**3GPP TSG-RAN WG4 Meeting #98-bis-e *R4-2106166***

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.104** | **CR** | **DRAFT** | **rev** | **-** | **Current version:** | **16.7.0** |  |
|  | | | | | | | | |
| *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 draftCR for NR-U BS demodulation requirements in TS 38.104 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei,HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_unlic-Perf | | | | |  | ***Date:*** | | | 2021-04-22 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The draft CRs for NR-U PUSCH, PUCCH and PRACH requirements were endorsed in RAN 4 98-bis-e meeting and corrosponding big CR should be prepared as per the work arrangement. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Added the following draft CRs to the big CR  - R4-2106013: Introduction of Interlaced PUSCH requirements  - R4-2106014: Introduction of FRC table  - R4-2106019: Introduction of interlaced PF0 and PF1 requirements  - R4-2106022: Introduction of interlaced PF2 and PF3 requirements  - R4-2106025: Introduction of requirements for PRACH with LRA=1151 and LRA=571 | | | | | | | | |
| ***Inte*** | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The requirements will be missing | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | New clauses: 8.2.10.1, 8.2.10.2, 8.3.8.1, 8.3.8.2 , 8.3.9.1, 8.3.9.2, 8.3.10.1, 8.3.10.2, 8.3.11.1, 8.3.11.2, 11.2.1.10, 11.3.1.8, 11.3.1.9, 11.3.1.10, 11.3.1.11  Existing clauses: A.5, A.6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.141-1; TS 38141-2 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

######################### Start of change#1 ############################

### 8.2.10 Requirements for interlaced PUSCH

#### 8.2.10.1 General

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

Table 8.2.10.1-1: Test parameters for testing PUSCH

|  |  |  |
| --- | --- | --- |
| Parameter | | Value |
| Transform precoding | | Disabled |
| Default TDD UL-DL pattern (Note 1) | | 15 kHz SCS:  3D1S1U, S=10D:2G:2U  30 kHz SCS:  7D1S2U, S=6D:4G:4U |
| HARQ | Maximum number of HARQ transmissions | 4 |
|  | RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
|  | DM-RS duration | single-symbol DM-RS |
|  | Additional DM-RS position | pos1 |
|  | Number of DM-RS CDM group(s) without data | 2 |
|  | Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
|  | DM-RS port(s) | 0 |
|  | DM-RS sequence generation | NID0=0, nSCID =0 |
| Time domain | PUSCH mapping type | A, B |
| resource | Start symbol | 0 |
| assignment | Allocation length | 14 |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth.  Frist interlace with RBs 0,10,20,…,100 are allocated for tests with 15kHz and first interlace with RBs 0,5,10,…50 are allocated for tests with 30kHz. |
|  | Frequency hopping | Disabled |
| Code block group based PUSCH transmission | | Disabled |
| NOTE 1: The same requirements are applicable to FDD and TDD with different UL-DL patterns. | | |

#### 8.2.10.2 Minimum requirements

The throughput shall be equal to or larger than the fraction of maximum throughput for the FRCs stated in tables 8.2.10.2-1 to 8.2.10.2-4 at the given SNR. FRCs are defined in annex A.

Table 8.2.10.2-1: Minimum requirements for PUSCH with 70% of maximum throughput, Type A, 20 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC (Annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 70% | G-FR1-A5-15 | pos1 | TBD |

Table 8.2.10.2-2: Minimum requirements for PUSCH with 70% of maximum throughput, Type A, 20 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC (Annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 70% | G-FR1-A5-16 | pos1 | TBD |

Table 8.2.10.2-3: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 20 MHz channel bandwidth, 15 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC (Annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 70% | G-FR1-A5-15 | pos1 | TBD |

Table 8.2.10.2-4: Minimum requirements for PUSCH with 70% of maximum throughput, Type B, 20 MHz channel bandwidth, 30 kHz SCS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of TX antennas | Number of RX antennas | Cyclic prefix | Propagation conditions and correlation matrix (Annex G) | Fraction of maximum throughput | FRC (Annex A) | Additional DM-RS position | SNR  (dB) |
| 1 | 2 | Normal | TDLA30-10 Low | 70% | G-FR1-A5-16 | pos1 | TBD |

######################### End of change#1 ############################

### 8.3.7 Performance requirements for multi-slot PUCCH

######################### Start of change#2 ############################

### 8.3.8 Performance requirements for interlaced PUCCH format 0

#### 8.3.8.1 General

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

The ACK missed detection probability performance requirement only apply to PUCCH format 0 with 1 UCI bit. The UCI information only contain ACK/NACK information.

