**3GPP TSG-RAN WG4 Meeting #104bis-e R4-2215978**

**Electronic Meeting, 10th – 19th Oct., 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.108** | **CR** | **0014** | **rev** | **0** | **Current version:** | **17.1.0** |  |
|  |
| *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 |  |

|  |
| --- |
|  |
| ***Title:***  | Big CR on NTN SAN performance requirements (TS38.108, Rel-17) |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_NTN\_solutions-Perf |  | ***Date:*** | 2022-10-21 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories 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:*** | Introduce NTN SAN performance requirements. |
|  |  |
| ***Summary of change:*** | Collection of changes in R4-2217351, R4-2217353, R4-2217356, R4-2217360. Introduce NTN SAN performance requirements with updated clauses 8, 11, A.3 and add new clause A.3A, A.4. |
|  |  |
| ***Consequences if not approved:*** | There will be inconsist between specification and RAN4 agreements. |
|  |  |
| ***Clauses affected:*** | 8, 11, A.3, A.3A, A.4 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.181 |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | New clause: A.3A, A.4. |
|  |  |
| ***This CR's revision history:*** |  |

*<START OF THE CHANGE 1>*

8 Conducted performance requirements

8.1 General

*<Text will be added.>*

8.2 Performance requirements for PUSCH

8.2.1 Requirements for PUSCH with transform precoding disabled

8.2.1.1 General

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 retransmissions.

**Table: 8.2.1.1-1 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 | {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 |

8.2.1.2 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs stated in tables 8.2.1.2-1 to 8.2.1.2-4 at the given SNR. FRCs are defined in annex A.

**Table 8.2.1.2-1: Minimum 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 | TBD |
| Normal | NTN-TDLC5-200 Low | 70 % | [G-FR1-A3-1] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 70 % | [G-FR1-A3-1] | pos1 | TBD |
| Normal | NTN-TDLC5-200 Low | 70% | [G-FR1-A3-1] | pos1 | TBD |

**Table 8.2.1.2-2: Minimum 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 | TBD |
| Normal | NTN-TDLC5-200 Low | 70 % | [G-FR1-A3-2] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 70 % | [G-FR1-A3-2] | pos1 | TBD |
| Normal | NTN-TDLC5-200 Low | 70% | [G-FR1-A3-2] | pos1 | TBD |

**Table 8.2.1.2-3: Minimum 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 | TBD |
| Normal | NTN-TDLC5-200 Low | 70 % | [G-FR1-A3-1] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 70 % | [G-FR1-A3-1] | pos1 | TBD |
| Normal | NTN-TDLC5-200 Low | 70% | [G-FR1-A3-1] | pos1 | TBD |

**Table 8.2.1.2-4: Minimum 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 | TBD |
| Normal | NTN-TDLC5-200 Low | 70 % | [G-FR1-A3-2] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 70 % | [G-FR1-A3-2] | pos1 | TBD |
| Normal | NTN-TDLC5-200 Low | 70% | [G-FR1-A3-2] | pos1 | TBD |

8.2.2 Requirements for PUSCH with transform precoding enabled

8.2.2.1 General

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 retransmissions.

**Table 8.2.2.1-1: 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 | {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 | Full applicable test bandwidth |
| Frequency hopping | Disabled |
| Code block group based PUSCH transmission | Disabled |

8.2.2.2 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs stated in tables 8.2.2.2-1 to 8.2.2.2-4 at the given SNR. FRCs are defined in annex A.

**Table 8.2.2.2-1: Minimum requirements for PUSCH with 70% of maximum throughput, PUSCH mapping 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 | TBD |
| Normal | NTN-TDLC5-200 Low | 70 % | [G-FR1-A3-3] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 70 % | [G-FR1-A3-3] | pos1 | TBD |
| Normal | NTN-TDLC5-200 Low | 70% | [G-FR1-A3-3] | pos1 | TBD |

