**3GPP TSG-RAN4 Meeting # 112 *R4-2413562***

**Maastricht, Netherlands, August 19th – 23th 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.141-1** | **CR** | **0460** | **rev** | **1** | **Current version:** | **18.6.0** |  |
|  | | | | | | | | |
| *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:*** | [NR\_NTN\_enh\_HAPS-Perf] CR for 38.141-1 on PRACH format 1 demodulation requirements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson, NTT DOCOMO | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | TEI18 | | | | |  | ***Date:*** | | | 2024-08-19 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | The HAPS is a deployed scenario in some regions which has large cell range (up to 100 km). NR PRACH format 1 would be the most typical format used in this scenario due to large covered cell range (~108 km), but there is no corresponding demodulation requirements in existing specifications. As requested by operators, it should be considered for adding the requirement to secure the product performance. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * Adding manufactory declarations. * Adding FR1 PRACH format 1 demodulation requirements. * Adding PRACH configurations. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | There is no demodulation requirements for HAPS scenario and the access performance of the product can’t be tested. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Revised from R4-2412310. | | | | | | | | |

################## Start of Change #1 ######################

## 4.6 Manufacturer declarations

The following BS declarations listed in table 4.6-1, when applicable to the BS under test, are required to be provided by the manufacturer for the conducted requirements testing of the *BS type 1-C* and *BS type 1-H*.

For the *BS type 1-H* declarations required for the radiated requirements testing, refer to TS 38.141-2 [3].