The 1bit UCI information is further defined with the bitmap as [0].

Table 8.3.8.1-1: Test Parameters

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

#### 8.3.8.2 Minimum requirements

The ACK missed detection probability shall not exceed 1% at the SNR given in table 8.3.8.2-1

Table 8.3.8.2-1: Minimum requirements for interlaced PUCCH format 0 with 15 kHz SCS, 20MHz channel bandwidth

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

Table 8.3.8.2-2: Minimum requirements for interlaced PUCCH format 0 with 30 kHz SCS, 20MHz channel bandwidth

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

### 8.3.9 Performance requirements for interlaced PUCCH format 1

#### 8.3.9.1 NACK to ACK requirements

##### 8.3.9.1.1 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.

The NACK to ACK detection probability performance requirement only apply to PUCCH format 1 with 2 UCI bits. The UCI information only contain ACK/NACK information.

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

Table 8.3.9.1.1-1: Test Parameters

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

##### 8.3.9.1.2 Minimum requirements

The NACK to ACK probability shall not exceed 0.1% at the SNR given in table 8.3.9.1.2-1.

Table 8.3.9.1.2-1: Minimum requirements for interlaced PUCCH format 1 with 15 kHz SCS, 20MHz channel bandwidth

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

Table 8.3.9.1.2-2: Minimum requirements for interlaced PUCCH format 1 with 30 kHz SCS, 20MHz channel bandwidth

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

#### 8.3.9.2 ACK missed detection requirements

##### 8.3.9.2.1 General

The ACK missed detection probability is the probability of not detecting an ACK when an ACK was sent. The test parameters in table 8.3.9.1.1-1 are configured.

The ACK missed detection probability performance requirement only apply to PUCCH format 1 with 2 UCI bits. The UCI information only contain ACK/NACK information.

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

##### 8.3.9.2.2 Minimum requirements

The ACK missed detection probability shall not exceed 1% at the SNR given in table 8.3.9.2.2-1.

Table 8.3.9.2.2-1: Minimum requirements for interlaced PUCCH format 1 with 15 kHz SCS, 20MHz channel bandwidth

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

Table 8.3.9.2.2-2: Minimum requirements for interlaced PUCCH format 1 with 30 kHz SCS, 20MHz channel bandwidth

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

######################### End of change#2 ############################

######################### Start of change#3 ############################

### 8.3.10 Performance requirements for interlaced PUCCH format 2

#### 8.3.10.1 General

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

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

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

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

**Table 8.3.10.1-1: Test Parameters**

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

#### 8.3.10.2 Minimum requirements

The UCI block error probability shall not exceed 1% at the SNR given in table 8.3.10.2-1 and table 8.3.10.2-2 for 22 UCI bits.

**Table 8.3.10.2-1: Minimum requirements for interlaced PUCCH format 2 with 15 kHz SCS, 20 MHz channel bandwidth**

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

**Table 8.3.10.2-2: Minimum requirements for interlaced PUCCH format 2 with 30 kHz SCS, 20 MHz channel bandwidth**

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

### 8.3.11 Performance requirements for interlaced PUCCH format 3

#### 8.3.11.1 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 3 with 4 UCI bits. The UCI information only contains ACK/NACK information.

The 4 bits UCI information case is further defined with the bitmap as [0 0 0 0].

**Table 8.3.11.1-1: Test Parameters**

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

#### 8.3.11.2 Minimum requirements

The ACK missed detection probability shall not exceed 1% at the SNR given in table 8.3.11.2-1 and table 8.3.11.2-2 for 4UCI bits.

**Table 8.3.11.2-1: Minimum requirements for interlaced PUCCH format 3 with 15 kHz SCS, 20 MHz channel bandwidth**

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

**Table 8.3.11.2-2: Minimum requirements for interlaced PUCCH format 3 with 30 kHz SCS, 20 MHz channel bandwidth**

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

######################### End of change#3 ############################

######################### Start of change#4 ############################

### 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, TDLC300-100 and TDLA30-10, 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.

