**3GPP TSG-RAN4 Meeting # 112 *R4-2412300***

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

|  |
| --- |
| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.181** | **CR** | **0037** | **rev** | **1**  | **Current version:** | **17.5.0** |  |
|  |
| *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)*.* |
|  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

|  |
| --- |
|  |
| ***Title:***  | (NR\_NTN\_solutions-Core) CR for 38.181 on RF FR1-NTN FRC alignments  |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_NTN\_solutions-Core |  | ***Date:*** | 2024-08-19 |
|  |  |  |  |  |
| ***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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | In RAN4#111 meeting, companies agreed to use “FRx-NTN” for NR NTN demodulation FRC table to differenciate NTN deployment bands, and also differenciate from different deployment scenarios to avoid misunderstanding of FRC table naming, such as TN and NTN deployment. In Rel-18 specifications, FR2-NTN demodulation part have been updated and it is reasonable to update RF part (reference sensitivity and dynamic range) as well to get alignment in whole specification.  |
|  |  |
| ***Summary of change:*** | * Change “FR1” to “FR1-NTN” in all statements and tables.
* Correct some editorial errors and adjust table format.
 |
|  |  |
| ***Consequences if not approved:*** | It will not be aligned between RF and Demod part in same specifications and it would cause misunderstanding for TE vendors to implement FRC tables.  |
|  |  |
| ***Clauses affected:*** | 7.2, 7.3, 10.2, 10.3, 10.4, A.1, A.2 |
|  |  |
|  | **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 R4-2412300. |

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

# 7 Conducted receiver characteristics

## 7.1 General

Conducted receiver characteristics are specified at the *TAB connector* for *SAN type 1-H*, with full complement of transceivers for the configuration in normal operating condition.

Unless otherwise stated, the following arrangements apply for conducted receiver characteristics requirements in clause 7:

- Requirements shall be met for any transmitter setting.

- The requirements shall be met with the transmitter unit(s) ON.

- Throughput requirements do not assume HARQ retransmissions.

- When SAN is configured to receive multiple carriers, all the throughput requirements are applicable for each received carrier.

- For ACS and blocking characteristics, the negative offsets of the interfering signal apply relative to the lower *SAN RF Bandwidth* edge, and the positive offsets of the interfering signal apply relative to the upper *SAN RF Bandwidth* edge.

NOTE: In normal operating condition the SAN is configured to transmit and receive at the same time.

For *SAN type 1-H* if a number of *TAB connectors* have been declared equivalent (D.37), only a representative one is necessary to demonstrate conformance.

## 7.2 Reference sensitivity level

### 7.2.1 Definition and applicability

The reference sensitivity power level PREFSENS is the minimum mean power received at the *TAB connector* for *SAN type 1-H* at which a throughput requirement shall be met for a specified reference measurement channel.

### 7.2.2 Minimum requirement

The minimum requirement for *SAN type 1-H* is in TS 38.108 [2], clause 7.2.2.

### 7.2.3 Test purpose

To verify that for the *SAN type 1-H* receiver at the reference sensitivity level the throughput requirement shall be met for a specified reference measurement channel.

### 7.2.4 Method of test

#### 7.2.4.1 Initial conditions

Test environment:

- Normal; see annex B.2.

RF channels to be tested for single carrier: B, M and T; see clause 4.9.1.

#### 7.2.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *SAN type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.1 for *SAN type 1-H*.

2) Set the SAN to transmit a signal using the applicable test configuration and corresponding power setting specified in clauses 4.7 and 4.8 using the corresponding test models or set of physical channels in clause 4.9.2, for *SAN type 1-H* set the *TAB connector* to the manufacturers declared *rated carrier output power* (Prated,c,TABC, D.34).

3) Start the signal generator for the wanted signal to transmit the Fixed Reference Channels for reference sensitivity according to annex A.1.

4) Set the signal generator for the wanted signal power as specified in clause 7.2.5.

5) Measure the throughput according to annex A.1.

### 7.2.5 Test requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A.1 with parameters specified in table 7.2.5-1 and 7.2.5-2 for *SAN type 1-H* in all operating band in FR1-NTN.