Table 4.6-1 Manufacturer declarations for *BS type 1-C* and *BS type 1-H* conducted test requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Declaration identifier | Declaration | Description | Applicability | |
|  |  |  | *BS type 1-C* | *BS type 1-H* |
| D.1 | BS requirements set | Declaration of one of the NR base station *requirement's set* as defined for *BS type 1-C*, or *BS type 1-H*. | x | x |
| D.2 | BS class | BS class of the BS, declared as Wide Area BS, Medium Range BS, or Local Area BS. | x | x |
| D.3 | *Operating bands* and frequency ranges | List of NR *operating band(s)* supported by *single-band connector(s)* and/or *multi-band connector(s)* of the BS and if applicable, frequency range(s) within the *operating band(s)* that the BS can operate in.  Declarations shall be made per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.4 | Spurious emission category | Declare the BS spurious emission category as either category A or B with respect to the limits for spurious emissions, as defined in Recommendation ITU-R SM.329 [5]. | x | x |
| D.5 | Additional operating band unwanted emissions | The manufacturer shall declare whether the BS under test is intended to operate in geographic areas where the additional operating band unwanted emission limits defined in clause 6.6.4.5.6 apply. (Note 3, Note 6). | x | x |
| D.6 | Co-existence with other systems | The manufacturer shall declare whether the BS under test is intended to operate in geographic areas where one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD, E-UTRA, PHS and/or NR operating in another band are deployed. | x | x |
| D.7 | Co-location with other base stations | The manufacturer shall declare whether the BS under test is intended to operate co-located with Base Stations of one or more of the systems GSM850, GSM900, DCS1800, PCS1900, UTRA FDD, UTRA TDD, E-UTRA and/or NR operating in another band. | x | x |
| D.8 | *Single band connector* or *multi-band connector* | Declaration of the single band or multi-band capability of *single band connector(s)* or *multi-band connector(s),* declared for every connector. | x | x |
| D.9 | Contiguous or non-contiguous spectrum operation support | Ability to support contiguous or non-contiguous (or both) frequency distribution of carriers when operating multi-carrier. Declared per *single band connector* or *multi-band connector*, per *operating band*. | x | x |
| D.10 | void | void | x | x |
| D.11 | Maximum *Base Station RF Bandwidth* | Maximum *Base Station RF Bandwidth* in the *operating band* for single-band operation. Declared per supported *operating band,* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* (Note 2) | x | x |
| D.12 | Maximum *Base Station RF Bandwidth* for multi-band operation | Maximum *Base Station RF Bandwidth* for multi-band operation. Declared per supported *operating band,* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.13 | Total RF bandwidth (BWtot) | Total RF bandwidth BWtot of transmitter and receiver, declared per the band combinations (D.27). | x | x |
| D.14 | NR supported channel bandwidths and SCS | NR supported SCS and channel bandwidths per supported SCS. Declared per supported *operating band,* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.15 | CA only operation | Declaration of CA-only operation (with equal power spectral density among carriers) but not multiple carriers, declared per *operating band* per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.16 | Single or multiple carrier | Capable of operating with a single carrier (only) or multiple carriers. Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.17 | Maximum number of supported carriers per operating band in single band operation | Maximum number of supported carriers per supported *operation band* in single band operation*.* Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* (Note 2) | x | x |
| D.18 | Maximum number of supported carriers per operating band in multi-band operation | Maximum number of supported carriers per supported *operation band* in multi-band operation. (Note 2) | x | x |
| D.19 | Total maximum number of supported carriers in multi-band operation | Maximum number of supported carriers for all supported *operating bands* in multi-band operation*.* Declared for all connectors (D.18)*.* | x | x |
| D.20 | Other band combination multi-band restrictions | Declare any other limitations under simultaneous operation in the declared band combinations (D.27) for each *multi-band connector* which have any impact on the test configuration generation.  Declared for every *multi-band connector*. | x | x |
| D.21 | Rated carrier output power(Prated,c,AC, or Prated,c,TABC) | Conducted rated carrier output power, per *single band connector* or *multi-band connector.*  Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. (Note 1, 2, 7) | x | x |
| D.22 | R*ated total output power* (Prated,t,AC, or Prated,t,TABC) | Conducted total rated output power*.*  Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.*  For *multi-band connectors* declared for each supported *operating band* in each supported band combination. (Note 1, 2, 7) | x | x |
| D.23 | Rated multi-band total output power, Prated,MB,TABC | Conducted multi-band rated total output power*.*  Declared per supported operating band combinations, per *multi-band connector*. (Note 1, 7) | x | x |
| D.24 | Ncells | Number corresponding to the minimum number of cells that can be transmitted by a BS in a particular *operating band* with transmission on all *TAB connectors* supporting the *operating band*. |  | x |