The performance requirements for high speed train (table 8.4.23-1 to 8.4.2.3-4) are optional.

Table 8.4.2.1-1: Time error tolerance for AWGN, TDLC300-100 and TDLA30-10

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PRACH | PRACH SCS | Time error tolerance | | |
| preamble | (kHz) | AWGN | TDLC300-100 | TDLA30-10 |
| 0 | 1.25 | 1.04 us | 2.55 us | N/A |
| A1, A2, A3, B4, | 15 | 0.52 us | 2.03 us | 0.67 us |
| C0, C2 | 30 | 0.26 us | 1.77 us | 0.41 us |

The test preambles for normal mode are listed in table A.6-1 and the test parameter *msg1-FrequencyStart* is set to 0. The test preambles for high speed train restricted set type A are listed in A.6-3 and the test preambles for high speed train restricted set type B are listed in A.6-4. The test parameter *msg1-FrequencyStart* for high speed train is set to 0.

The test preambles for PRACH with LRA=1151 and LRA=571 are listed in table A.6-6.

#### 8.4.2.2 Minimum requirements for Normal Mode

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 requirements for Normal Mode, 1.25 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of TX | Number of RX | Propagation conditions and | Frequency offset | SNR (dB) |
| antennas | antennas | correlation matrix (Annex G) |  | Burst format 0 |
| 1 | 2 | AWGN | 0 | -14.5 |
|  |  | TDLC300-100 Low | 400 Hz | -6.6 |
|  | 4 | AWGN | 0 | -16.7 |
|  |  | TDLC300-100 Low | 400 Hz | -11.9 |
|  | 8 | AWGN | 0 | -18.9 |
|  |  | TDLC300-100 Low | 400 Hz | -15.8 |

Table 8.4.2.2-2: PRACH missed detection requirements for Normal Mode, 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of |  | Propagation | Frequency | SNR (dB) | | | | | |
| TX antennas | Number of RX antennas | conditions and correlation matrix (Annex G) | offset | Burst format A1 | Burst format A2 | Burst format A3 | Burst format B4 | Burst format C0 | Burst format C2 |
| 1 | 2 | AWGN | 0 | -9.3 | -12.6 | -14.2 | -16.8 | -6.3 | -12.5 |
|  |  | TDLC300-100 Low | 400 Hz | -2.1 | -4.8 | -6.6 | -8.8 | 0.8 | -4.9 |
|  | 4 | AWGN | 0 | -11.6 | -14.3 | -16.0 | -19.0 | -8.7 | -14.1 |
|  |  | TDLC300-100 Low | 400 Hz | -7.3 | -10.3 | -11.7 | -13.8 | -4.3 | -10.2 |
|  | 8 | AWGN | 0 | -13.8 | -16.7 | -18.2 | -21.2 | -11.1 | -16.6 |
|  |  | TDLC300-100 Low | 400 Hz | -11.0 | -13.9 | -15.2 | -17.3 | -8.1 | -13.9 |

Table 8.4.2.2-3: PRACH missed detection requirements for Normal Mode, 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number of |  | Propagation | Frequency | SNR (dB) | | | | | |
| TX antennas | Number of RX antennas | conditions and correlation matrix (Annex G) | offset | Burst format A1 | Burst format A2 | Burst format A3 | Burst format B4 | Burst format C0 | Burst format C2 |
| 1 | 2 | AWGN | 0 | -9.1 | -12.0 | -13.8 | -16.5 | -6.1 | -11.9 |
|  |  | TDLC300-100 Low | 400 Hz | -2.8 | -5.7 | -7.4 | -9.9 | 0.1 | -5.6 |
|  | 4 | AWGN | 0 | -11.4 | -14.2 | -15.9 | -19.0 | -8.6 | -14.1 |
|  |  | TDLC300-100 Low | 400 Hz | -7.2 | -10.4 | -12.0 | -14.5 | -4.5 | -10.4 |
|  | 8 | AWGN | 0 | -13.7 | -16.6 | -18.1 | -21.1 | -11.0 | -16.5 |
|  |  | TDLC300-100 Low | 400 Hz | -10.7 | -13.7 | -15.1 | -17.6 | -7.8 | -13.7 |

