**3GPP TSG-RAN WG4 Meeting #103-eR4-22xxxxx**

**Electronic Meeting, 9 – 20 May, 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **38.141-2** | **CR** | **<>** | **rev** |  | **Current version:** | **17.5.0** |  |
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| *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 CR for TS 38.141-2 Maintenance RF part (Rel-17, CAT F) |
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| ***Source to WG:*** | MCC, Huawei |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Perf, TEI16, TEI17 |  | ***Date:*** | 2022-05-24 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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:*** | This big CR merges the multiple endorsed draft CRs. The reason for change in each endorsed draft CR is copied below.R4-2208233 CR for TS 38.141-2: On sweep time for unwanted emission testing (Rel-17)The measurement uncertainty for FR2 is not in Table 4.1.2.2-1, and the measurement uncertainty for receiver is also not in Table 4.1.2.2-1. R4-2210698 Draft CR for TS 38.141-2 R17: correction of BS type 1-O co-existence tableThere’re the following mistakes in the latest version.1. NR system is missing in the declarations of co-existence and co-location.2. Some bands are missing in the type 1-O co-existence table.3. The co-existence requirement with E-UTRA band 85 and n85 is not correct.R4-2210033 Draft CR to TS 38.141-2 on clarifications of interfering signal for the OTA transmitter intermodulation requirementFor the interfering signal for the OTA transmitter intermodulation requirement, it is not clear how the power is split between the supported polarizations, and whether the power is split when the power is 46 dBm but not Prated,t,TRP.R4-2209652 Draft CR to TS 38.141-2: removal of Editor's notes, Rel-17It was identified, that several Editor’s notes are existing in the specification since Rel-15, causing confusions. Those notes were introduced at the TS drafting stage, and shall have been removed in the final version of the Rel-15 specification. |
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| ***Summary of change:*** | The summary of change in each each endorsed draft CR is copied below.R4-2208233 CR for TS 38.141-2: On sweep time for unwanted emission testing (Rel-17)* Add transmitter MU Table 4.1.2.2-2 for FR2.
* For receiver spurious emissions, change transmitter MU Table 4.1.2.2-1 to receiver MU Table 4.1.2.3-1 for FR1 and Table 4.1.2.3-2 for FR2.

R4-2210698 Draft CR for TS 38.141-2 R17: correction of BS type 1-O co-existence tableThe following changes are made,1. Add NR in the declarations of co-existence and co-location.
2. Add the missing bands in the co-existence table.

Correct the co-existence requirement with E-UTRA band 85 and n85.R4-2210033 Draft CR to TS 38.141-2 on clarifications of interfering signal for the OTA transmitter intermodulation requirement- Clarify the power is split equally between the supported polarizations- other clarifications related to polarization match and polarization of CLTA.R4-2209652 Draft CR to TS 38.141-2: removal of Editor's notes, Rel-17* Removal of unnecessary Editor’s notes from the spec,
* Editorial corrections.
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| ***Consequences if not approved:*** | The consequences if not approved for each endorsed draft CR are copied below.R4-2208233 CR for TS 38.141-2: On sweep time for unwanted emission testing (Rel-17)The measurement uncertainty for sweep time is not clear.R4-2210698 Draft CR for TS 38.141-2 R17: correction of BS type 1-O co-existence tableMistakes exit in spec.R4-2210033 Draft CR to TS 38.141-2 on clarifications of interfering signal for the OTA transmitter intermodulation requirementAmbiguities remain and would lead to different interpretations.R4-2209652 Draft CR to TS 38.141-2: removal of Editor's notes, Rel-17Remaining Editor’s notes would still exist in the spec, causing confusions. |
|  |  |
| ***Clauses affected:*** | 4.5.1, 4.6, 4.12.2.2, 6.3.5.2, 6.7.3.4.2, 6.7.4.4.2, 6.7.5.2.4.2, 6.7.5.4.4.2, 6.7.5.4.5.1, 6.8.4.2, 6.8.5.1, 7.7.4.2, M.1.2, M1.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 37.105, 38.104 |
| ***affected:*** | **X** |  |  Test specifications | TS 37.145-2 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |   |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*------------------------------ Modified section -----------------------------*

## 4.5 BS configurations

### 4.5.1 Transmit configurations

Unless otherwise stated, the radiated transmitter characteristics in clause 6 are specified at RIB, with a full complement of transceiver units for the configuration in normal operating conditions.



Figure 4.5.1-1: Transmitter test interfaces



Figure 4.5.1-2: Transmitter test interfaces for co-location concept

### 4.5.2 Receive configurations

Unless otherwise stated, the radiated receiver characteristics in clause 7 are specified at RIB, with a full complement of transceiver units for the configuration in normal operating conditions.



Figure 4.5.2-1: Receiver test interfaces



Figure 4.5.2-2: Receiver test interfaces for co-location concept

*----------------------------- Next modified section ------------------------------*

## 4.6 Manufacturer's declarations

The following BS manufacturer's declarations listed in table 4.6-1, when applicable to the BS under test, are required to be provided by the manufacturer for radiated requirements testing for *BS type 1-H,* *BS type 1-O* and *BS type 2-O*.

For the *BS type 1-H* declarations required for the conducted requirements testing, refer to TS 38.141-1 [3], clause 4.6.