| D.25 | Maximum supported power difference between carriers | Maximum supported power difference between carriers. Declared per supported *operating band*, per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.26 | Maximum supported power difference between carriers is different *operating bands* | Supported power difference between any two carriers in any two different supported *operating bands.* Declared per supported operating band combination, per *multi-band connector.* | x | x |
| D.27 | Operating band combination support | List of operating bands combinations supported by *single-band connector(s)* and/or *multi-band connector(s)* of the BS. Declared per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H.* | x | x |
| D.28 | void | void | x | x |
| D.29 | Intra-system interfering signal declaration list | List of *single band connector(s)* or *multi-band connector(s)* for which an intra-system interfering signal level is required to be declared. Declaration is required if the intra-system interfering signal level is larger than the co-location interfering signal level. |  | x |
| D.30 | Intra-system interfering signal level | The interfering signal level in dBm. Declared per supported *operating band*, per *TAB connector* for *BS type 1-H* covered by D.29. |  | x |
| D.31 | TAE groups | Set of declared *TAB connector beam forming groups* on which the TAE requirements apply.  *All TAB connectors* belong to at least one *TAB connector beam forming group* (even if it's a *TAB connector beam forming group* consisting of one connector).  The smallest possible number of *TAB connector beam forming groups* need to be declared such that there is no *TAB connector* not contained in at least one of the declared *TAB connector beam forming groups*.  Declared per supported *operating band*. |  | x |
| D.32 | Equivalent connectors | List of *antenna connectors* of *BS type 1-C*, or *TAB connector* of *BS type 1-H*, which have been declared equivalent.  Equivalent connectors imply that the *antenna connector* of *BS type 1-C*, or *TAB connector* of *BS type 1-H*, are expected to behave in the same way when presented with identical signals under the same operating conditions. All declarations made for the *antenna connector* of *BS type 1-C*, or *TAB connector* of *BS type 1-H* are identical and the transmitter unit and/or receiver unit driving the *antenna connector* of *BS type 1-C* or *TAB connector* of *BS type 1-H* are of identical design. | x | x |
| D.33 | *TAB connector RX min cell group* | Declared as a group of *TAB connectors* to which RX requirements are applied. This declaration corresponds to group of *TAB connectors* which are responsible for receiving a cell when the *BS type 1-H* setting corresponding to the declared minimum number of cells (Ncells) with transmission on all *TAB connectors* supporting an *operating band*. |  | x |
| D.34 | *TAB connector TX min cell group* | Declared group of *TAB connectors* to which TX requirements are applied. This declaration corresponds to group of *TAB connectors* which are responsible for transmitting a cell when the *BS type 1-H* setting corresponding to the declared minimum number of cells (Ncells) with transmission on all *TAB connectors* supporting an *operating band*. |  | x |
| D.35 | Connecting network loss range for BS testing with ancillary RF amplifiers | Declaration of the range of connecting network losses (in dB) for *BS type 1-C* testing with ancillary Tx RF amplifier only, or with Rx RF amplifier only, or with combined Tx/Rx RF amplifiers. (Note 4) | x |  |
| D.36 | Relation between supported maximum RF bandwidth, number of carriers and Rated total output power | If the rated total output power and total number of supported carriers are not simultaneously supported, the manufacturer shall declare the following additional parameters:  - The reduced number of supported carriers at the rated total output power;  - The reduced total output power at the maximum number of supported carriers. | x | x |
| D.37 | *TAB connectors* used for performance requirement testing | To reduce test complexity, declaration of a representative (sub)set of *TAB connectors* to be used for performance requirement test purposes. At least one *TAB connector* mapped to each *demodulation branch* is declared. |  | x |
| D.38 | Inter-band CA | Band combinations declared to support inter-band CA (per CA capable *multi-band connector(s)*, as in D.15).  Declared for every *multi-band connector* which support CA. | x | x |
| D.39 | Intra-band contiguous CA | Bands declared to support intra-band contiguous CA (per CA capable *single band connector(s)* or *multi-band connector(s)*, as in D.15).  Declared per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.40 | Intra-band non-contiguous CA | Bands declared to support intra-band non-contiguous CA (per CA capable *single band connector(s)* or *multi-band connector(s)*, as in D.15).  Declared per *antenna connector* for *BS type 1-C*, or *TAB connector* for *BS type 1-H*. | x | x |
| D.41 | NB-IoT operation | Manufacturer shall declare the support of NB-IoT operation in NR in-band and the number of supported NB-IoT carriers in total and for each supported band, frequency range and channel bandwidth. | x |  |
| D.42 | NB-IoT sub-carrier spacing | If the BS supports NB-IoT operation in NR in-band, manufacturer shall declare if it supports 15 kHz sub-carrier spacing, 3.75 kHz sub-carrier spacing, or both for NPUSCH. | x |  |
| D.43 | NB-IoT power dynamic range | If the BS supports NB-IoT operation in NR in-band, manufacturer shall declare the maximum power dynamic range it could support with a minimum of +6dB or +3dB as specified in clause 6.3.4 of TS 38.104 [2] (Note 5). | x |  |
| D.100 | PUSCH mapping type | Declaration of the supported PUSCH mapping type as specified in TS 38.211 [17], i.e., type A, type B or both. | x | x |