**Table 8.2.2.2-2: Minimum requirements for PUSCH with 70% of maximum throughput, PUSCH mapping 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 | TBD |
| Normal | NTN-TDLC5-200 Low | 70 % | [G-FR1-A3-4] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 70 % | [G-FR1-A3-4] | pos1 | TBD |
| Normal | NTN-TDLC5-200 Low | 70% | [G-FR1-A3-4] | pos1 | TBD |

**Table 8.2.2.2-3: Minimum requirements for PUSCH with 70% of maximum throughput, PUSCH mapping 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 | TBD |
| Normal | NTN-TDLC5-200 Low | 70 % | [G-FR1-A3-3] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 70 % | [G-FR1-A3-3] | pos1 | TBD |
| Normal | NTN-TDLC5-200 Low | 70% | [G-FR1-A3-3] | pos1 | TBD |

**Table 8.2.2.2-4: Minimum requirements for PUSCH with 70% of maximum throughput, PUSCH mapping 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 | TBD |
| Normal | NTN-TDLC5-200 Low | 70 % | [G-FR1-A3-4] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 70 % | [G-FR1-A3-4] | pos1 | TBD |
| Normal | NTN-TDLC5-200 Low | 70% | [G-FR1-A3-4] | pos1 | TBD |

8.2.3 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.

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

**Table 8.2.3-1 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 | {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 |
| Start symbol | 0  |
| Allocation length | 14  |
| Frequency domain resourceassignment | RB assignment | 12 RB for each UE |
| Starting PRB index | Moving UE: 0Stationary UE: 12 |
| Frequency hopping | Disabled |
| SRS resource allocation | Slots in which sounding RS is transmitted (Note 1) | slot #1 in radio frames |
| SRS resource allocation | CSRS = 5, BSRS =0, for 20 RB |
| Code block group based PUSCH transmission | Disabled |
| NOTE 1. The transmission of SRS is optional. The transmission comb is configured as KTC = 2. The SRS periodic is configured as TSRS = 10 for 15kHz SCS and 20 for 30kHz SCS respectively. |

8.2.3.2 Minimum requirements

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 8.2.3.2-1 to table 8.2.3.2-4.

**Table 8.2.3.2-1: Minimum requirements for UL timing adjustment with 70% of maximum throughput, PUSCH mapping 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 | Scenario X | 70 % | [G-FR1-A3-5] | pos1 | TBD |
| 2 | Normal | Scenario X | 70 % | [G-FR1-A3-5] | pos1 | TBD |

**Table 8.2.3.2-2: Minimum requirements for UL timing adjustment with 70% of maximum throughput, PUSCH mapping 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 | Scenario X | 70 % | [G-FR1-A3-6] | pos1 | TBD |
| 2 | Normal | Scenario X | 70 % | [G-FR1-A3-6] | pos1 | TBD |

**Table 8.2.3.2-3: Minimum requirements for UL timing adjustment with 70% of maximum throughput, PUSCH mapping 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 | Scenario X | 70 % | [G-FR1-A3-5] | pos1 | TBD |
| 2 | Normal | Scenario X | 70 % | [G-FR1-A3-5] | pos1 | TBD |

**Table 8.2.3.2-4: Minimum requirements for UL timing adjustment with 70% of maximum throughput, PUSCH mapping 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 | Scenario X | 70 % | [G-FR1-A3-6] | pos1 | TBD |
| 2 | Normal | Scenario X | 70 % | [G-FR1-A3-6] | pos1 | TBD |

8.2.4 Requirements for PUSCH repetition Type A

8.2.4.1 General

The performance requirement of PUSCH is determined by a maximum block error probability (BLER) for a given SNR. The BLER is defined as the probability of incorrectly decoding the PUSCH information when the PUSCH information is sent. The performance requirements assume HARQ re-transmissions.

**Table: 8.2.4.1-1 Test parameters for testing PUSCH repetition Type A**

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Transform precoding | Disabled |
| HARQ | Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 3, 0, 3 [Note 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 | {0} |
| DM-RS sequence generation | NID0=0, nSCID =0 |
| Time domainresourceassignment | PUSCH mapping type | A, B |
| Start symbol | 0  |
| Allocation length | 14  |
| PUSCH aggregation factor | n2 |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth |
| Frequency hopping | Disabled |
| Code block group based PUSCH transmission | Disabled |
| Note 1: The effective RV sequence is {0, 2, 3, 1} with slot aggregation. |

8.2.4.2 Minimum requirements

The BLER shall be equal to or smaller than the required target BLER for the FRCs stated in tables 8.2.4.2-1 to 8.2.4.2-4 at the given SNR. FRCs are defined in annex A.