Table 8.4.2.2-4: Void

Table 8.4.2.2-5: Void

#### 8.4.2.3 Minimum requirements for high speed train

The probability of detection shall be equal to or exceed 99% for the SNR levels listed in Tables 8.4.2.3-1 to 8.4.2.3-4

Table 8.4.2.3-1: PRACH missed detection requirements for high speed train, burst format 0, restricted set type A, 1.25 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of TX | Number of RX | Propagation conditions and | Frequency offset | SNR (dB) |
| antennas | antennas | correlation matrix (Annex G) |  | Burst format 0 |
| 1 | 2 | AWGN | 625 Hz | -12.0 |
|  |  | AWGN | 1340 Hz | -13.8 |
|  |  | TDLC300-100 Low | 0 Hz | [-6. 3] |
|  | 4 | AWGN | 625 Hz | -14.5 |
|  |  | AWGN | 1340 Hz | -16.2 |
|  |  | TDLC300-100 Low | 0 Hz | [-11. 8] |
|  | 8 | AWGN | 625 Hz | -16.5 |
|  |  | AWGN | 1340 Hz | -18.4 |
|  |  | TDLC300-100 Low | 0 Hz | [-16. 2] |

Table 8.4.2.3-2: PRACH missed detection requirements for high speed train, burst format 0, restricted set type B, 1.25 kHz SCS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of TX | Number of RX | Propagation conditions and | Frequency offset | SNR (dB) |
| antennas | antennas | correlation matrix (Annex G) |  | Burst format 0 |
| 1 | 2 | AWGN | 625 Hz | -11.6 |
|  |  | AWGN | 2334 Hz | -13.1 |
|  |  | TDLC300-100 Low | 0 Hz | [-6. 0] |
|  | 4 | AWGN | 625 Hz | -14.0 |
|  |  | AWGN | 2334 Hz | -15.4 |
|  |  | TDLC300-100 Low | 0 Hz | [-11. 7] |
|  | 8 | AWGN | 625 Hz | -16.3 |
|  |  | AWGN | 2334 Hz | -17.4 |
|  |  | TDLC300-100 Low | 0 Hz | [-16. 0] |

Table 8.4.2.3-3: PRACH missed detection requirements for high speed train, 15 kHz SCS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of | Number of | Propagation | Frequency | SNR (dB) | | |
| TX antennas | RX antennas | conditions and correlation matrix (Annex G) | offset | Burst format A2 | Burst format B4 | Burst format C2 |
| **1** | 2 | AWGN | 1740 Hz | -11.3 | -14.3 | -11.1 |
|  | 4 | AWGN | 1740 Hz | -13.5 | -16.7 | -13.4 |
|  | 8 | AWGN | 1740 Hz | -15.6 | -18.2 | -15.5 |

Table 8.4.2.3-4: PRACH missed detection requirements for high speed train, 30 kHz SCS

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of | Number of | Propagation | Frequency | SNR (dB) | | |
| TX antennas | RX antennas | conditions and correlation matrix (Annex G) | offset | Burst format A2 | Burst format B4 | Burst format C2 |
| **1** | 2 | AWGN | 3334 Hz | -11.2 | -14.6 | -11.0 |
|  | 4 | AWGN | 3334 Hz | -13.4 | -16.7 | -13.4 |
|  | 8 | AWGN | 3334 Hz | -15.4 | -18.4 | -15.4 |

#### 8.4.2.4 Minimum requirements for PRACH with LRA=1151 and LRA=571

The probability of detection shall be equal to or exceed 99% for the SNR levels listed in Tables 8.4.2.4-1 to 8.4.2.4-2.

Table 8.4.2.4-1: Missed detection requirements for PRACH with LRA=1151, 15 kHz SCS

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

Table 8.4.2.4-2: Missed detection requirements for PRACH with LRA=571, 30 kHz SCS

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

######################### End of change#4 ############################

######################### Start of change#5 ############################

## 11.2 Performance requirements for PUSCH

#### 11.2.1.10 Requirements for interlaced PUSCH

Apply the requirements defined in clause 8.2.10 for 2Rx.