| D.101 | PUSCH additional DM-RS positions | Declaration of the supported additional DM-RS position(s), i.e., pos0, pos1 or both. |  |  |
| D.102 | PUCCH format | Declaration of the supported PUCCH format(s) as specified in TS 38.211 [17], i.e., format 0, format 1, format 2, format 3, format 4. | x | x |
| D.103 | PRACH format and SCS | Declaration of the supported PRACH format(s) as specified in TS 38.211 [17], i.e., format: 0, A1, A2, A3, B4, C0, C2.  Declaration of the supported SCS(s) per supported PRACH format with short sequence, as specified in TS 38.211 [17], i.e., 15 kHz, 30 kHz or both. | x | x |
| D.104 | Additional DM-RS for PUCCH format 3 | Declaration of the supported additional DM-RS for PUCCH format 3: without additional DM-RS, with additional DM-RS or both. | x | x |
| D.105 | Additional DM-RS for PUCCH format 4 | Declaration of the supported additional DM-RS for PUCCH format 4: without additional DM-RS, with additional DM-RS or both. | x | x |
| D.106 | PUCCH multi-slot | Declaration of multi-slot PUCCH support. | x | x |
| D.107 | UL CA | For the highest supported SCS, declaration of the carrier combination with the largest aggregated bandwidth. If there is more than one combination, the carrier combination with the largest number of carriers shall be declared. | x | x |
| D.108 | High speed train | Declaration of high speed train scenario support, i.e. HST support or no HST support | x | x |
| D.109 | Maximum speed of high speed train for PUSCH | Declaration of supported maximum speed for high speed train scenario, i.e. 350 km/h or 500 km/h.  This declaration is applicable to PUSCH for high speed train and UL timing adjustment only if BS declares to support high speed train in D.108. | x | X |
| D.110 | PRACH format for high speed train | Declaration of supported PRACH format(s) for high speed train scenario, i.e. format 0 restricted set type A, format 0 restricted set type B, format A2, format B4, format C2.  This declaration is applicable to PRACH for high speed train only if BS declares to support high speed train in D.108. | x | x |
| D.111 | Interlaced formats | Declaration of support of interlaced PUSCH and PUCCH formats. | x | x |
| D.112 | PRACH format with LRA = 1151 for 15 kHz SCS and LRA = 571 for 30 kHz SCS | Declaration of the supported PRACH format(s) as specified in TS 38.211 [17], i.e., format: A2, B4, C2.    Declaration of the supported SCS(s) per supported PRACH format as specified in TS 38.211 [17], i.e., 15 kHz, 30 kHz or both. | x | x |
| D.113 | CG-UCI | Declaration of support of GC-UCI multiplexed on PUSCH as specified in TS 38.211 [17]. | x | x |
| D.114 | 2-step RA | Declaration of support of 2-step RA type. | x | x |
| D.115 | PUSCH 256QAM | Declaration of PUSCH 256QAM support | x | x |
| D.116 | PUCCH sub-slot based repetition formats | Declaration of PUCCH sub-slot based repetition formats | x | x |
| D.117 | PUSCH TB over Multi-slots | BS support TBoMS over physical consecutive UL slots | x | x |
| D.118 | PUSCH TB over Multi-slots | BS support TBoMS over physical non-consecutive UL slots | x | x |
| D.119 | Supported SCS for TDD PUSCH DM-RS bundling and PUCCH DM-RS bundling | Declaration of supported SCS for TDD PUSCH DM-RS bundling and and PUCCH DM-RS bundling and, i.e. {15kHz, 30kHz, 60kHz 120kHz} | x | x |
| D.120 | Supported FDD PUSCH DM-RS bundling and and PUCCH DM-RS bundling and | Declaration of supporting FDD PUSCH DM-RS bundling and PUCCH DM-RS bundling | x | x |
| D.121 | MCS index table 3 | Declaration of support MCS index table 3 as specified in TS 38.214 [18]. | x | x |
| D.122 | PUSCH repetition type A | Declaration of support PUSCH repetition type A | x | x |
| D.123 | Air-to-ground scenario | Declaration of air-to-ground scenario support, i.e., ATG support or no ATG support | x | x |
| D.14 | PUSCH with enhanced DM-RS | Declaration of support for *enhanced-dmrs-Type r18* as specified in TS 38.211 [17]. | x | x |
| D.xxx | PRACH format for HAPS scenario | Declaration of supported PRACH format(s) for HAPS scenario, i.e., format 1. | x | x |
| NOTE 1: If a BS is capable of 1024QAM DL operation then up to three rated output power declarations may be made. One declaration is applicable when configured for 1024QAM transmissions, a different declaration is applicable when configured 256QAM transmissions and the other declaration is applicable when configured neither for 256QAM nor 1024QAM transmissions.  NOTE 2: Parameters for contiguous or non-contiguous spectrum operation in the operating band are assumed to be the same unless they are separately declared. When separately declared, they shall still use the same declaration identifier.  NOTE 3: If BS is declared to support Band n20 (D.3), the manufacturer shall declare if the BS may operate in geographical areas allocated to broadcasting (DTT). Additionally, related declarations of the emission levels and maximum output power shall be declared.  NOTE 4: This manufacturer declaration is optional.  NOTE 5: This manufacturer may declare two values, one with a minimum of +6dB and the other with a minimum of +3dB.  NOTE 6: If BS is declared to support Band n24 (D.3), the manufacturer shall declare if the BS may operate in geographical areas where FCC regulations apply. Additionally, related declarations of the emission levels and maximum output power shall be declared.  NOTE 7: If a BS is capable of 256QAM DL operation but not capable of 1024QAM DL operation then up to two rated output power declarations may be made. One declaration is applicable when configured for 256QAM transmissions, and the other declaration is applicable when not configured for 256QAM transmissions | | | | |