Table 7.2.5-1: SAN GEO class reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| SAN channel bandwidth (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel(NOTE) | Reference sensitivity power level, PREFSENS (dBm) |
| 5, 10, 15  | 15 | G-FR1-NTN-A1-1 | -98.6 |
| 10, 15  | 30 | G-FR1-NTN-A1-2 | -98.7 |
| 10, 15 | 60 | G-FR1-NTN-A1-3 | -95.8 |
| 20  | 15 | G-FR1-NTN-A1-4 | -92.2 |
| 20  | 30 | G-FR1-NTN-A1-5 | -92.5 |
| 20  | 60 | G-FR1-NTN-A1-6 | -92.6 |
| NOTE: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *SAN channel bandwidth*. |

Table 7.2.5-2: SAN LEO class reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| SAN channel bandwidth (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel(NOTE) | Reference sensitivity power level, PREFSENS (dBm) |
| 5, 10, 15  | 15 | G-FR1-NTN-A1-1 | -101.7 |
| 10, 15  | 30 | G-FR1-NTN-A1-2 | -101.8 |
| 10, 15 | 60 | G-FR1-NTN-A1-3 | -98.9 |
| 20  | 15 | G-FR1-NTN-A1-4 | -95.3 |
| 20  | 30 | G-FR1-NTN-A1-5 | -95.6 |
| 20  | 60 | G-FR1-NTN-A1-6 | -95.7 |
| NOTE: PREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *SAN channel bandwidth*. |

## 7.3 Dynamic range

### 7.3.1 Definition and applicability

The dynamic range is specified as a measure of the capability of the receiver to receive a wanted signal in the presence of an interfering signal at the *TAB connector* for *SAN type 1-H* inside the received *SAN channel bandwidth*. In this condition, a throughput requirement shall be met for a specified reference measurement channel. The interfering signal for the dynamic range requirement is an AWGN signal.

### 7.3.2 Minimum requirement

The minimum requirement for *SAN type 1-H* is in TS 38.108 [2], clause 7.3.2.

### 7.3.3 Test purpose

To verify that the each *SAN type 1-H* *TAB connector* receiver dynamic range, the relative throughput shall fulfil the specified limit.

### 7.3.4 Method of test

#### 7.3.4.1 Initial conditions

Test environment: Normal; see annex B.2.

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

#### 7.3.4.2 Procedure

The minimum requirement is applied to all connectors under test.

For *SAN type 1-H* the procedure is repeated until all *TAB connectors* necessary to demonstrate conformance have been tested; see clause 7.1.

1) Connect the connector under test to measurement equipment as shown in annex D.2.2 for *SAN type 1-H*.

2) Set the signal generator for the wanted signal to transmit as specified in table 7.3.5-1 according to the appropriate SAN class.

3) Set the Signal generator for the AWGN interfering signal at the same frequency as the wanted signal to transmit as specified in table 7.3.5-1 according to the appropriate SAN class.

4) Measure the throughput according to annex A.2.

### 7.3.5 Test requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channel as specified in annex A.2 with parameters specified in table 7.3.5-1 for SAN LEO class.

Table 7.3.5-1: SAN LEO class dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SAN channel bandwidth (MHz) | Subcarrier spacing (kHz) | Reference measurement channel | Wanted signal mean power (dBm) | Interfering signal mean power (dBm) / BWConfig | Type of interfering signal |
| 5 | 15 | G-FR1-NTN-A2-1 | -76.1 | -88.2  | AWGN |
| 30 | G-FR1-NTN-A2-2  | -76.8 |
| 10 | 15 | G-FR1-NTN-A2-1 | -76.1 | -85.0  | AWGN |
| 30 | G-FR1-NTN-A2-2  | -76.8 |
| 60 | G-FR1-NTN-A2-3  | -73.8 |
| 15 | 15 | G-FR1-NTN-A2-1 | -76.1 | -83.2  | AWGN |
| 30 | G-FR1-NTN-A2-2  | -76.8 |
| 60 | G-FR1-NTN-A2-3 | -73.8 |
| 20 | 15 | G-FR1-NTN-A2-4 | -69.9 | -81.9  | AWGN |
| 30 | G-FR1-NTN-A2-5 | -69.9 |
| 60 | G-FR1-NTN-A2-6 | -70.2 |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *SAN channel bandwidth*. |

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

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

# 10 Radiated receiver characteristic

## 10.1 General

General test conditions for receiver tests are given in clause 4, including interpretation of measurement results and configurations for testing. SAN configurations for the tests are defined in clause 4.5.

Radiated receiver characteristics are specified at RIB for *SAN type 1-H or* *SAN type 1-O*, with full complement of transceivers for the configuration in normal operating condition.