## 11.3 Performance requirements for PUCCH

#### 11.3.1.7 Performance requirements for multi-slot PUCCH

Apply the requirements defined in clause 8.3.7 for 2Rx.

#### 11.3.1.8 Performance requirements for interlaced PUCCH format 0

Apply the requirements defined in clause 8.3.8.

#### 11.3.1.9 Performance requirements for interlaced PUCCH format 1

Apply the requirements defined in sub-clause 8.3.9.

#### 11.3.1.10 Performance requirements for interlaced PUCCH format 2

Apply the requirements defined in clause 8.3.10 for 2Rx.

#### 11.3.1.11 Performance requirements for interlaced PUCCH format 3

Apply the requirements defined in clause 8.3.11 for 2Rx.

######################### End of change#5 ############################

######################### Start of change#6 ############################

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

The parameters for the reference measurement channels are specified in table A.5-2 for FR1 PUSCH performance requirements:

- FRC parameters are specified in table A.5-2 for FR1 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

The parameters for the reference measurement channels are specified in table A.5-3 to table A.5-4 for FR2 PUSCH performance requirements:

- FRC parameters are specified in table A.5-3 for FR2 PUSCH with transform precoding disabled, *Additional DM-RS position = pos0* and 1 transmission layer.

- FRC parameters are specified in table A.5-4 for FR2 PUSCH with transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer.

Table A.5-1: Void

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-A5-8 | G-FR1-A5-9 | G-FR1-A5-10 | G-FR1-A5-11 | G-FR1-A5-12 | G-FR1-A5-13 | G-FR1-A5-14 |
| Subcarrier spacing [kHz] | 15 | 15 | 15 | 30 | 30 | 30 | 30 |
| Allocated resource blocks | 25 | 52 | 106 | 24 | 51 | 106 | 273 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| Code rate (Note 2) | 567/1024 | 567/1024 | 567/1024 | 567/1024 | 567/1024 | 567/1024 | 567/1024 |
| Payload size (bits) | 12040 | 25104 | 50184 | 11528 | 24576 | 50184 | 131176 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Number of code blocks - C | 2 | 3 | 6 | 2 | 3 | 6 | 16 |
| Code block size including CRC (bits) (Note 2) | 6056 | 8400 | 8392 | 5800 | 8224 | 8392 | 8224 |
| Total number of bits per slot | 21600 | 44928 | 91584 | 20736 | 44064 | 91584 | 235872 |
| Total symbols per slot | 3600 | 7488 | 15264 | 3456 | 7344 | 15264 | 39312 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos1*, *l0*= 2 and *l* =11 for PUSCH mapping type A, *l0*= 0 and *l* =10 for PUSCH mapping type B as per table 6.4.1.1.3-3 of TS 38.211 [5].  NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [15]. | | | | | | | |

Table A.5-3: FRC parameters for FR2 PUSCH performance requirements, transform precoding disabled, *Additional DM-RS position = pos0* and 1 transmission layer (64QAM, R=567/1024)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR2-A5-1 | G-FR2-A5-2 | G-FR2-A5-3 | G-FR2-A5-4 | G-FR2-A5-5 |
| Subcarrier spacing [kHz] | 60 | 60 | 120 | 120 | 120 |
| Allocated resource blocks | 66 | 132 | 32 | 66 | 132 |
| CP-OFDM Symbols per slot (Note 1) | 9 | 9 | 9 | 9 | 9 |
| Modulation | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| Code rate (Note 2) | 567/1024 | 567/1024 | 567/1024 | 567/1024 | 567/1024 |
| Payload size (bits) | 23568 | 47112 | 11528 | 23568 | 47112 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 | 24 | 24 | 24 |
| Number of code blocks - C | 3 | 6 | 2 | 3 | 6 |
| Code block size including CRC (bits) (Note 2) | 7888 | 7880 | 5800 | 7888 | 7880 |
| Total number of bits per slot | 42768 | 85536 | 20736 | 42768 | 85536 |
| Total symbols per slot | 7128 | 14256 | 3456 | 7128 | 14256 |
| 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 = pos0* with *l0*= 0 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 sub-clause 5.2.2 of TS 38.212 [15]. | | | | | |