################## End of Change #1 ######################

################## Start of Change #2 ######################

#### 8.1.2.3 Applicability of PRACH performance requirements

##### 8.1.2.3.1 Applicability of requirements for different formats

Unless otherwise stated, PRACH requirement tests shall apply only for each PRACH format declared to be supported (see D.103 in table 4.6-1).

Unless otherwise stated, PRACH requirement tests for high speed train shall apply only for each PRACH formats declared to be supported (see D.110 in table 4.6-1).

Unless otherwise stated, PRACH requirement tests for HAPS scenario shall apply only for each PRACH formats declared to be supported (see D.xxx in table 4.6-1).

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

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

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

Unless otherwise stated, for the subcarrier spacing to be tested, the test requirements shall apply only for anyone channel bandwidth declared to be supported (see D.14 in table 4.6-1).

Unless otherwise stated, for BS supporting less than 5MHz carrier bandwidth (see D.14 in table 4.6-1), only test requirements relating to RACH preamble formats with 15kHz SCS with sequence length LRA=139, and PRACH formats with 1.25kHz SCS with sequence length LRA=839 shall apply.

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

Unless otherwise stated, PRACH requirement tests for long PRACH preamble format 0 with restricted set Type A and B shall apply only for the restricted set type declared to be supported (see D.110 in table 4.6-1). If both restricted set type A and type B are declared to be supported, the tests shall be done for type B; the same chosen mapping type shall then be used for all tests.

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

################## End of Change #2 ######################

################## Start of Change #3 ######################

## 8.4 Performance requirements for PRACH

### 8.4.1 PRACH false alarm probability and missed detection

#### 8.4.1.1 Definition and applicability

The performance requirement of PRACH for preamble detection is determined by the two parameters: total probability of false detection of the preamble (Pfa) and the probability of detection of preamble (Pd). The performance is measured by the required SNR at probability of detection, Pd of 99%. Pfa shall be 0.1% or less.

Pfa is defined as a conditional total probability of erroneous detection of the preamble (i.e. erroneous detection from any detector) when input is only noise.

Pd is defined as conditional probability of detection of the preamble when the signal is present. The erroneous detection consists of several error cases – detecting only different preamble(s) than the one that was sent, not detecting any preamble at all, or detecting the correct preamble but with the out-of-bounds timing estimation value.

For AWGN and 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 values given in table 8.4.1.1-1.