Unless otherwise stated, the following arrangements apply for the radiated receiver characteristics requirements in clause 10:

- Requirements shall be met for any transmitter setting.

- The requirements shall be met with the transmitter unit(s) ON.

- Throughput requirements defined for the radiated receiver characteristics do not assume HARQ retransmissions.

- When SAN is configured to receive multiple carriers, all the throughput requirements are applicable for each received carrier.

- For ACS and blocking characteristics, the negative offsets of the interfering signal apply relative to the lower *SAN RF Bandwidth* edge, and the positive offsets of the interfering signal apply relative to the upper *SAN RF Bandwidth* edge.

- Each requirement shall be met over the RoAoA specified.

NOTE 1: In normal operating condition the SAN in FDD operation is configured to transmit and receive at the same time.

For FR1 requirements which are to be met over the *OTA REFSENS RoAoA* absolute requirement values are offset by the following term:

 ΔOTAREFSENS = 44.1 - 10\*log10(BeWθ,REFSENS\*BeWφ,REFSENS) dB for the reference direction

and

 ΔOTAREFSENS = 41.1 - 10\*log10(BeWθ,REFSENS\*BeWφ,REFSENS) dB for all other directions

For requirements which are to be met over the *minSENS RoAoA* absolute requirement values are offset by the following term:

 ΔminSENS = PREFSENS – EISminSENS (dB)

## 10.2 OTA sensitivity

### 10.2.1 Definition and applicability

The OTA sensitivity requirement is a *directional requirement* based upon the declaration of one or more *OTA sensitivity direction declarations* (OSDD), related to a *SAN type 1-H* and *SAN type 1-O* receiver.

The *SAN type 1-H* and *SAN type 1-O* may optionally be capable of redirecting/changing the *receiver target* by means of adjusting SAN settings resulting in multiple *sensitivity RoAoA*. The *sensitivity RoAoA* resulting from the current SAN settings is the active *sensitivity RoAoA*.

If the SAN is capable of redirecting the *receiver target* related to the OSDD then the OSDD shall include:

- *SAN channel bandwidth* and declared minimum EISlevel applicable to any active *sensitivity RoAoA* inside the *receiver target redirection range* in the OSDD.

- A declared *receiver target redirection range*, describing all the angles of arrival that can be addressed for the OSDD through alternative settings in the SAN.

- Five declared *sensitivity RoAoA* comprising the conformance testing directions as detailed in TR 37. 941 [13].

- The *receiver target reference direction*.

NOTE 1: Some of the declared *sensitivity RoAoA* may coincide depending on the redirection capability.

NOTE 2: In addition to the declared *sensitivity RoAoA*, several *sensitivity RoAoA* may be implicitly defined by the *receiver target redirection range* without being explicitly declared in the OSDD.

If the SAN is not capable of redirecting the *receiver target* related to the OSDD, then the OSDD includes only:

- The set(s) of RAT, *SAN channel bandwidth* and declared minimum EISlevel applicable to the *sensitivity RoAoA* in the OSDD.

- One declared active *sensitivity RoAoA*.

- The *receiver target reference direction*.

NOTE 4: For SAN without target redirection capability, the declared (fixed) *sensitivity RoAoA* is always the active *sensitivity RoAoA*.

The OTA sensitivity EIS level declaration shall apply to each supported polarization, under the assumption of *polarization match*.

### 10.2.2 Minimum requirement

For a received signal whose AoA of the incident wave is within the active *sensitivity RoAoA* of an OSDD, the error rate criterion as described in TS 38.108 [2] clause 10.2.2 shall be met when the level of the arriving signal is equal to the minimum EIS level in the respective declared set of EIS level and *SAN channel bandwidth*.

### 10.2.3 Test Purpose

The test purpose is to verify that the SAN can meet the throughput requirement for a specified measurement channel at the EIS level and the range of angles of arrival declared in the OSDD.

### 10.2.4 Method of test

#### 10.2.4.1 Initial conditions

Test environment: Normal, see annex B.2.

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

Directions to be tested:

- receiver target reference direction (D.26),

- conformance test directions (D.28).

#### 10.2.4.2 Procedure

1) Place the SAN with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex D.4.1.

2) Align the manufacturer declared coordinate system orientation of the SAN with the test system.

3) Align the SAN with the test antenna in the declared direction to be tested.

4) Ensure the polarization is accounted for such that all the power from the test antenna is captured by the SAN under test.