**Table 8.2.4.2-1: Minimum requirements for PUSCH repetition TypeA, PUSCH mapping 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])** | **Target BLER** | **FRC(Annex A)** | **Additional DM-RS position** | **SNR****(dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 1% (Note 1) | [G-FR1-A3A-1] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 1% (Note 1) | [G-FR1-A3A-1] | pos1 | TBD |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. |

**Table 8.2.4.2-2: Minimum requirements for PUSCH, PUSCH mapping Type A, 10 MHz channel bandwidth, 15 kHz SCS**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Number of TX antennas** | **Number of RX antennas** | **Cyclic prefix** | **Propagation conditions and correlation matrix (Annex [G])** | **Target BLER** | **FRC(Annex A)** | **Additional DM-RS position** | **SNR****(dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 1% (Note 1) | [G-FR1-A3A-2] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 1% (Note 1) | [G-FR1-A3A-2] | pos1 | TBD |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. |

**Table 8.2.4.2-3: Minimum requirements for PUSCH, PUSCH mapping 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])** | **Target BLER** | **FRC(Annex A)** | **Additional DM-RS position** | **SNR****(dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 1% (Note 1) | [G-FR1-A3A-1] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 1% (Note 1) | [G-FR1-A3A-1] | pos1 | TBD |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. |

**Table 8.2.4.2-4: Minimum requirements for PUSCH, PUSCH mapping Type A, 40 MHz channel bandwidth, 30 kHz SCS**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Number of TX antennas** | **Number of RX antennas** | **Cyclic prefix** | **Propagation conditions and correlation matrix (Annex [G])** | **Target BLER** | **FRC(Annex A)** | **Additional DM-RS position** | **SNR****(dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | 1% (Note 1) | [G-FR1-A3A-2] | pos1 | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | 1% (Note 1) | [G-FR1-A3A-2] | pos1 | TBD |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. |

8.3 Performance requirements for PUCCH

8.3.1 DTX to ACK probability

8.3.1.1 General

The DTX to ACK probability, i.e. the probability that ACK is detected when nothing was sent:

 $Prob\left(PUCCH DTX\rightarrow Ack bits\right)= \frac{\#(false ACK bits)}{\#\left(PUCCH DTX\right)\*\#(ACK/NACK bits)}$

where:

- #(false ACK bits) denotes the number of detected ACK bits.

- #(ACK/NACK bits) denotes the number of encoded bits per slot

- #(PUCCH DTX) denotes the number of DTX occasions

8.3.1.2 Minimum requirement

The DTX to ACK probability shall not exceed 1% for all PUCCH formats carrying ACK/NACK bits:

 $Prob\left(PUCCH DTX\rightarrow Ack bits\right) \leq 10^{-2}$

8.3.2 Performance requirements for PUCCH format 0

8.3.2.1 General

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

**Table 8.3.2.1-1: Test Parameters**

|  |  |
| --- | --- |
| **Parameter** | **Test** |
| Number of UCI information bits | 1 |
| Number of PRBs | 1 |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | Enabled |
| First PRB after frequency hopping | N/A |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Initial cyclic shift | 0 |
| First symbol | 12 for 2 symbols |

The transient period as specified in TS 38.101-1 [xx] clause 6.3.3.1 is not taken into account for performance requirement testing, where the RB hopping is symmetric to the CC centre, i.e. intra-slot frequency hopping is enabled.

8.3.2.2 Minimum requirements

The ACK missed detection probability shall not exceed 1% at the SNR given in table 8.3.2.2-1 and in table 8.3.2.2-2.

