**3GPP TSG-RAN WG4 Meeting #98-bis-e *R4-2106025***

**Electronic, , 12th Apr - 20th Apr**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **TS 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:***  | DraftCR NR-U BS demod PRACH performance requirements 38.104 |
|  |  |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_unlic-Perf |  | ***Date:*** | 2021-04-02 |
|  |  |  |  |  |
| ***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 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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Introduction of BS demod PRACH requirements with LRA=1151 and LRA=571.  |
|  |  |
| ***Summary of change:*** | Introduction of BS demod requirements for wide PRACH sequences used in unlicensed bands.  |
|  |  |
| ***Consequences if not approved:*** | No BS demod requirements for PRACH with NR-U sequences.  |
|  |  |
| ***Clauses affected:*** | 8.4.2.1, 8.4.2.4 (new), A.6 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **x** |  |  Test specifications | TS38.141-1. TS38.141-2 |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | Draft CR submitted to AI 5.1.4.4.4 |
|  |  |
| ***This CR's revision history:*** | Revision of R4-2104627 |

### <Start of Change 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, 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 1>

### <Start of Change 2>

# 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 |

<End of Change 2>