Table A.5-4: FRC parameters for FR2 PUSCH performance requirements, transform precoding disabled, *Additional DM-RS position = pos1* and 1 transmission layer (64QAM, R=567/1024)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR2-A5-6 | G-FR2-A5-7 | G-FR2-A5-8 | G-FR2-A5-9 | G-FR2-A5-10 |
| Subcarrier spacing [kHz] | 60 | 60 | 120 | 120 | 120 |
| Allocated resource blocks | 66 | 132 | 32 | 66 | 132 |
| CP-OFDM Symbols per slot (Note 1) | 8 | 8 | 8 | 8 | 8 |
| Modulation | 64QAM | 64QAM | 64QAM | 64QAM | 64QAM |
| Code rate (Note 2) | 567/1024 | 567/1024 | 567/1024 | 567/1024 | 567/1024 |
| Payload size (bits) | 21000 | 42016 | 10248 | 21000 | 42016 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 | 24 | 24 | 24 |
| Number of code blocks - C | 3 | 5 | 2 | 3 | 5 |
| Code block size including CRC (bits) (Note 2) | 7032 | 8432 | 5160 | 7032 | 8432 |
| Total number of bits per slot | 38016 | 76032 | 18432 | 38016 | 76032 |
| Total symbols per slot | 6336 | 12672 | 3072 | 6336 | 12672 |
| 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*= 0 and *l* =8 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 sub-clause 5.2.2 of TS 38.212 [15]. | | | | | |

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

|  |  |  |
| --- | --- | --- |
| Reference channel | G-FR1-A5-15 | G-FR1-A5-16 |
| Subcarrier spacing [kHz] | 15 | 30 |
| Allocated resource blocks | 11 | 11 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 |
| Modulation | 64QAM | 64QAM |
| Code rate | 567/1024 | 567/1024 |
| Payload size (bits) | 5248 | 5248 |
| Transport block CRC (bits) | 24 | 24 |
| Code block CRC size (bits) | 24 | 24 |
| Number of code blocks - C | 1 | 1 |
| Code block size including CRC (bits) (Note 2) | 5272 | 5272 |
| Total number of bits per slot | 9504 | 9504 |
| Total symbols per slot | 1584 | 1584 |
| NOTE 1: *DM-RS configuration type* = 1 with *DM-RS duration = single-symbol DM-RS* and the number of DM-RS CDM groups without data is 2, *Additional DM-RS position = pos1*, *l0*= 2 and *l* =11 for PUSCH mapping type A, *l0*= 0 and *l* =10 for PUSCH mapping type B as per table 6.4.1.1.3-3 of TS 38.211 [5].  NOTE 2: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [15]. | | |

######################### End of change#6 ############################

######################### Start of change#7 ############################

# A.6 PRACH Test preambles

Table A.6-1: Test preambles for Normal Mode in FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Burst format | SCS (kHz) | Ncs | Logical sequence index | v |
| 0 | 1.25 | 13 | 22 | 32 |
| A1, A2, A3, | 15 | 23 | 0 | 0 |
| B4, C0, C2 | 30 | 46 | 0 | 0 |

Table A.6-2: Test preambles for Normal Mode in FR2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Burst format | SCS (kHz) | Ncs | Logical sequence index | v |
| A1, A2, A3, | 60 | 69 | 0 | 0 |
| B4, C0, C2 | 120 | 69 | 0 | 0 |

Table A.6-3: Test preambles for high speed train restricted set type A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Burst format | SCS (kHz) | Ncs | Logical sequence index | v |
| 0 | 1.25 | 15 | 384 | 0 |

Table A.6-4: Test preambles for high speed train restricted set type B

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Burst format | SCS (kHz) | Ncs | Logical sequence index | v |
| 0 | 1.25 | 15 | 30 | 30 |

Table A.6-5: Test preambles for high speed train short formats

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Burst format | SCS (kHz) | Ncs | Logical sequence index | v |
| A2, B4, C2 | 15 | 23 | 0 | 0 |
|  | 30 | 46 | 0 | 0 |

Table A.6-6: Test preambles for PRACH with LRA=1151 and LRA=571

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Burst format | SCS (kHz) | Ncs | Logical sequence index | v |
| A2, B4, C2 | 15 | 164 | 0 | 0 |
|  | 30 | 190 | 0 | 0 |

######################### Start of change#7 ############################