Table 4.6-1 Manufacturers declarations for *BS type 1-H, BS type 1-O* and *BS type 2-O* radiated test requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Declaration identifier | Declaration | Description | Applicability(Note 1) |
|  |  |  | *BS type 1-H*(Note 2) | *BS type 1-O* | *BS type 2-O* |
| D.1 | Coordinate system reference point | Location of coordinated system reference point in reference to an identifiable physical feature of the BS enclosure. | x | x | x |
| D.2 | Coordinate system orientation | Orientation of the coordinate system in reference to an identifiable physical feature of the BS enclosure. | x | x | x |
| D.3 | Beam identifier | A unique title to identify a beam, e.g. a, b, c or 1, 2, 3. The vendor may declare any number of beams with unique identifiers. The minimum set to declare for conformance, corresponds to the beams at the reference beam direction with the highest intended EIRP, and covering the properties listed below:1) A beam with the narrowest intended BeWθ and narrowest intended BeWϕ possible when narrowest intended BeWθ is used.2) A beam with the narrowest intended BeWϕ and narrowest intended BeWθ possible when narrowest intended BeWϕ is used.3) A beam with the widest intended BeWθ and widest intended BeWϕ possible when widest intended BeWθ is used.4) A beam with the widest intended BeWϕ and widest intended BeWθ possible when widest intended BeWϕ is used.5) A beam which provides the highest intended EIRP of all possible beams.When selecting the above five beam widths for declaration, all beams that the BS is intended to produce shall be considered, including beams that during operation may be identified by any kind of cell or UE specific reference signals, with the exception of any type of beam that is created from a group of transmitters that are not all phase synchronised.(Note 3) | x | x | x |
| D.4 | *Operating bands* and frequency ranges | List of NR *operating band(s)* supported by the BS and if applicable, frequency range(s) within the *operating band(s)* that the BS can operate in. Supported bands declared for every beam (D.3).(Note 4) | c | x | x |
| D.5 | BS requirements set | Declaration of one of the NR base station *requirement's set* as defined for *BS type 1-H*, *BS type 1-O*, *or BS type 2-O*. | c | x | x |
| D.6 | BS class | Declared as Wide Area BS, Medium Range BS, or Local Area BS. | c | x | x |
| D.7 | BS channel band width and SCS support | BS supported SCS and channel bandwidth per supported SCS. Declared for each beam (D.3) and each *operating band* (D.4). | c | x | x |
| D.8 | *OTA peak directions set* reference beam direction pair | The beam direction pair, describing the reference beam peak direction and the reference beam centre direction. Declared for every beam (D.3). | x | x | x |
| D.9 | *OTA peak directions set* | The OTA peak directions set for each beam. Declared for every beam (D.3). | x | x | x |
| D.10 | *OTA peak directions set* maximum steering direction(s) | The *beam direction pair(s)* corresponding to the following points:1) The *beam peak direction* corresponding to the maximum steering from the *reference beam centre direction* in the positive *Φ* direction, while the *θ value being the closest possible to the reference beam centre direction.*2) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the negative *Φ* direction, while the *θ value being the closest possible to the* reference beam centre direction*.*3) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the positive *θ* direction, while the *Φ value being the closest possible to the* reference beam centre direction.4) The beam peak direction corresponding to the maximum steering from the reference beam centre direction in the negative *θ* direction, while the *Φ value being the closest possible to the* reference beam centre direction*.*The maximum steering direction(s) may coincide with *the reference beam centre direction*.Declared for every beam (D.3). | x | x | x |
| D.11 | Rated beam EIRP | The rated EIRP level per carrier (Prated,c,EIRP) at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.8). Declared for every beam (D.3).(Note 12, 14) | x | x | x |
| D.12 | Beamwidth | The *beamwidth* for the reference *beam direction pair* and the four maximum steering directions. Declared for every beam (D.3). | x | x | x |
| D.13 | Equivalent beams | List of beams which are declared to be equivalent.Equivalent beams imply that the beams are expected to have identical *OTA peak directions sets* and intended to have identical spatial properties at all steering directions within the *OTA peak directions set* when presented with identical signals. All declarations (D.4 – D.12) made for the beams are identical and the transmitter unit*,* RDN and antenna array responsible for generating the beam are of identical design. | x | x | x |
| D.14 | Parallel beams | List of beams which have been declared equivalent (D.13) and can be generated in parallel using independent RF power resources.Independent power resources mean that the beams are transmitted from mutually exclusive transmitter units. | x | x | x |
| D.15 | Number of carriers at maximum TRP | The number of carriers per operating band the BS is capable of generating at maximum TRP declared for every beam (D.3). | n/a | x | x |
| D.16 | Operating bands with multi-band dependencies | List of *operating bands* which are generated using transceiver units supporting operation in multiple *operating bands* through common active RF components. Declared for each *operating band* for which multi-band transceiver is used. | c | x | n/a |
| D.17 | Maximum radiated *Base Station RF Bandwidth* | Maximum *Base Station RF Bandwidth* in the *operating band*, declared for each supported operating band (D.4).(Note 15) | c | x | x |
| D.18 | Maximum *Radio Bandwidth* of the *operating band* with multi-band dependencies | Largest *Radio Bandwidth* that can be supported by the *operating bands* with multi-band dependencies.Declared for each supported *operating band* which has multi-band dependencies (D.16). | c | x | n/a |
| D.19 | Total RF bandwidth (BWtot) | Total RF bandwidth BWtot of transmitter and receiver, declared per the band combinations (D.52).  | c | x | x |
| D.20 | CA-only operation | Declared of CA-only (with equal power spectral density among carriers) but not multiple carriers operation, declared per *operating band* (D.4) and per beam (D.3). | c | x | x |
| D.21 | Maximum number of supported carriers per *operating band* in multi-band operations  | Maximum number of supported carriers per supported *operating band* declared to have multi-band dependencies (D.16). | c | x | n/a |
| D.22 | Contiguous or non-contiguous spectrum operation support | Ability of BS to support contiguous or non-contiguous (or both) frequency distribution of carriers when operating multi-carrier in an operating band. | c | x | x |
| D.23 | OSDD identifier | A unique identifier for the OSDD. | x | x | n/a |
| D.24 | OSDD operating band support | Operating band supported by the OSDD, declared for every OSDD (D.23).(Note 5) | x | x | n/a |
| D.25 | OTA sensitivity supported BS channel bandwidth and SCS | The *BS* supported SCS and channel bandwidth per supported SCS by each OSDD. | x | x | n/a |
| D.26 | Redirection of receiver target support | Ability to redirect the receiver target related to the OSDD. | x | x | n/a |
| D.27 | Minimum EIS for FR1 (EISminSENS) | The minimum EISminSENS requirement (i.e. maximum allowable EIS value) applicable to all sensitivity RoAoA per OSDD.Declared per NR supported channel BW for the OSDD (D.30).The lowest EIS value for all the declared OSDD's is called minSENS, while its related range of angles of arrival is called *minSENS RoAoA*.(Note 6) | x | x | n/a |
| D.28 | EIS REFSENS for FR2 (EISREFSENS\_50M) | The EISREFSENS\_50M level applicable in the OTA REFSENS RoAoA, (used as a basis for the derivation of the FR2 EISREFSENS for other channel bandwidths supported by BS).(Note 7) | n/a | n/a | x |
| D.29 | Receiver target reference direction Sensitivity Range of Angle of Arrival | The sensitivity RoAoA associated with the receiver target reference direction (D.31) for each OSDD. | x | x | n/a |
| D.30 | Receiver target redirection range | For each OSDD the associated union of all the sensitivity RoAoA achievable through redirecting the receiver target related to the OSDD.(Note 8) | x | x | n/a |
| D.31 | Receiver target reference direction | For each OSDD an associated direction inside the receiver target redirection range (D.30).(Note 9) | x | x | n/a |
| D.32 | Conformance test directions sensitivity RoAoA | For each OSDD that includes a receiver target redirection range, four sensitivity RoAoA comprising the conformance test directions (D.33). | x | x | n/a |
| D.33 | Conformance test directions | For each OSDD four conformance test directions.If the OSDD includes a receiver target redirection range the following four directions shall be declared:1) The direction determined by the maximum φ value achievable inside the receiver target redirection range, while θ value being the closest possible to the receiver target reference direction.2) The direction determined by the minimum φ value achievable inside the receiver target redirection range, while θ value being the closest possible to the receiver target reference direction.3) The direction determined by the maximum θ value achievable inside the receiver target redirection range, while φ value being the closest possible to the receiver target reference direction.4) The direction determined by the minimum θ value achievable inside the receiver target redirection range, while φ value being the closest possible to the receiver target reference direction.If an OSDD does not include a receiver target redirection range the following 4 directions shall be declared:1) The direction determined by the maximum φ value achievable inside the sensitivity RoAoA, while θ value being the closest possible to the receiver target reference direction.2) The direction determined by the minimum φ value achievable inside the sensitivity RoAoA, while θ value being the closest possible to the receiver target reference direction.3) The direction determined by the maximum θ value achievable inside the sensitivity RoAoA, while φ value being the closest possible to the receiver target reference direction.4) The direction determined by the minimum θ value achievable inside the sensitivity RoAoA, while φ value being the closest possible to the receiver target reference direction. | x | x | n/a |
| D.34 | *OTA coverage range* | Declared as a single range of directions within which selected TX OTA requirements are intended to be met.(Note 10) | x | x | x |