**Table 8.3.2.2-1: Minimum requirements for PUCCH format 0, 15 kHz SCS and 5MHz channel bandwidth**

|  |  |  |  |
| --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | NTN-TDLA100-200 Low | TBD |
| 2 | NTN-TDLA100-200 Low | TBD |

**Table 8.3.2.2-2: Minimum requirements for PUCCH format 0, 30 kHz SCS and 10MHz channel bandwidth**

|  |  |  |  |
| --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | NTN-TDLA100-200 Low | TBD |
| 2 | NTN-TDLA100-200 Low | TBD |

8.3.3 Performance requirements for PUCCH format 1

8.3.3.1 NACK to ACK requirements

8.3.3.1.1 General

The NACK to ACK detection probability is the probability that an ACK bit is falsely detected when an NACK bit was sent on the particular bit position, where the NACK to ACK detection probability is defined as follows:

 **,

where:

- denotes the total number of NACK bits transmitted

- denotes the number of NACK bits decoded as ACK bits at the receiver, i.e. the number of received ACK bits

- 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.

Random codeword selection is assumed.

**Table 8.3.3.1.1-1: Test Parameters**

|  |  |
| --- | --- |
| **Parameter** | **Test** |
| Number of information bits | 2 |
| Number of PRBs | 1 |
| Number of symbols | 14 |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | enabled |
| First PRB after frequency hopping | The largest PRB index – (nrofPRBs – 1) |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Initial cyclic shift | 0 |
| First symbol | 0 |
| Index of orthogonal cover code (*timeDomainOCC*) | 0 |

The transient period as specified in TS 38.101-1 [xx] clause 6.3.3.1 is not taken into account for performance requirement testing, where the RB hopping is symmetric to the CC centre, i.e. intra-slot frequency hopping is enabled.

8.3.3.1.2 Minimum requirements

The NACK to ACK probability shall not exceed 0.1% at the SNR given in table 8.3.3.1.2-1 and table 8.3.3.1.2-2.

**Table 8.3.3.1.2-1: Minimum requirements for PUCCH format 1, 15 kHz SCS and 5MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

**Table 8.3.3.1.2-2: Minimum requirements for PUCCH format 1, 30 kHz SCS and 10MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

8.3.3.2 ACK missed detection requirements

8.3.3.2.1 General

The ACK missed detection probability is the probability of not detecting an ACK when an ACK was sent. The test parameters in table 8.3.3.1.1-1 are configured.

The transient period as specified in TS 38.101-1 [xx] clause 6.3.3.1 is not taken into account for performance requirement testing, where the RB hopping is symmetric to the centre, i.e. intra-slot frequency hopping is enabled.

8.3.3.2.2 Minimum requirements

The ACK missed detection probability shall not exceed 1% at the SNR given in table 8.3.3.2.2-1 and in table 8.3.3.2.2-2.

**Table 8.3.3.2.2-1: Minimum requirements for PUCCH format 1, 15 kHz SCS and 5MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

**Table 8.3.3.2.2-2: Minimum requirements for PUCCH format 1, 30 kHz SCS and 10MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

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 |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | N/A  |
| First PRB after 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 |

The transient period as specified in TS 38.101-1 [xx] clause 6.3.3.1 is not taken into account for performance requirement testing, where the RB hopping is symmetric to the CC center, i.e. intra-slot frequency hopping is enabled.

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 4 UCI bits.

**Table 8.3.4.1.2-1: Minimum requirements for PUCCH format 2, 15 kHz SCS and 5MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

**Table 8.3.4.1.2-2: Minimum requirements for PUCCH format 2, 30 kHz SCS and 10MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

8.3.4.2 UCI BLER performance requirements

8.3.4.2.1 General

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 part1 and part 2.

The transient period as specified in TS 38.101-1 [xx] clause 6.3.3.1 is not taken into account for performance requirement testing, where the RB hopping is symmetric to the CC centre, i.e. intra-slot frequency hopping is enabled.