5) Configure the beam peak direction for the transmitter according to the declared reference beam direction pair for the appropriate beam identifier.

6) For FDD operation, set the SAN to transmit beam(s) of the same operational band as the OSDD being tested according to the appropriate test configuration in clauses 4.7 and 4.8.

7) Start the signal generator for the wanted signal to transmit:

- The test signal as specified in clause 10.2.5.

8) Set the test signal mean power so the calibrated radiated power at the SAN Antenna Array coordinate system reference point is as specified in clause 10.2.5.

9) Measure the throughput according to annex A.1 for each supported polarization.

10) Repeat steps 3 to 9 for all OSDD(s) declared for the SAN (D.19), and supported polarizations.

### 10.2.5 Test requirements

#### 10.2.5.1 General

The minimum EIS level is a declared figure (D.23) for each OSDD (D.19). The test requirement is calculated from the declared value offset by the EIS Test Tolerance specified in clause 4.1.

#### 10.2.5.2 Test requirements for *SAN type 1-H* and *SAN type 1-O*

For each measured carrier, the throughput measured in step 9 of clause 10.2.4.2 shall be ≥ 95 % of the maximum throughput of the reference measurement channel as specified in annex A.1 with parameters specified in table 7.2.5.2-1.

Table 7.2.5.2-1: SAN GEO and LEO class EIS levels

|  |  |  |  |
| --- | --- | --- | --- |
| SAN channel bandwidth (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel(NOTE) | OTA sensitivity level, EIS (dBm) |
| 5, 10, 15  | 15 | G-FR1-NTN-A1-1 | Declaredminimum EIS+ 1.3 |
| 10, 15  | 30 | G-FR1-NTN-A1-2 |
| 10, 15 | 60 | G-FR1-NTN-A1-3 |
| 20  | 15 | G-FR1-NTN-A1-4 |
| 20  | 30 | G-FR1-NTN-A1-5 |
| 20  | 60 | G-FR1-NTN-A1-6 |
| NOTE: EIS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *SAN channel bandwidth*. |

## 10.3 OTA reference sensitivity level

### 10.3.1 Definition and applicability

The OTA REFSENS requirement is a *directional requirement* and is intended to ensure the minimum OTA reference sensitivity level for a declared *OTA REFSENS RoAoA*. The OTA reference sensitivity power level EISREFSENS is the minimum mean power received at the RIB at which a reference performance requirement shall be met for a specified reference measurement channel.

The OTA REFSENS requirement shall apply to each supported polarization, under the assumption of *polarization match*.

### 10.3.2 Minimum requirement

For SAN *type 1-O* the minimum requirement is in TS 38.108 [2], clause 10.3.2.

### 10.3.3 Test Purpose

The test purpose is to verify that the SAN receiver can meet the throughput requirement for a specified measurement channel at the EISREFSENS level and the range of angles of arrival within the *OTA REFSENS RoAoA*.

### 10.3.4 Method of test

#### 10.3.4.1 Initial conditions

Test environment: Normal, see annex B.2.

RF channels to be tested for single carrier:

- B, M and T; see clause 4.9.1.

Directions to be tested:

- OTA REFSENS receiver target reference direction (D.44),

- OTA REFSENS conformance test directions (D.45)

#### 10.3.4.2 Procedure

1) Place the SAN with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex D.4.1.

2) Align the manufacturer declared coordinate system orientation of the SAN with the test system.

3) Align the SAN with the test antenna in the declared direction to be tested.

4) Ensure the polarization is accounted for such that all the power from the test antenna is captured by the SAN under test.

5) Configure the beam peak direction for the transmitter according to the declared reference beam direction pair for the appropriate beam identifier.

6) Set the SAN to transmit beam(s) of the same operational band as the *OTA REFSENS RoAoA* being tested according to the appropriate test configuration in clauses 4.7 and 4.8.

7) Start the signal generator for the wanted signal to transmit:

- The test signal as specified in clause 10.3.5.

8) Set the test signal mean power so the calibrated radiated power at the SAN Antenna Array coordinate system reference point is as specified in clause 10.3.5.

9) Measure the throughput according to annex A.1 for each supported polarization.

10) Repeat steps 3 to 9 for all OTA REFSENS conformance test directions of the SAN (D.45) and supported polarizations.

### 10.3.5 Test requirements

#### 10.3.5.1 General

The EISREFSENS level is the conducted REFSENS requirement value offset by ΔOTAREFSENS. The test requirement is calculated from the EISREFSENS level offset by the EISREFSENS Test Tolerance specified in clause 4.1.