| D.35 | *OTA coverage range* reference direction | The direction describing the reference direction of the *OTA converge range* (D.34).(Note 11) | x | x | x |
| D.36 | *OTA coverage range* *maximum directions* | The directions corresponding to the following points:1) The direction determined by the maximum φ value achievable inside the *OTA coverage range*, while θ value being the closest possible to the *OTA coverage range* reference direction.2) The direction determined by the minimum φ value achievable inside the *OTA coverage range*, while θ value being the closest possible to the *OTA coverage range* reference direction.3) The direction determined by the maximum θ value achievable inside the *OTA coverage range*, while φ value being the closest possible to the *OTA coverage range* reference direction.4) The direction determined by the minimum θ value achievable inside the OTA coverage range, while φ value being the closest possible to the OTA coverage range reference direction. | x | x | x |
| D.37 | The rated carrier OTA BS power, Prated,c,TRP | Prated,c,TRP is declared as TRP OTA power per carrier, declared per supported operating band.(Note 12, 14) | n/a | x | x |
| D.38 | Rated transmitter TRP, Prated,t,TRP | Rated total radiated output power*.*Declared per supported *operating band*.(Note 12,14) | n/a | x | x |
| D.39 | CLTA placement for co-location test | The manufacturer shall declare the side of EUT where radiating elements are placed closest to the edge of EUT when applicable. The CLTA shall be placed at the EUT side where radiating elements are placed closest. | n/a | x | n/a |
| D.40 | 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]. | c | x | x |
| D.41 | 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 6.7.4 apply.(Note 16) | c | x | x |
| D.42 | 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 operating band are deployed. | c | x | x |
| D.43 | 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 operating band. | c | x | n/a |
| D.44 | *Single-band RIB or multi-band RIB* | List of *single-band RIB and/or multi-band RIB* for the supported *operating bands* (D.4).  | c | x | n/a |
| D.45 | Single or multiple carrier | BS capability to operate with a single carrier (only) or multiple carriers. Declared per supported operating band, per RIB. (Note 17) | c | x | x |
| D.46 | Maximum number of supported carriers per *operating band* | Maximum number of supported carriers. Declared per supported operating band, per RIB.(Note 15) | c | x | x |
| D.47 | Total maximum number of supported carriers | Maximum number of supported carriers for all supported operating bands. Declared per RIB. | c | x | x |
| D.48 | Other band combination multi-band restrictions | Declare any other limitation under simultaneous operation in the declared band combinations (D.16), which have any impact on the test configuration generation. | c | x | n/a |
| D.49 | Ncells | Number corresponding to the minimum number of cells that can be transmitted by a BS in a particular *operating band*. Declared per *operating band* (D.4). | c | n/a | n/a |
| D.50 | Maximum supported power difference between carriers | Maximum supported power difference between carriers in each supported *operating band*. Declared per *operating band* (D.4). | c | x | x |
| D.51 | Maximum supported power difference between carriers is different *operating bands* | Maximum supported power difference between any two carriers in any two different supported *operating bands*. Declared per operating bands combination (D.52). | c | x | n/a |
| D.52 | Operating band combination support | List of *operating bands* combinations supported by *single-band RIB(s)* and/or *multi-band RIB(s)* of the BS.  | c | x | n/a |
| D.53 | OTA REFSENS RoAoA | Range of angles of arrival associated with the OTA REFSENS.  | n/a | x | x |
| D.54 | OTA REFSENS receiver target reference direction | Reference direction inside the OTA REFSENS RoAoA (D.53). | n/a | x | x |
| D.55 | OTA REFSENS conformance test directions | The following four OTA REFSENS conformance test directions shall be declared:1) The direction determined by the maximum φ value achievable inside the OTA REFSENS RoAoA, while θ value being the closest possible to the OTA REFSENS receiver target reference direction.2) The direction determined by the minimum φ value achievable inside the OTA REFSENS RoAoA, while θ value being the closest possible to the OTA REFSENS receiver target reference direction.3) The direction determined by the maximum θ value achievable inside the OTA REFSENS RoAoA, while φ value being the closest possible to the OTA REFSENS receiver target reference direction.4) The direction determined by the minimum θ value achievable inside the OTA REFSENS RoAoA, while φ value being the closest possible to the OTA REFSENS receiver target reference direction. | n/a | x | x |
| D.56 | Supported frequency range of the NR *operating band* | List of supported frequency ranges representing *fractional bandwidths* (FBW) of *operating bands* with FBW larger than 6%. | x | x | x |
| D.57 | Rated beam EIRP at lower end of the *fractional bandwidth* (Prated,c,FBWlow) | The rated EIRP level per carrier at lower frequency range of the *fractional bandwidth* (Prated,c,FBWlow), at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.8).Declared per beam for all supported frequency ranges (D.56).(Note 12, 13, 14, 15) | x | x | x |
| D.58 | Rated beam EIRP at higher frequency range of the *fractional bandwidth* (Prated,c,FBWhigh) | The rated EIRP level per carrier at higher frequency range of the *fractional bandwidth* (Prated,c,FBWhigh), at the *beam peak direction* associated with a particular *beam direction pair* for each of the declared maximum steering directions (D.10), as well as the reference *beam direction pair* (D.8).Declared per beam for all supported frequency ranges in (D.56).(Note 12, 13, 14 ,15) | x | x | x |
| D.59 | Relation between supported maximum RF bandwidth, number of carriers and Rated maximum TRP  | If the rated transmitter TRP 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 transmitter TRP;- The reduced total output power at the maximum number of supported carriers. | n/a | x | x |
| D.60 | Inter-band CA  | Declaration of operating band(s) combinations supporting inter‑band CA. Declared per operating band combination (D.52).  | c | x | x |
| D.61 | Intra-band contiguous CA  | Declaration of operating band(s) supporting intra-band contiguous CA. Declared per *operating band* with CA support. | c | x | x |
| D.62 | Intra-band non-contiguous CA  | Declaration of operating band(s) supporting intra-band non‑contiguous CA. Declared per operating band with CA support.  | c | x | x |
| D.63 | Total maximum number of supported carriers in multi-band operation | Maximum number of supported carriers for all supported *operating bands* declared to have multi-band dependencies (D.16)*.*  | c | x | n/a |
| D.100 | PUSCH mapping type | Declaration of the supported PUSCH mapping type for FR1 as specified in TS 38.211 [20], i.e., type A, type B or both. | c | x | n/a |
| D.101 | PUSCH additional DM-RS positions | Declaration of the supported additional DM-RS position(s) for FR2, i.e., pos0, pos1, or both. | n/a | n/a | x |
| D.102 | PUCCH format | Declaration of the supported PUCCH format(s) as specified in TS 38.211 [20], i.e., format 0, format 1, format 2, format 3, format 4. | c | x | x |
| D.103 | PRACH format and SCS | Declaration of the supported PRACH format(s) as specified in TS 38.211 [20], 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 [20], i.e.: - For *BS type 1-O*: 15 kHz, 30 kHz or both.- For *BS type 2-O*: 60 kHz, 120 kHz or both. | c | 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. | c | 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. | c | x | x |
| D.106 | PUSCH PT-RS  | Declaration of PT-RS in PUSCH support: without PT-RS, with PT-RS or both. | n/a | n/a | x |
| D.107 | PUCCH multi-slot  | Declaration of multi-slot PUCCH support. | c | x | n/a |
| D.108 | 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. | c | x | x |
| NOTE 1: Manufacturer declarations applicable per BS *requirement set* were marked as "x". Manufacturer declarations not applicable per BS *requirement set* were marked as "n/a".NOTE 2: For *BS type 1-H*, the only radiated declarations are related to EIRP and EIS requirements. For *BS type 1-H* declarations required for the conducted requirements testing, refer to TS 38.141-1 [3]. For declarations marked as 'c', related conducted declarations in TS 38.141-1 [3] apply. When separately declared, they shall still use the same declaration identifier.NOTE 3: Depending on the capability of the system some of these beams may be the same. For those same beams, testing is not repeated.NOTE 4: These *operating bands* are related to their respective single‑band RIBs.NOTE 5: As each identified OSDD has a declared minimum EIS value (D.27), multiple operating band can only be declared if they have the same minimum EIS declaration.NOTE 6: If the *BS type 1-H* or *BS type 1-O* is not capable of redirecting the receiver target related to the OSDD then there is only one RoAoA applicable to the OSDD.NOTE 7: Although EISREFSENS\_50M level is based on a reference measurement channel with BWChannel = 50 MHz, it does not imply that BS has to support 50 MHz channel bandwidth.NOTE 8: Not applicable for *BS type 2-O*.NOTE 9: For an OSDD without receiver target redirection range, this is a direction inside the sensitivity RoAoA.NOTE 10: *OTA coverage range* is used for conformance testing of such TX OTA requirements as occupied bandwidth, frequency error, TAE or EVM.NOTE 11: The *OTA coverage reference* direction may be the same as the Reference beam direction pair (D.8) but does not have to be.NOTE 12: If a *BS type 2-O* is capable of 64QAM DL operation then two rated output power declarations may be made. One declaration is applicable when configured for 64QAM transmissions and the other declaration is applicable when not configured for 64QAM transmissions.NOTE 13: If D.57 and D.58 are declared for certain frequency range (D.56), there shall be no "Rated beam EIRP" declaration (D.11) for the *operating band* containing that particular frequency range.NOTE 14: If a *BS type 1-H* or *BS type 1-O* is capable of 256QAM DL operation then 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.NOTE 15: Parameters for contiguous or non-contiguous spectrum operation in the operating band are assumed to be the same unless they are separately declared.NOTE 16: If BS is declared to support Band n20 (D.4), 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 17: In case of BS type 1-H, this declaration applies per *TAB connector*. |