Table 8.4.1.1-1: Time error tolerance for AWGN and TDLC300-100

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PRACH | PRACH SCS | Time error tolerance | | |
| preamble | (kHz) | AWGN | TDLC300-100 | TDLA30-10 |
| 0 | 1.25 | 1.04 us | 2.55 us | N/A |
| 1 | 1.25 | 1.04 us | N/A | 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. The test preambles for high speed train restricted set type A are listed in table A.6-3 and the test preambles for high speed train restricted set type B are listed in table A.6-4. The test preambles for high speed train short formats are listed in table A.6-5. The test preambles for PRACH with LRA=1151 and LRA=571 are listed in table A.6-6.

Which specific test(s) are applicable to BS is based on the test applicability rules defined in clause 8.1.2. The performance requirements for high speed train (table 8.4.1. 6-1 to 8.4.1.6-4) are optional. The performance requirement of format 1 is optional and only for a BS declare to support HAPS scenario (see D.xxx in table 4.6-1).

#### 8.4.1.2 Minimum requirement

The minimum requirement is in TS 38.104 [2] clause 8.4.1.2 and 8.4.2.2, 8.4.2.3, and 8.4.2.4.

#### 8.4.1.3 Test purpose

The test shall verify the receiver's ability to detect PRACH preamble under static conditions and multipath fading propagation conditions for a given SNR.

#### 8.4.1.4 Method of test

##### 8.4.1.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

##### 8.4.1.4.2 Procedure

1) Connect the BS tester generating the wanted signal, multipath fading simulators and AWGN generators to all BS antenna connectors for diversity reception via a combining network as shown in annex D.5 and D.6 for *BS type 1-C* and *BS* *type 1-H* respectively.

2) Adjust the AWGN generator, according to the SCS and channel bandwidth.

Table 8.4.1.4.2-1: AWGN power level at the BS input

|  |  |  |
| --- | --- | --- |
| Sub-carrier spacing (kHz) | Channel bandwidth (MHz) | AWGN power level |
| 15 | 5 | -83.5 dBm / 4.5MHz |
|  | 10 | -80.3 dBm / 9.36MHz |
|  | 20 | -77.2 dBm / 19.08MHz |
| 30 | 10 | -80.6 dBm / 8.64MHz |
|  | 20 | -77.4 dBm / 18.36MHz |
|  | 40 | -74.2 dBm / 38.16MHz |
|  | 100 | -70.1 dBm / 98.28MHz |
| NOTE: The AWGN power level contains an AWGN offset of 16dB by default. If needed for test purposes, the AWGN level can be reduced from the default by any value in the range 0dB to 16dB. Changing the AWGN level does not impact the validity of the test, as it reduces the effective base band SNR level. | | |

3) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A and the test parameter *msg1-FrequencyStart* is set to 0.

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

5) Adjust the frequency offset of the test signal according to table 8.4.1.5-1 or 8.4.1.5-2 or 8.4.1.5-3 or 8.4.1.6-1 or 8.4.1.6-2 or 8.4.1.6-3 or 8.4.1.6-4 or 8.4.1.7-1 or 8.4.1.7-2.

6) Adjust the equipment so that the SNR specified in table 8.4.1.5-1 or 8.4.1.5-2 or 8.4.1.5-3 or 8.4.1.6-1 or 8.4.1.6-2 or 8.4.1.6-3 or 8.4.1.6-4 or 8.4.1.7-1 or 8.4.1.7-2 is achieved at the BS input during the PRACH preambles.

7) The test signal generator sends a preamble and the receiver tries to detect the preamble. This pattern is repeated as illustrated in figure 8.4.1.4.2-1. The preambles are sent with certain timing offsets as described below. The following statistics are kept: the number of preambles detected in the idle period and the number of missed preambles.



Figure 8.4.1.4.2-1: PRACH preamble test pattern

The timing offset base value for PRACH preamble format 0 is set to 50% of Ncs. This offset is increased within the loop, by adding in each step a value of 0.1us, until the end of the tested range, which is 0.9us. Then the loop is being reset and the timing offset is set again to 50% of Ncs. The timing offset scheme for PRACH preamble format 0 and 1 is presented in figure 8.4.1.4.2-2.