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

**Table 8.3.4.2.1-1: Test Parameters**

|  |  |
| --- | --- |
| **Parameter** | **Value**  |
| Modulation order | QSPK |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | enabled |
| Frist PRB after frequency hopping | The largest PRB index – (Number of PRBs – 1) |
| Number of PRBs | 9 |
| Number of symbols | 2 |
| The number of UCI information bits | 22 |
| First symbol | 12 |
| DM-RS sequence generation | *NID*0=0 |

8.3.4.2.2 Minimum requirements

The UCI block error probability shall not exceed 1% at the SNR given in table 8.3.4.2.2-1 and table 8.3.4.2.2-2 for 22 UCI bits.

**Table 8.3.4.2.2-1: Minimum requirements for PUCCH format 2, 15 kHz SCS and 5MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

**Table 8.3.4.2.2-2: Minimum requirements for PUCCH format 2, 30 kHz SCS and 10MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

8.3.5 Performance requirements for PUCCH format 3

8.3.5.1 General

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

The UCI block error probability is defined as the conditional probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part1 and part 2.

The transient period as specified in TS 38.101-1 [xx] clause 6.3.3.1 is not taken into account for performance requirement testing, where the RB hopping is symmetric to the centre, i.e. intra-slot frequency hopping is enabled.

**Table 8.3.5.1-1: Test Parameters**

|  |  |
| --- | --- |
| **Parameter** | **Test**  |
| Modulation order | QPSK |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | enabled |
| First PRB after frequency hopping | The largest PRB index – (Number of PRBs – 1) |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Number of PRBs | 1 |
| Number of symbols | 14 |
| The number of UCI information bits | 16 |
| First symbol | 0 |

8.3.5.2 Minimum requirements

The UCI block error probability shall not exceed 1% at the SNR given in Table 8.3.5.2-1 and Table 8.3.5.2-2.

**Table 8.3.5.2-1: Minimum requirements for PUCCH format 3, 15 kHz SCS and 5MHz channel bandwidth**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **Additioan DM-RS configuration** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | No additional DM-RS | TBD |
| Additional DM-RS | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | No additional DM-RS | TBD |
| Additional DM-RS | TBD |

**Table 8.3.5.2-2: Minimum requirements for PUCCH format 3, 30 kHz SCS and 10MHz channel bandwidth**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **Additioan DM-RS configuration** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | No additional DM-RS | TBD |
| Additional DM-RS | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | No additional DM-RS | TBD |
| Additional DM-RS | TBD |

8.3.6 Performance requirements for PUCCH format 4

8.3.6.1 General

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

The UCI block error probability is defined as the conditional probability of incorrectly decoding the UCI information when the UCI information is sent. The UCI information does not contain CSI part1 and part 2.

The transient period as specified in TS 38.101-1 [xx] clause 6.3.3.1 is not taken into account for performance requirement testing, where the RB hopping is symmetric to the centre, i.e. intra-slot frequency hopping is enabled.

**Table 8.3.6.1-1: Test parameters**

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Modulation order | QPSK |
| First PRB prior to frequency hopping | 0 |
| Number of PRBs | 1 |
| Intra-slot frequency hopping | enabled |
| First PRB after frequency hopping | The largest PRB index – (Number of PRBs – 1) |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Number of symbols | 14 |
| The number of UCI information bits | 22 |
| First symbol | 0 |
| Length of the orthogonal cover code | n2 |
| Index of the orthogonal cover code | n0 |

8.3.6.2 Minimum requirement

The UCI block error probability shall not exceed 1% at the SNR given in Table 8.3.6.2-1 and Table 8.3.6.2-2.

**Table 8.3.6.2-1: Minimum requirements for PUCCH format 4, 15 kHz SCS and 5MHz channel bandwidth**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **Additioan DM-RS configuration** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | No additional DM-RS | TBD |
| Additional DM-RS | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | No additional DM-RS | TBD |
| Additional DM-RS | TBD |

**Table 8.3.6.2-2: Minimum requirements for PUCCH format 4, 30 kHz SCS and 10MHz channel bandwidth**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Number of** **TX antennas** | **Number of RX** **antennas** | **Cyclis Prefix** | **Propagation conditions and****correlation matrix (Annex X)** | **Additioan DM-RS configuration** | **SNR (dB)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | No additional DM-RS | TBD |
| Additional DM-RS | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | No additional DM-RS | TBD |
| Additional DM-RS | TBD |