*----------------------------- Next modified section ------------------------------*

#### 4.12.2.2 Co-location test antenna characteristics

A *co-location test antenna* is a practical passive antenna that is used for conformance testing of the co-location requirements and is based on the definition of the *co-location reference antenna*. A CLTA shall comply with the requirements specified in table 4.12.2.2-1.

Translation of the requirements to other test antennas are not precluded but suitable translations between the co-location reference antenna and test antenna must be provided to demonstrate that the method is within the specified MU.

NOTE: The currently defined CLTAs are suitable for testing *BS type 1-O* implemented with a planar antenna array. The method for testing BS with other antenna array implementations is not covered by the present release of this specification.

Table 4.12.2.2-1: CLTA characteristics

|  |  |  |
| --- | --- | --- |
| Parameter | In-band CLTA | Out-of-band CLTAs |
| Vertical radiating dimension (h) | Test object vertical radiating length ±30% | Test object vertical radiating length ±30%(Note 2) |
| Horizontal beam width | 65° ± 10° | 65° ± 10° |
| Vertical beam width | N/A | The half-power vertical beam width of the CLTA equals the narrowest declared (D.3) vertical beamwidth ±3°(Note 2) |
| Polarization (Note 3) | Match (Note4) | Match to in-band (Note 4) |
| Conducted interface return loss | > 10 dB | > 10 dB |
| NOTE 1: If a multi-column or multi-band antenna is used the column closest to the NR BS shall be selected while other columns are terminated during testing.NOTE 2: The vertical radiating dimension definition shall be used instead of the vertical beam width definition when the test chamber dimensions limit the use of vertical beam width definition. Otherwise the vertical beam width definition shall be used.NOTE 3: For *BS type 1-O* with dual polarization the CLTA has two conducted interfaces each representing one polarization.NOTE 4: Matched to the polarization of EUT antenna. |

*----------------------------- Next modified section ------------------------------*

#### 6.3.5.2 *BS type 2-O*

The final TRP measurement result in clause 6.3.4.2 shall remain:

- within +5.1 dB and -5.1 dB of the manufacturer's declared *rated carrier TRP* Prated,c,TRP carrier frequency 24.25 GHz < f ≤ 29.5 GHz.

- within +5.4 dB and –5.4 dB of the manufacturer's declared *rated carrier TRP* Prated,c,TRP for carrier frequency 37 GHz < f ≤ 40 GHz.

*----------------------------- Next modified section ------------------------------*

##### 6.7.3.4.2 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber if so follow steps 1, 3, 4, 6, 8, 9, 10, 11, 12 and 13.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) The measurement devices characteristics shall be:

 - measurement filter bandwidth: defined in clause 6.7.3.5.

 - detection mode: true RMS voltage or true power averaging.

The emission power should be averaged over an appropriate time duration to ensure the measurement is within the measurement uncertainty in Table 4.1.2.2-1 for FR1 and Table 4.1.2.2-2 for FR2.

4) For single carrier operation, set the BS to transmit according to the applicable test configuration in clause 4.8 using the corresponding test model(s) in clause 4.9.2 at manufacturers declared *rated carrier output power* (Prated,c,TRP).

 For a BS declared to be capable of multi-carrier and/or CA operation use the applicable test signal configuration and corresponding power setting specified in clauses 4.7.2 and 4.8 using the corresponding test model(s) in clause 4.9.2 on all carriers configured.

5) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I).

6) Measure the absolute power of the assigned channel frequency and the (adjacent channel frequency).

7) Repeat step 5-6 for all directions in the appropriated TRP measurement grid needed for TRPEstimate (see annex I).

8) Calculate TRPEstimate for the absolute total radiated power of the wanted channel and the adjacent channel using the measurements made in Step 7.

9) Calculate relative ACLR estimate.

NOTE 1: ACLR is calculated by the ratio of the absolute TRP of the assigned channel frequency and the absolute TRP of the adjacent frequency channel.

NOTE 2: For FR1 the measurement uncertainty of the reverberation chamber for the relative ACLR is higher than the measurement uncertainty in clause 4.1.2 the test requirements in table 6.7.3.5.1-1 shall be tightened following the procedure in clause 4.1.3.

10) Measure OTA ACLR for the frequency offsets both side of channel frequency as specified in table 6.7.3.5.1-1 for *BS type 1-O* or table 6.7.3.5.2-1for *BS type 2-O* respectively. In multiple carrier case only offset frequencies below the lowest and above the highest carrier frequency used shall be measured.

11) For the OTA ACLR requirement applied inside sub-block gap for non-contiguous spectrum operation or inside *Inter RF Bandwidth gap* for multi-band operation:

a) Measure OTA ACLR inside sub-block gap or *Inter RF Bandwidth gap*, if applicable.

b) Measure OTA CACLR inside sub-block gap or *Inter RF Bandwidth gap*, if applicable.

12) Repeat the test with the channel set-up using NR- FR1-TM1.2 defined in clause 4.9.2 in TS 38.141-1 [3] for *BS type 1-O*.

In addition, for *multi-band RIB*, the following steps shall apply:

13) For *BS type 1-O* and *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

*----------------------------- Next modified section ------------------------------*

##### 6.7.4.4.2 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber if so follow steps 1, 3, 4, 6 and 9.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) The measurement devices characteristics shall be:

- measurement filter bandwidth: defined in clause 6.7.4.5.

- detection mode: true RMS voltage or true power averaging.

 As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity, efficiency and avoiding e.g. carrier leakage, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

The emission power should be averaged over an appropriate time duration to ensure the measurement is within the measurement uncertainty in Table 4.1.2.2-1 for FR1 and Table 4.1.2.2-2 for FR2.

4) For single carrier operation, set the BS to transmit according to the applicable test configuration in clause 4.8 using the corresponding test model(s) in clause 4.9.2 at manufacturers declared *rated carrier output power* (Prated,c,TRP).

 For a BS declared to be capable of multi-carrier and/or CA operation, use the applicable test signal configuration and corresponding power setting specified in clause 4.7.2 and 4.8 using the corresponding test model(s) in clause 4.9.2 on all carriers configured.

5) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I).

6) Sweep the centre frequency of the measurement filter in contiguous steps and measure emission power within the specified frequency ranges with the specified measurement bandwidth.

7) Repeat step 5-6 for all directions in the appropriated TRP measurement grid needed for TRPEstimate (see annex I).

8) Calculate TRPEstimate using the measurements made in step 6.

9) For *BS type 1-O* and *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

*----------------------------- Next modified section ------------------------------*

6.7.5.2.4.2 Procedure

The following procedure for measuring TRP is based on directional power measurements as described in annex I. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber if so follow steps 1, 3, 4, 5, 7 and 10.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Measurements shall use a measurement bandwidth in accordance to the conditions in clause 6.7.5.2.5.

4) The measurement device characteristics shall be:

- Detection mode: True RMS.

The emission power should be averaged over an appropriate time duration to ensure the measurement is within the measurement uncertainty in Table 4.1.2.2-1 for FR1 and Table 4.1.2.2-2 for FR2.

5) Set the BS to transmit

- For RIBdeclared to be capable of single carrier operation only, set the RIB to transmit a signal according to the applicable test configuration in clause 4.8 using the corresponding test model in clause 4.9.2 (i.e. NR-FR1-TM1.1 for *BS type 1-O* and NR-FR2-TM1.1 for *BS type 2-O*), at manufacturer's declared rated output power Prated,c,TRP.

- For a RIB declared to be capable of multi-carrier and/or CA operation, set the RIB to transmit according to the corresponding test model in clause 4.9.2 on all carriers configured using the applicable test configuration and corresponding power setting specified in clause 4.7.2 and 4.8.

6) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I).

7) Measure the emission at the specified frequencies with specified measurement bandwidth.

8) Repeat step 6-7 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex I).

NOTE 1: The TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: The frequency sweep or the TRP measurement grid sweep may be done in any order.

9) Calculate TRP at each specified frequency using the directional measurements.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

10) For *BS type 1-O* and *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

*----------------------------- Next modified section ------------------------------*

6.7.5.4.4.2 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber if so follow steps 1, 3, 4, 5, 7 and 10.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Measurements shall use a measurement bandwidth in accordance to the conditions in clause 6.7.5.4.5.

4) The measurement device characteristics shall be:

- Detection mode: True RMS.

The emission power should be averaged over an appropriate time duration to ensure the measurement is within the measurement uncertainty in Table 4.1.2.2-1 for FR1 and Table 4.1.2.2-2 for FR2.