Figure 8.4.1.4.2-2: Timing offset scheme for PRACH preamble format 0 and 1

The timing offset base value for PRACH preamble format A1, A2, A3, B4, C0 and C2 is set to 0. This offset is increased within the loop, by adding in each step a value of 0.1us, until the end of the tested range, which is 0.8 us. Then the loop is being reset and the timing offset is set again to 0. The timing offset scheme for PRACH preamble format A1, A2, A3, B4, C0 and C2 is presented in figure 8.4.1.4.2-3.



Figure 8.4.1.4.2-3: Timing offset scheme for PRACH preamble format A1 A2, A3, B4, C0 and C2

#### 8.4.1.5 Test requirement for Normal Mode

Pfa shall not exceed 0.1%. Pd shall not be below 99% for the SNRs in tables 8.4.1.5-1 to 8.4.1.5-3.

Table 8.4.1.5-1: PRACH missed detection test requirements for Normal Mode, 1.25 kHz SCS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number of TX | Number of RX | Propagation conditions | Frequency offset | SNR (dB) | |
| antennas | antennas | and correlation matrix (annex G) |  | Burst format 0 | Burst format 1 |
| 1 | 2 | AWGN | 0 | -14.2 | -16.2 |
|  |  | TDLC300-100 Low | 400 Hz | -6.0 | N/A |
|  | 4 | AWGN | 0 | -16.4 | -18.5 |
|  |  | TDLC300-100 Low | 400 Hz | -11.3 | N/A |
|  | 8 | AWGN | 0 | -18.6 | -21.0 |
|  |  | TDLC300-100 Low | 400 Hz | -15.2 | N/A |

Table 8.4.1.5-2: PRACH missed detection test requirements for Normal Mode, 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number | Number | Propagation | Frequency | SNR (dB) | | | | | |
| of TX antennas | 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 | -9.0 | -12.3 | -13.9 | -16.5 | -6.0 | -12.2 |
|  |  | TDLC300-100 Low | 400 Hz | -1.5 | -4.2 | -6.0 | -8.2 | 1.4 | -4.3 |
|  | 4 | AWGN | 0 | -11.3 | -14.0 | -15.7 | -18.7 | -8.4 | -13.8 |
|  |  | TDLC300-100 Low | 400 Hz | -6.7 | -9.7 | -11.1 | -13.2 | -3.7 | -9.6 |
|  | 8 | AWGN | 0 | -13.5 | -16.4 | -17.9 | -20.9 | -10.8 | -16.3 |
|  |  | TDLC300-100 Low | 400 Hz | -10.4 | -13.3 | -14.6 | -16.7 | -7.5 | -13.3 |

Table 8.4.1.5-3: PRACH missed detection test requirements for Normal Mode, 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Number | Number | Propagation | Frequency | SNR (dB) | | | | | |
| of TX antennas | 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 | -8.8 | -11.7 | -13.5 | -16.2 | -5.8 | -11.6 |
|  |  | TDLC300-100 Low | 400 Hz | -2.2 | -5.1 | -6.8 | -9.3 | 0.7 | -5.0 |
|  | 4 | AWGN | 0 | -11.1 | -13.9 | -15.6 | -18.7 | -8.3 | -13.8 |
|  |  | TDLC300-100 Low | 400 Hz | -6.6 | -9.8 | -11.4 | -13.9 | -3.9 | -9.8 |
|  | 8 | AWGN | 0 | -13.4 | -16.3 | -17.8 | -20.8 | -10.7 | -16.2 |
|  |  | TDLC300-100 Low | 400 Hz | -10.1 | -13.1 | -14.5 | -17.0 | -7.2 | -13.1 |

Table 8.4.1.5-4: Void

Table 8.4.1.5-5: Void

#### 8.4.1.6 Test requirement for high speed train

################## End of Change #3 ######################

################## Start of Change #4 ######################

# 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 |
| 1 | 1.25 | 0 | 22 | 0 |
| A1, A2, A3, | 15 | 23 | 0 | 0 |
| B4, C0, C2 | 30 | 46 | 0 | 0 |

Table A.6-2: Void

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 #4 ######################