8.3.7 Performance requirements for multi-slot PUCCH

8.3.7.1 General

8.3.7.2 Performance requirements for multi-slot PUCCH format 1

8.3.7.2.1 NACK to ACK requirements

8.3.7.2.1.1 General

The NACK to ACK detection probability is the probability that an ACK bit is falsely detected when a NACK bit was sent on the particular bit position, where the NACK to ACK detection probability is defined as follows:

 **,

where:

- denotes the total number of NACK bits transmitted

- denotes the number of NACK bits decoded as ACK bits at the receiver, i.e., the number of received ACK bits

- 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.

Random codeword selection is assumed.

**Table 8.3.7.2.1.1-1: Test Parameters for multi-slot PUCCH format 1**

|  |  |
| --- | --- |
| **Parameter** | **Test** |
| Number of information bits | 2 |
| Number of PRBs | 1 |
| Number of symbols | 14 |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | disabled |
| Inter-slot frequency hopping  | enabled |
| First PRB after frequency hopping | The largest PRB index – (nrofPRBs – 1) |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Initial cyclic shift | 0 |
| First symbol | 0 |
| Index of orthogonal cover code (*timeDomainOCC*) | 0 |
| Number of slots for PUCCH repetition | 2 |

8.3.7.2.1.2 Minimum requirements

The multi-slot NACK to ACK probability shall not exceed 0.1% at the SNR given in table 8.3.7.2.1.2-1 and 8.3.7.2.1.2-2.

**Table 8.3.7.2.1.2-1: Minimum requirements for multi-slot PUCCH format 1 with 15kHz SCS 5MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of TX** | **Number of RX** | **Cyclic Prefix** | **Propagation conditions and correlation matrix** | **SNR (dB)** |
| **antennas** | **antennas** |  | **(Annex G)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

**Table 8.3.7.2.1.2-2: Minimum requirements for multi-slot PUCCH format 1 with 30kHz SCS 10MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of TX** | **Number of RX** | **Cyclic Prefix** | **Propagation conditions and correlation matrix** | **SNR (dB)** |
| **antennas** | **antennas** |  | **(Annex G)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

8.3.7.2.2 ACK missed detection requirements

8.3.7.2.2.1 General

The ACK missed detection probability is the probability of not detecting an ACK when an ACK was sent. The test parameters in table 8.3.7.2.1.1-1 are configured.

8.3.7.2.2.2 Minimum requirements

The multi-slot ACK missed detection probability shall not exceed 1% at the SNR given in table 8.3.7.2.2.2-1 and 8.3.7.2.2.2-2.

**Table 8.3.7.2.2.2-1: Minimum requirements for multi-slot PUCCH format 1 with 15kHz SCS 5MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of TX** | **Number of RX** | **Cyclic Prefix** | **Propagation conditions and correlation matrix** | **SNR (dB)** |
| **antennas** | **antennas** |  | **(Annex G)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

**Table 8.3.7.2.2.2-2: Minimum requirements for multi-slot PUCCH format 1 with 30kHz SCS 10MHz channel bandwidth**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of TX** | **Number of RX** | **Cyclic Prefix** | **Propagation conditions and correlation matrix** | **SNR (dB)** |
| **antennas** | **antennas** |  | **(Annex G)** |
| 1 | 1 | Normal | NTN-TDLA100-200 Low | TBD |
| 2 | Normal | NTN-TDLA100-200 Low | TBD |

8.4 Performance requirements for PRACH

8.4.1 PRACH False alarm probability

8.4.1.1 General

The false alarm requirement is valid for any number of receive antennas, for any channel bandwidth.

The false alarm probability is the conditional total probability of erroneous detection of the preamble (i.e. erroneous detection from any detector) when input is only noise.

8.4.1.2 Minimum requirement

The false alarm probability shall be less than or equal to 0.1%.