5) Set the BS to transmit:

- For RIBdeclared to be capable of single carrier operation only, set the RIB to transmit a signal according to the applicable test configuration in clause 4.8 using the corresponding test model in clause 4.9.2 (NR-FR1-TM1.1 for *BS type 1-O* and NR-FR2-TM1.1 for *BS type 2-O*), at manufacturer's declared rated output power Prated,c,TRP.

- For a RIB declared to be capable of multi-carrier and/or CA operation, set the RIB to transmit according to NR-FR1-TM1.1 in clause 4.9.2 on all carriers configured using the applicable test configuration and corresponding power setting specified in clause 4.7.2 and 4.8.

6) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I).

7) Measure the emission at the specified frequencies with specified measurement bandwidth.

8) Repeat step 6-7 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex I).

NOTE 1: The TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: The frequency sweep or the TRP measurement grid sweep may be done in any order.

9) Calculate TRP at each specified frequency using the directional measurements.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

10) For *multi-band RIBs* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

*----------------------------- Next modified section ------------------------------*

6.7.5.4.5.1 Test requirement for *BS type 1-O*

The power of any spurious emission shall not exceed the test limits in table 6.7.5.4.5-1 for a BS where requirements for co-existence with the system listed in the first column apply. For a *multi-band RIB*, the exclusions and conditions in the Note column of table 6.7.5.4.5-1 apply for each supported *operating band*.

Table 6.7.5.4.5-1: BS spurious emissions test limits for BS for co-existence with systems operating in other frequency bands

| System type for NR to co-exist with | Frequency range for co-existence requirement | Test limit | Measurement bandwidth | Notes |
| --- | --- | --- | --- | --- |
| GSM900 | 921 – 960 MHz | -45.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n8. |
|  | 876 – 915 MHz | -49.4 dBm | 100 kHz | For the frequency range 880-915 MHz, this requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.7.5.3. |
| DCS1800 | 1805 – 1880 MHz | -35.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n3.  |
|  | 1710 – 1785 MHz | -49.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in clause 6.7.5.3. |
| PCS1900 | 1930 – 1990 MHz | -35.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n2, n25 or band n70.  |
|  | 1850 – 1910 MHz | -49.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n2 or n25 since it is already covered by the requirement in clause 6.7.5.3.  |
| GSM850 or CDMA850 | 869 – 894 MHz | -45.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n5 or n26.  |
|  | 824 – 849 MHz | -49.4 dBm | 100 kHz | This requirement does not apply to BS operating in band n5 or n26, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band I or | 2110 – 2170 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n1 or n65. |
| E-UTRA Band 1 or NR Band n1 | 1920 – 1980 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n1 or n65, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band II or | 1930 – 1990 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n2 or n70.  |
| E-UTRA Band 2 or NR Band n2 | 1850 – 1910 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n2, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band III or | 1805 – 1880 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n3. |
| E-UTRA Band 3 or NR Band n3 | 1710 – 1785 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in clause 6.7.5.3.  |
| UTRA FDD Band IV or | 2110 – 2155 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66. |
| E-UTRA Band 4 | 1710 – 1755 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band V or | 869 – 894 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n5 or n26.  |
| E-UTRA Band 5 or NR Band n5 | 824 – 849 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n5 or n26, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band VI, XIX | 860 – 890 MHz  | -40.4 dBm | 1 MHz |  |
| or E-UTRA Band 6, 18, | 815 – 830 MHz  | -37.4 dBm | 1 MHz |  |
| 19 | 830 – 845 MHz | -37.4 dBm | 1 MHz |  |
| UTRA FDD Band VII or | 2620 – 2690 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n7. |
| E-UTRA Band 7 or NR Band n7 | 2500 – 2570 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n7, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band VIII or | 925 – 960 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n8. |
| E-UTRA Band 8 or NR Band n8 | 880 – 915 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band IX or | 1844.9 – 1879.9 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n3. |
| E-UTRA Band 9 | 1749.9 – 1784.9 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band X or | 2110 – 2170 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66 |
| E-UTRA Band 10 | 1710 – 1770 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band XI or XXI or | 1475.9 – 1510.9 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n74 or n75. |
| E-UTRA Band 11 or | 1427.9 – 1447.9 MHz  | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| 21 | 1447.9 – 1462.9 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n74 or n75. |
| UTRA FDD Band XII or | 729 – 746 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n12. |
| E-UTRA Band 12 or NR Band n12 | 699 – 716 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n12, since it is already covered by the requirement in clause 6.7.5.3.For NR BS operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| UTRA FDD Band XIII or | 746 – 756 MHz | -40.4 dBm | 1 MHz |  |
| E-UTRA Band 13 | 777 – 787 MHz | -37.4 dBm | 1 MHz |  |
| UTRA FDD Band XIV or | 758 – 768 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n14. |
| E-UTRA Band 14 or NR Band n14 | 788 – 798 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n14, since it is already covered by the requirement in clause 6.7.5.3. |
| E-UTRA Band 17 | 734 – 746 MHz | -40.4 dBm | 1 MHz |  |
|  | 704 – 716 MHz | -37.4 dBm | 1 MHz | For NR BS operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| UTRA FDD Band XX or | 791 – 821 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n20 or n28. |
| E-UTRA Band 20 or NR Band n20 | 832 – 862 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n20, since it is already covered by the requirement in clause 6.7.5.3. |
| UTRA FDD Band XXII or | 3510 – 3590 MHz | -40 dBm | 1 MHz | This requirement does not apply to BS operating in Band n77 or n78. |
| E-UTRA Band 22 | 3410 – 3490 MHz | -37 dBm | 1 MHz | This requirement does not apply to BS operating in Band n77 or n78. |
| E-UTRA Band 24 | 1525 – 1559 MHz | -40.4 dBm | 1 MHz |  |
|  | 1626.5 – 1660.5 MHz | -37.4 dBm | 1 MHz |  |
| UTRA FDD Band XXV or | 1930 – 1995 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n2, n25 or n70. |
| E-UTRA Band 25 or NR band n25 | 1850 – 1915 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n25 since it is already covered by the requirement in clause 6.7.5.3. For BS operating in Band n2, it applies for 1910 MHz to 1915 MHz, while the rest is covered in clause 6.7.5.3. |
| UTRA FDD Band XXVI or | 859 – 894 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n5 or n26.  |
| E-UTRA Band 26 or NR Band n26 | 814 – 849 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n26 since it is already covered by the requirement in clause 6.7.5.3. For BS operating in Band n5, it applies for 814 MHz to 824 MHz, while the rest is covered in clause 6.7.5.3. |
| E-UTRA Band 27 | 852 – 869 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n5. |
|  | 807 – 824 MHz | -37.4 dBm | 1 MHz | This requirement also applies to BS operating in Band n28, starting 4 MHz above the Band n28 downlink *operating band* (Note 5). |
| E-UTRA Band 28 or | 758 – 803 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n20 or n28. |
| NR Band n28 | 703 – 748 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n28, since it is already covered by the requirement in clause 6.7.5.3.  |
| E-UTRA Band 29 or NR Band n29 | 717 – 728 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n29. |
| E-UTRA Band 30 or | 2350 – 2360 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n30. |
| NR Band n30 | 2305 – 2315 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n30, since it is already covered by the requirement in clause 6.7.5.3. |
| E-UTRA Band 31 | 462.5 -467.5 MHz | -40.4 dBm | 1 MHz |  |
|  | 452.5 -457.5 MHz | -37.4 dBm | 1 MHz |  |
| UTRA FDD band XXXII or E-UTRA band 32 | 1452 – 1496 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n74 or n75. |
| UTRA TDD Band a) or E-UTRA Band 33 | 1900 – 1920 MHz | -40.4 dBm | 1 MHz |  |
| UTRA TDD Band a) or E-UTRA Band 34 or NR band n34 | 2010 – 2025 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n34. |
| UTRA TDD Band b) or E-UTRA Band 35 | 1850 – 1910 MHz | -40.4 dBm | 1 MHz |  |
| UTRA TDD Band b) or E-UTRA Band 36 | 1930 – 1990 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n2 or n25. |
| UTRA TDD Band c) or E-UTRA Band 37 | 1910 – 1930 MHz | -40.4 dBm | 1 MHz |  |
| UTRA TDD Band d) or E-UTRA Band 38 or NR Band n38 | 2570 – 2620 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n38.  |
| UTRA TDD Band f) or E-UTRA Band 39 or NR band n39 | 1880 – 1920MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n39. |
| UTRA TDD Band e) or E-UTRA Band 40 or NR Band n40 | 2300 – 2400MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Bands n30 or n40. |
| E-UTRA Band 41 or NR Band n41 | 2496 – 2690 MHz | -40.4 dBm | 1 MHz | This is not applicable to BS operating in Band n41. |
| E-UTRA Band 42 | 3400 – 3600 MHz | -40 dBm | 1 MHz | This requirement does not apply to BS operating in Band n77 or n78. |
| E-UTRA Band 43 | 3600 – 3800 MHz | -40 dBm | 1 MHz | This requirement does not apply to BS operating in Band n77 or n78. |
| E-UTRA Band 44 | 703 – 803 MHz | -40.4 dBm | 1 MHz | This is not applicable to BS operating in Band n28. |
| E-UTRA Band 45 | 1447 – 1467 MHz | -40.4 dBm | 1 MHz |  |
| E-UTRA Band 46 or NR Band n46 | 5150 – 5925 MHz | -39.5 dBm | 1 MHz | This is not applicable to BS operating in Band n46 or n96. |
| E-UTRA Band 47 | 5855 – 5925 MHz | -39.5 dBm | 1 MHz |  |
| E-UTRA Band 48 | 3550 – 3700 MHz | -40 dBm | 1 MHz | This requirement does not apply to BS operating in Band n77 or n78. |
| E-UTRA Band 50 or NR Band n50 | 1432 – 1517 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| E-UTRA Band 51 or NR Band n51 | 1427 – 1432 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75 or n76. |
| E-UTRA Band 53 or NR Band n53 | 2483.5 - 2495 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n41 or n90. |
| E-UTRA Band 65 or | 2110 – 2200 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n1 or n65.  |
| NR Band n65 | 1920 – 2010 MHz | -37.4 dBm | 1 MHz | For BS operating in Band n1, it applies for 1980 MHz to 2010 MHz, while the rest is covered in clause 6.7.5.3.This requirement does not apply to BS operating in band n65, since it is already covered by the requirement in clause 6.7.5.3. |
| E-UTRA Band 66 or | 2110 – 2200 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66. |
| NR Band n66 | 1710 – 1780 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in clause 6.7.5.3. |
| E-UTRA Band 67 | 738 – 758 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n28. |
| E-UTRA Band 68 | 753 -783 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n28. |
|  | 698-728 MHz | -37.4 dBm | 1 MHz | For BS operating in Band n28, this requirement applies between 698 MHz and 703 MHz, while the rest is covered in clause 6.7.5.3. |
| E-UTRA Band 69 | 2570 – 2620 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n38. |
| E-UTRA Band 70 or | 1995 – 2020 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n2, n25 or n70 |
| NR Band n70 | 1695 – 1710 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n70, since it is already covered by the requirement in clause 6.7.5.3. |
| E-UTRA Band 71 or | 617 – 652 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n71 |
| NR Band n71 | 663 – 698 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n71, since it is already covered by the requirement in clause 6.7.5.3. |
| E-UTRA Band 72 | 461 – 466 MHz | -40.4 dBm | 1 MHz |  |
|  | 451 – 456 MHz | -37.4 dBm | 1 MHz |  |
| E-UTRA Band 74 or | 1475 – 1518 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n74 or n75. |
| NR Band n74 | 1427 – 1470 MHz | -37.4 dBm | 1MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| E-UTRA Band 75 or NR Band n75 | 1432 – 1517 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| E-UTRA Band 76 or NR Band n76 | 1427 – 1432 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75 or n76. |
| NR Band n77 | 3.3 – 4.2 GHz | -40 dBm | 1 MHz | This requirement does not apply to BS operating in Band n77 or n78 |
| NR Band n78 | 3.3 – 3.8 GHz | -40 dBm | 1 MHz | This requirement does not apply to BS operating in Band n77 or n78 |
| NR Band n79 | 4.4 – 5.0 GHz | -39.5 dBm | 1 MHz | This requirement does not apply to BS operating in Band n79 |
| NR Band n80 | 1710 – 1785 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n3, since it is already covered by the requirement in clause 6.7.5.3. |
| NR Band n81 | 880 – 915 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.7.5.3. |
| NR Band n82 | 832 – 862 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n20, since it is already covered by the requirement in clause 6.7.5.3. |
| NR Band n83 | 703 – 748 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n28, since it is already covered by the requirement in clause 6.7.5.3.  |
| NR Band n84 | 1920 – 1980 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n1, since it is already covered by the requirement in clause 6.7.5.3. |
| E-UTRA Band 85 or NR Band n85 | 728 - 746 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n12 or n85. |
| 698 - 716 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n12 or n85, since it is already covered by the requirement in clause 6.7.5.3.For NR BS operating in n29, it applies 1 MHz below the Band n29 downlink operating band (Note 5). |
| NR Band n86 | 1710 – 1780 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n66, since it is already covered by the requirement in clause 6.7.5.3. |
| NR Band n89 | 824 – 849 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n5, since it is already covered by the requirement in clause 6.7.5.3. |
| NR Band n91 | 1427 – 1432 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75 or n76. |
| 832 – 862 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n20, since it is already covered by the requirement in clause 6.7.5.3. |
| NR Band n92 | 1432 – 1517 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| 832 – 862 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n20, since it is already covered by the requirement in clause 6.7.5.3. |
| NR Band n93 | 1427 – 1432 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n75 or n76. |
| 880 – 915 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.7.5.3. |
| NR Band n94 | 1432 – 1517 MHz | -40.4 dBm | 1 MHz | This requirement does not apply to BS operating in Band n50, n51, n74, n75 or n76. |
| 880 – 915 MHz | -37.4 dBm | 1 MHz | This requirement does not apply to BS operating in band n8, since it is already covered by the requirement in clause 6.7.5.3. |
| NR Band n95 | 2010 – 2025 MHz | -40.4 dBm | 1 MHz |  |
| NR Band n96 | 5925 – 7125 MHz | -39.5 dBm | 1 MHz | This requirement does not apply to BS operating in Band n46 or n96. |

