) | 99/1024 | 99/1024 |
| Payload size (bits) | 704 | 672 |
| Transport block CRC (bits) | 16 | 16 |
| Code block CRC size (bits) | - | - |
| Number of code blocks - C | 1 | 1 |
| Code block size including CRC (bits) (Note 2) | 720 | 688 |
| Total number of bits per slot | 7200 | 6912 |
| Total symbols per slot | 3600 | 3456 |
| 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, and l0= 2 and l= 11 for PUSCH mapping type A, and l0= 0 and l= 10 for PUSCH type B, as per table 6.4.1.1.3-3 of TS 38.211 [8].NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [7]. |

**<< END of modifed clause >>**