8.4.2 PRACH detection requirements

8.4.2.1 General

The probability of detection is the conditional probability of correct detection of the preamble when the signal is present. There are several error cases – detecting different preamble than the one that was sent, not detecting a preamble at all or correct preamble detection but with the wrong timing estimation. For AWGN, NTN-TDLA100, a timing estimation error occurs if the estimation error of the timing of the strongest path is larger than the time error tolerance given in Table 8.4.2.1-1.

**Table 8.4.2.1-1: Time error tolerance for AWGN, NTN-TDLA100**

|  |  |  |
| --- | --- | --- |
| **PRACH** | **PRACH SCS** | **Time error tolerance** |
| **preamble** | **(kHz)** | **AWGN** | **NTN-TDLA100** |
| 0 | 1.25 | 1.04 us | 1.324 us |
| 2 | 1.25 | 1.04 us | 1.324 us |
| B4, C2 | 15 | 0.52 us | 0.804 us |
| 30 | 0.26 us | 0.544 us |

The test preambles are listed in table [A.4] and the test parameter *msg1-FrequencyStart* is set to 0.

8.4.2.2 Minimum requirements

The probability of detection shall be equal to or exceed 99% for the SNR levels listed in Tables 8.4.2.2-1 to 8.4.2.2-3.

**Table 8.4.2.2-1: PRACH missed detection test requirements, 1.25 kHz SCS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of TX** **antennas** | **Number of demodulation** **branches** | **Propagation conditions and** **correlation matrix (annex J)** | **Frequency offset** | **SNR (dB)** |
| **Burst format 0** | **Burst format 2** |
| 1 | 1 | AWGN | 0 | TBD | TBD |
| NTN-TDLA100 Low | 200 Hz  | TBD | TBD |
| 2 | AWGN | 0 | -14.5 | TBD |
| NTN-TDLA100 Low | 200 Hz  | TBD | TBD |

**Table 8.4.2.2-2: PRACH missed detection test requirements, 15 kHz SCS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of TX** **antennas** | **Number of demodulation** **branches** | **Propagation conditions and** **correlation matrix (annex J)** | **Frequency offset** | **SNR (dB)** |
| **Burst format B4** | **Burst format C2** |
| 1 | 1 | AWGN | 0 | TBD | TBD |
| NTN-TDLA100 Low | 200 Hz  | TBD | TBD |
| 2 | AWGN | 0 | -16.8 | -12.5 |
| NTN-TDLA100 Low | 200 Hz  | TBD | TBD |

**Table 8.4.2.2-3: PRACH missed detection test requirements, 30 kHz SCS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of TX** **antennas** | **Number of demodulation** **branches** | **Propagation conditions and** **correlation matrix (annex J)** | **Frequency offset** | **SNR (dB)** |
| **Burst format B4** | **Burst format C2** |
| 1 | 1 | AWGN | 0 | TBD | TBD |
| NTN-TDLA100 Low | 200 Hz  | TBD | TBD |
| 2 | AWGN | 0 | -16.5 | -11.9 |
| NTN-TDLA100 Low | 200 Hz  | TBD | TBD |

*<END OF THE CHANGE 1>*

*<START OF THE CHANGE 2>*

11 Radiated performance requirements

11.1 General

*<Text will be added.>*

11.2 Performance requirements for PUSCH

11.2.1 Requirements for PUSCH with transform precoding disabled

Apply the requirements defined in clause 8.2.1.

11.2.2 Requirements for PUSCH with transform precoding enabled

Apply the requirements defined in clause 8.2.2.

11.2.3 Requirements for UL timing adjustment

Apply the requirements defined in clause 8.2.3.

11.2.4 Requirements for PUSCH repetition Type A

Apply the requirements defined in clause 8.2.4.

11.3 Performance requirements for PUCCH

11.3.1 Requirements for *SAN type 1-O*

11.3.1.1 DTX to ACK probability

Apply the requirements defined in clause 8.3.1

11.3.1.2 Performance requirements for PUCCH format 0

Apply the requirements defined in clause 8.3.2 for 1Rx and 2Rx.

11.3.1.3 Performance requirements for PUCCH format 1

Apply the requirements defined in sub-clause 8.3.3 for 1Rx and 2Rx.