*----------------------------- Next modified section ------------------------------*

#### 6.8.4.2 Procedure

1) Select a CLTA according to the description in clause 4.12 and parameters given in table 4.12.2.2-1.

2) Place the CLTA according to the description in clause 4.12 and parameters given in table 4.12.2.3-1.

3) The test antenna(s) shall be dual (or single) polarized covering the same frequency range as the NR BS and the emission frequencies.

4) Several test antennas are required to cover both the NRBSand the whole emission frequency range.

5) Connect test antenna and CLTA to the measurement equipment as shown in annex E.1.5.

6) During the OTA emission measurements at the test antenna conducted output(s), both NR BS and CLTA are rotated around same axis.

7) The OTA emission measurement method shall be TRP, according to the procedure described in annex I.

8) The measurement device (signal analyzer) characteristics shall be:

- Detection mode: True RMS.

The emission power should be averaged over an appropriate time duration to ensure the measurement is within the measurement uncertainty in Table 4.1.2.2-1.

9) Set the BS *type 1-O* to transmit:

- Set the NR BSto transmit maximum power according to the applicable test configuration in clause 4.8 using the corresponding test models or set of physical channels in clause 4.9.2.

- For the NR BS declared to be capable of multi-carrier and/or CA operation, set the BS to transmit according to the applicable test configuration and corresponding power setting specified in clause 4.7.2 and 4.8 using the corresponding test models on all carriers configured.

10) Generate the interfering signal using test model as defined in clause 4.9.2, at a centre frequency offset according to the conditions in table 9.8.2-1 in TS 38.104 [2], but exclude interfering frequencies that are outside of the allocated downlink operating band or interfering frequencies that are not completely within the sub-block gap or within the *Inter RF Bandwidth gap*.

11) Connect the interfering signal to the CLTA input interfaces, equally dividing the power among supported polarizations. Adjust the interfering signal level at the CLTA conducted input(s) as defined in table 6.8.5.1-1.

12) If the interfering signal is applicable according to clause 4.7, perform the unwanted emission tests specified in clauses 6.7.3 (OTA ACLR) and 6.7.4 (OTA OBUE) for all third and fifth order intermodulation products which appear in the frequency ranges defined in clauses 6.7.3 and 6.7.4 (Note 2). The width of the intermodulation products shall be taken into account.

13) If the interfering signal is applicable according to clause 4.7, perform the Transmitter spurious emissions test as specified in clause 6.7.5 (OTA spurious emission), except OTA co-location spurious emission, for all third and fifth order intermodulation products which appear in the frequency ranges defined in clause 6.7.5 (Note 2). The width of the intermodulation products shall be taken into account.

14) Verify that the emission level does not exceed the required level in clause 6.8.5 (Test requirements) with the exception of interfering signal frequencies.

15) Repeat the test for the remaining interfering signal centre frequency offsets defined in table 6.8.5.1-1.

16) Repeat the test for the remaining interfering signals defined in clause 4.7 for requirements 6.7.3 (OTA ACLR), 6.7.4 (OTA OBUE) and 6.7.5 (OTA spurious emission), except OTA co-location spurious emission.

In addition, for *multi-band RIB,* the following steps shall apply:

17) For *multi-band RIB* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

NOTE 1: The third order intermodulation products are centred at 2F1±F2 and 2F2±F1. The fifth order intermodulation products are centred at 3F1±2F2, 3F2±2F1, 4F1±F2, and 4F2±F1 where F1 represents the test signal centre frequency or centre frequency of each sub-block and F2 represents the interfering signal centre frequency. The widths of intermodulation products are:

- (n\*BWF1 + m\* BWF2) for the nF1±mF2 products;

- (n\* BWF2 + m\* BWF1) for the nF2±mF1 products;

 where BWF1 represents the test wanted signal RF bandwidth or channel bandwidth in case of single carrier, or sub-block bandwidth and BWF2 represents the interfering signal channel bandwidth.

NOTE 2: During the conformance test the interferer signal can be applied on one side of the wanted signal, while the transmitter intermodulation emission is measured only on the opposite side of the wanted signal. This applies for intermodulation products which are within the operating band or OBUE region.

*----------------------------- Next modified section ------------------------------*

### 6.8.5 Test requirements

#### 6.8.5.1 Requirement for BS type 1-O

The transmitter intermodulation level shall not exceed the TRP unwanted emission limits specified for OTA transmitter spurious emission in clause 6.7.5 (except co-location with other base stations), OTA out-of-band emissions in clause 6.7.4 and OTA ACLR in clause 6.7.3 in the presence of a wanted signal and an interfering signal, defined in table 6.8.5.1-1.

The requirement is applicable outside the *Base Station RF Bandwidth edges*. The interfering signal offset is defined relative to the *Base Station RF Bandwidth* *edges* or *Radio Bandwidth* edges.

For RIBs supporting operation in *non-contiguous spectrum*, the requirement is also applicable inside a *sub-block gap* for interfering signal offsets where the interfering signal falls completely within the *sub-block gap*. The interfering signal offset is defined relative to the *sub-block* edges.

For RIBs supporting operation in multiple *operating bands*, the requirement shall apply relative to the *Base Station RF Bandwidth* *edges* of each *operating band*. In case the inter *RF Bandwidth* gap is less than 3\*BWChannel MHz (where BWChannel is the minimal *BS channel bandwidth* of the band), the requirement in the gap shall apply only for interfering signal offsets where the interfering signal falls completely within the inter *RF Bandwidth* gap.

Table 6.8.5.1-1: Interfering and wanted signals for the OTA transmitter intermodulation requirement

| **Parameter** | **Value** |
| --- | --- |
| Wanted signal | NR single or multi-carrier, or multiple intra-band contiguously or non-contiguously aggregated carriers |
| Interfering signal type | NR signal, the minimum *BS channel bandwidth* (BWChannel) with 15 kHz SCS of the band defined in clause 5.3.5 of TS 38.104 [2] |
| Interfering signal power level | min(46 dBm, Prated,t,TRP) |
| Interfering signal centre frequency offset from the lower (upper) edge of the wanted signal or edge of *sub-block* inside a gap | , for n=1, 2 and 3 |
| NOTE 1: Interfering signal positions that are partially or completely outside of any downlink *operating band* of the BS are excluded from the requirement, unless the interfering signal positions fall within the frequency range of adjacent downlink *operating bands* in the same geographical area.NOTE 2: In Japan, NOTE 1 is not applied in Band n77, n78, n79.NOTE 3: For *BS type 1-O* supporting dual polarization, the interfering signal power shall be equally divided between supported polarizations at the CLTA interfaces. |

*----------------------------- Next modified section ------------------------------*

#### 7.7.4.2 Procedure

The following procedure for measuring TRP is based on the directional power measurements as described in annex I. An alternative method to measure TRP is to use a characterized and calibrated reverberation chamber if so follow steps 1, 3, 4, 5, 7 and 10.

1) Place the BS at the positioner.

2) Align the manufacturer declared coordinate system orientation (D.2) of the BS with the test system.

3) Measurements shall use a measurement bandwidth in accordance to the conditions in clause 7.7.5.

4) The measurement device characteristics shall be:

- Detection mode: True RMS.

The emission power should be averaged over an appropriate time duration to ensure the measurement is within the measurement uncertainty in Table 4.1.2.3-1 for FR1 and Table 4.1.2.3-2 for FR2.

5) Set the TDD BS to receive only.

6) Orient the positioner (and BS) in order that the direction to be tested aligns with the test antenna such that measurements to determine TRP can be performed (see annex I).

7) Measure the emission at the specified frequencies with specified measurement bandwidth

8) Repeat step 6-9 for all directions in the appropriated TRP measurement grid needed for full TRP estimation (see annex I).

NOTE 1: The TRP measurement grid may not be the same for all measurement frequencies.

NOTE 2: The frequency sweep or the TRP measurement grid sweep may be done in any order

9) Calculate TRP at each specified frequency using the directional measurements.

In addition, for *multi-band RIB(s)*, the following steps shall apply:

10) For *BS type 1-O* and *multi-band RIB(s)* and single band tests, repeat the steps above per involved band where single band test configurations and test models shall apply with no carrier activated in the other band.

*----------------------------- Next modified section ------------------------------*