11.3.1.4 Performance requirements for PUCCH format 2

Apply the requirements defined in clause 8.3.4 for 1Rx and 2Rx.

11.3.1.5 Performance requirements for PUCCH format 3

Apply the requirements defined in clause 8.3.5 for 1Rx and 2Rx.

11.3.1.6 Performance requirements for PUCCH format 4

Apply the requirements defined in clause 8.3.6 for 1Rx and 2Rx.

11.3.1.7 Performance requirements for multi-slot PUCCH

Apply the requirements defined in clause 8.3.7 for 1Rx and 2Rx.

11.4 Performance requirements for PRACH

11.4.1 PRACH False alarm probability

Apply the requirements defined in clause 8.4.1.

11.4.2 PRACH detection requirements

Apply the requirements defined in clause 8.4.2.

*<END OF THE CHANGE 2>*

*<START OF THE CHANGE 3>*

A.3 Fixed Reference Channels for performance requirements (QPSK, R=308/1024)

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

- FRC parameters are specified in table A.3-1 for FR1 PUSCH with transform precoding disabled, additional DM-RS position = pos0 and 1 transmission layer.

- FRC parameters are specified in table A.3-2 for FR1 PUSCH with transform precoding enabled, additional DM-RS position = pos0 and 1 transmission layer.

**Table A.3-1: FRC parameters for FR1 PUSCH performance requirements, transform precoding disabled, additional DM-RS position = pos1 and 1 transmission layer (QPSK, R=308/1024)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Reference channel** | **G-FR1-A3-1** | **G-FR1-A3-2** | **G-FR1-A3-3** | **G-FR1-A3-4** |
| Subcarrier spacing (kHz) | 15 | 15 | 30 | 30 |
| Allocated resource blocks | 25 | 12 | 24 | 12 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 308/1024 | 308/1024 | 308/1024 | 308/1024 |
| Payload size (bits) | 2152 | 1032 | 2024 | 1032 |
| Transport block CRC (bits) | 16 | 16 | 16 | 16 |
| Code block CRC size (bits) | - | - | - | - |
| Number of code blocks - C | 1 | 1 | 1 | 1 |
| Code block size including CRC (bits) (Note 2) | 2168 | 1048 | 2040 | 1048 |
| Total number of bits per slot | 7200 | 3456 | 6912 | 3456 |
| Total resource elements per slot | 3600 | 1728 | 3456 | 1728 |
| 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 [10]. |

**Table A.3-2: FRC parameters for FR1 PUSCH performance requirements, transform precoding enabled, additional DM-RS position = pos1 and 1 transmission layer (QPSK, R=308/1024)**

|  |  |  |
| --- | --- | --- |
| **Reference channel** | **G-FR1-A3-5** | **G-FR1-A3-6** |
| Subcarrier spacing (kHz) | 15 | 30 |
| Allocated resource blocks | 25 | 24 |
| Data bearing CP-OFDM Symbols per slot (Note 1) | 12 | 12 |
| Modulation | QPSK | QPSK |
| Code rate (Note 2) | 308/1024 | 308/1024 |
| Payload size (bits) | 2152 | 2088 |
| 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) | 2168 | 2104 |
| Total number of bits per slot | 7200 | 6912 |
| Total resource elements 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, *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 [10]. |

*<END OF THE CHANGE 3>*

*<START OF THE CHANGE 4>*

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 |
| Data beraing CP-OFDM Symbols per slot (Note 1) | 12 | 12 |
| 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 resource elements 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, *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 [10]. |

*<END OF THE CHANGE 4>*

*<START OF THE CHANGE 5>*

A.4 PRACH test preambles

**Table A.4-1 Test preambles in FR1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Burst format** | **SCS (kHz)** | **Ncs** | **Logical sequence index** | **v** |
| 0 | 1.25 | 13 | 22 | 32 |
| 2 | 1.25 | 13 | 22 | 32 |
|  B4, C2 | 15 | 23 | 0 | 0 |
| 30 | 46 | 0 | 0 |

*<END OF THE CHANGE 5>*