## M.1.2 Numerical definition of the pass-fail limits for testing PUSCH 0.001% BLER

Table M.1.2-1: Pass fail limits

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ne | nsp | nsf | ne | nsp | nsf | ne | nsp | nsf |
| 0 | 1074532 | 1067 | 39 | 5369517 | 1508043 | (\*) | (\*) | (\*) |
| 1 | 1074532 | 1067 | 40 | 5463478 | 1568438 | 608 | 49669522 | 49113220 |
| 2 | 1274645 | 1067 | 41 | 5557107 | 1629304 | 609 | 49743206 | 49202955 |
| 3 | 1444583 | 1067 | 42 | 5650414 | 1690627 | 610 | 49816884 | 49292699 |
| 4 | 1599072 | 4727 | 43 | 5743410 | 1752389 | 611 | 49890556 | 49382451 |
| 5 | 1743641 | 12160 | 44 | 5836108 | 1814577 | 612 | 49964222 | 49472211 |
| 6 | 1881111 | 23683 | 45 | 5928516 | 1877177 | 613 | 50037883 | 49561980 |
| 7 | 2013164 | 39190 | 46 | 6020643 | 1940175 | 614 | 50111538 | 49651757 |
| 8 | 2140902 | 58403 | 47 | 6112500 | 2003560 | 615 | 50185187 | 49741542 |
| 9 | 2265092 | 81000 | 48 | 6204094 | 2067319 | 616 | 50258831 | 49831335 |
| 10 | 2386297 | 106667 | 49 | 6295434 | 2131442 | 617 | 50332469 | 49921137 |
| 11 | 2504945 | 135116 | 50 | 6386526 | 2195916 | 618 | 50406101 | 50010947 |
| 12 | 2621369 | 166089 | 51 | 6477380 | 2260734 | 619 | 50479728 | 50100765 |
| 13 | 2735834 | 199360 | 52 | 6568000 | 2325884 | 620 | 50553349 | 50190592 |
| 14 | 2848557 | 234730 | 53 | 6658395 | 2391358 | 621 | 50626965 | 50280427 |
| 15 | 2959718 | 272025 | 54 | 6748569 | 2457146 | 622 | 50700575 | 50370269 |
| 16 | 3069467 | 311091 | 55 | 6838530 | 2523241 | 623 | 50774179 | 50460120 |
| 17 | 3177931 | 351792 | 56 | 6928283 | 2589634 | 624 | 50847778 | 50549980 |
| 18 | 3285220 | 394009 | 57 | 7017834 | 2656318 | 625 | 50921372 | 50639847 |
| 19 | 3391428 | 437636 | 58 | 7107187 | 2723285 | 626 | 50994959 | 50729722 |
| 20 | 3496637 | 482577 | 59 | 7196348 | 2790528 | 627 | 51068542 | 50819605 |
| 21 | 3600921 | 528746 | 60 | 7285321 | 2858041 | 628 | 51142119 | 50909497 |
| 22 | 3704343 | 576068 | 61 | 7374112 | 2925816 | 629 | 51215690 | 50999396 |
| 23 | 3806960 | 624473 | 62 | 7462724 | 2993848 | 630 | 51289256 | 51089304 |
| 24 | 3908823 | 673898 | 63 | 7551162 | 3062130 | 631 | 51362816 | 51179219 |
| 25 | 4009977 | 724286 | 64 | 7639430 | 3130657 | 632 | 51436371 | 51269143 |
| 26 | 4110465 | 775585 | 65 | 7727532 | 3199424 | 633 | 51509921 | 51359074 |
| 27 | 4210324 | 827748 | 66 | 7815471 | 3268424 | 634 | 51583465 | 51449013 |
| 28 | 4309587 | 880730 | 67 | 7903252 | 3337653 | 635 | 51657003 | 51538961 |
| 29 | 4408285 | 934492 | 68 | 7990878 | 3407105 | 636 | 51730537 | 51628916 |
| 30 | 4506448 | 988997 | 69 | 8078352 | 3476777 | 637 | 51804065 | 51718879 |
| 31 | 4604101 | 1044211 | 70 | 8165677 | 3546663 | 638 | 51877587 | 51808850 |
| 32 | 4701268 | 1100101 | 71 | 8252857 | 3616759 | 639 | 51951104 | 51898828 |
| 33 | 4797972 | 1156638 | 72 | 8339894 | 3687060 | 640 | 52024616 | 51988815 |
| 34 | 4894232 | 1213795 | 73 | 8426792 | 3757563 | 641 | 52098123 | 52078809 |
| 35 | 4990069 | 1271547 | 74 | 8513553 | 3828263 | 642 | 52171624 | 52168811 |
| 36 | 5085500 | 1329869 | 75 | 8600181 | 3899156 |  |  |  |
| 37 | 5180542 | 1388740 | 76 | 8686677 | 3970239 |  |  |  |
| 38 | 5275209 | 1448137 | 77 | 8773044 | 4041508 | \*) Follow M.1.3.2 to derive |

NOTE 1: The first column is the number of errors (ne = number of NACK)

NOTE 2: The second column is the number of samples for the pass limit (nsp, ns=Number of Samples= number of NACK + ACK)

NOTE 3: The third column is the number of samples for the fail limit (nsf)

NOTE 4: An ideal EUT passes after 1074532 samples. The maximum test time is 52171625 samples. A EUT passes, if the maximum number of samples is reached and it did not fail before.

## M.1.3 Theory to derive the early pass/fail limits in M.1.2 (informative)

### M.1.3.1 Numerical definition of the pass-fail limits for testing PUSCH 0.001% BLER

A statistical test is characterized by test time, selectivity and confidence level. The outcome of the statistical test is a decision. This decision may be correct, i.e., BSs whose BLER is greater than 0.001% being declared to fail, and BSs whose BLER is smaller or equal to 0.001% being declared to pass, or in-correct (as detailed above). The Confidence Level (CL) describes the probability that the decision is a correct one. The complement is the wrong decision probability (risk) D = 1-CL.

When testing BLER, transport blocks or "samples" are observed and the numbers of correctly and erroneously received blocks are recorded. For a "standard" test, a pre-defined number of samples are observed, and a pass/fail decision is made based on the number of observed errors being above/below a threshold. This threshold is based on the targeted BLER and the design target CL. There is always some risk of a statistical variation leading to an incorrect pass/fail decision. The greater the number of samples that are recorded, the lower is the risk of such an error. The number of samples that are observed in a standard test is dimensioned to achieve an acceptable low risk of error (i.e., an acceptable high confidence level) for BS that just meet the BLER limit.

The standard test works well where the BLER level is relatively high and confidence level relatively low (both are chosen to be on a comparable order of magnitude). However, for ultra-low BLER testing the length of time required for observing sufficient samples to achieve a 99.999% confidence level is excessive. In many cases, the BS will in fact have a much lower true BLER than the limit, i.e., design target of the test, (in which case, the number of samples needed to achieve high confidence that the BLER is lower than the limit is much smaller) or, if failing the requirement will have a much higher true BLER (in which case, errors occur more frequently and it can be demonstrated that the BS is above the BLER limit with fewer samples).

To avoid long test times, an alternative test method called early pass/fail is adopted. With the early pass/fail, each time a block error is encountered, a decision is made on whether the BS can be passed/failed with 99.999% CL or the test needs to continue until another error is encountered. In the case of very good BSs, the test can also be passed, when the number of samples permissible for one error event is reached and no error event is recorded. Pass/Fail is decided based on the total number of observed samples and errors, and a statistical calculation based on an inverse binomial cumulative distribution. The calculation involves one parameter, one variable and the result:

- Parameter: d (per step decision probability).

- Variable: ne (number of observed errors).

- Result: ns (number of expected samples for pass/fail, depending on which one is calculated).

The per step decision probability risk, d, expresses the probability of making an incorrect pass/fail decision in the current step (i.e., for the current decision coordinate). d is determined by simulation such that the overall risk of making a wrong decision over all steps of each test of a large number of tests on a large number of BSs that exactly meet the BLER limit is D=0.001% (and hence the CL 99.999%).

It should be noted that d is determined separately considering early pass and early fail testing.

For a marginal BS (i.e., a BS almost exactly meeting the BLER), the unmodified early pass/early fail approach is unable to distinguish whether the BS has just passed or just failed the BLER (ε→0), and can thus terminate with an "undecided" result. To avoid this undecided result and provide selectivity, a so-called "bad device factor" (M) is introduced into the early pass calculation. This factor biases the decision towards avoiding failing good BS.

### M.1.3.2 Simulation to derive the pass-fail limits for testing PUSCH 0.001% BLER

There is freedom to design the decision co-ordinates (ne, ns), as captured in clause M.1.2.

The binomial distribution and its inverse are used to design the pass and fail limits. Note that this method is not unique and that other methods exist.



Where

- fail(..) is the error ratio for the fail limit.

- pass(..) is the error ratio for the pass limit.

- ER is the specified error ratio 1e-5.

- ne is the number of bad results. This is the variable in both equations.

- M is the Bad EUT factor M=1.5.

- df is the wrong decision probability of a single (ne, ns) co-ordinate for the fail limit.
It is found by simulation to be df = 2e-7.

- clp is the confidence level of a single (ne, ns) co-ordinate for the pass limit.
It is found by simulation to be clp = 0.9999999.

- qnbinom(..): The inverse cumulative function of the negative binomial distribution.

The simulation works as follows:

- A large population of limit EUTs with true ER = 1e-5 is decided against the pass and fail limits.

- clp and df are tuned such that CL (99.999 %) of the population passes and D (0.001 %) of the population fails.

- A population of Bad EUTs with true ER = M\*1e-5 is decided against the same pass and fail limits.

- clp and df are tuned such that CL (99.999 %) of the population fails and D (0.001 %) of the population passes.

- The number of EUTs decrease during the simulation, as the decided EUTs leave the population. That number decreases with an approximately exponential characteristics. After 642 bad results all EUTs of the population are decided.

NOTE: The exponential decrease of the population is an optimal design goal for the decision co-ordinates (ne, ns), which can be achieved with other formulas or methods as well.

*----------------------------- End of modified section ------------------------------*