#### 10.3.5.2 Test requirements for *SAN type 1-O*

For each measured carrier, the throughput measured in step 9 of clause 10.3.4.2 shall be ≥ 95 % of the maximum throughput of the reference measurement channel as specified in annex A.1 with parameters specified in tables 10.3.5.2-1 and 10.3.5.2-2.

Table 10.3.5-1: SAN GEO class reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| SAN channel bandwidth (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | OTA reference sensitivity level, EISREFSENS(dBm) |
| 5, 10, 15 | 15 | G-FR1-NTN-A1-1 | -98.0 - ΔOTAREFSENS |
| 10, 15  | 30 | G-FR1-NTN-A1-2 | -98.1 - ΔOTAREFSENS |
| 10, 15 | 60 | G-FR1-NTN-A1-3 |  -95.2 - ΔOTAREFSENS |
| 20  | 15 | G-FR1-NTN-A1-4 |  -91.6 - ΔOTAREFSENS |
| 20 | 30 | G-FR1-NTN-A1-5 | -91.9 - ΔOTAREFSENS |
| 20  | 60 | G-FR1-NTN-A1-6 | -92.0 - ΔOTAREFSENS |
| NOTE: EISREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *SAN channel bandwidth*. |

Table 10.3.5-2: SAN LEO class reference sensitivity levels

|  |  |  |  |
| --- | --- | --- | --- |
| SAN channel bandwidth (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | OTA reference sensitivity level, EISREFSENS(dBm) |
| 5, 10, 15 | 15 | G-FR1-NTN-A1-1 | -101.1 - ΔOTAREFSENS |
| 10, 15  | 30 | G-FR1-NTN-A1-2 | -101.2 - ΔOTAREFSENS |
| 10, 15 | 60 | G-FR1-NTN-A1-3 | -98.3 - ΔOTAREFSENS |
| 20  | 15 | G-FR1-NTN-A1-4 | -94.7 - ΔOTAREFSENS |
| 20  | 30 | G-FR1-NTN-A1-5 | -95.0 - ΔOTAREFSENS |
| 20 | 60 | G-FR1-NTN-A1-6 | -95.1 - ΔOTAREFSENS |
| NOTE: EISREFSENS is the power level of a single instance of the reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *SAN channel bandwidth*. |

## 10.4 OTA dynamic range

### 10.4.1 Definition and applicability

The OTA dynamic range is a measure of the capability of the receiver unit to receive a wanted signal in the presence of an interfering signal inside the received *SAN channel bandwidth*.

The requirement shall apply at the RIB when the AoA of the incident wave of a received signal and the interfering signal are from the same direction and are within the *OTA REFSENS RoAoA.*

The wanted and interfering signals apply to each supported polarization, under the assumption of *polarization match*.

### 10.4.2 Minimum requirement

For *SAN type 1-O*, the minimum requirement is in TS 38.108 [2], clause 10.4.2.

### 10.4.3 Test purpose

The test purpose is to verify that at the SAN receiver dynamic range, the relative throughput shall fulfil the specified limit.

### 10.4.4 Method of test

#### 10.4.4.1 Initial conditions

Test environment: Normal: see annex B.2.

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

Directions to be tested: OTA REFSENS receiver target reference direction (D.44).

#### 10.4.4.2 Procedure

1) Place the SAN with its manufacturer declared coordinate system reference point in the same place as calibrated point in the test system, as shown in annex D.4.2.

2) Align the manufacturer declared coordinate system orientation of the SAN with the test system.

3) Align the SAN with the test antenna in the declared direction to be tested.

4) Ensure the polarization is accounted for such that all the power from the test antenna is captured by the SAN under test.

5) Configure the beam peak direction for the transmitter according to the declared reference beam direction pair for the appropriate beam identifier.

6) For FDD operation, set the SAN to transmit beam(s) of the same operational band as the *OTA REFSENS RoAoA* being tested according to the appropriate test configuration in clauses 4.7 and 4.8.

7) Set the test signal mean power so that the calibrated radiated power at the SAN Antenna Array coordinate system reference point is as follows:

a) Set the signal generator for the wanted signal to transmit as specified in table 10.4.5.2-1.

b) Set the signal generator for the AWGN interfering signal at the same frequency as the wanted signal to transmit as specified in table 10.4.5.2-1.

8) Measure the throughput according to annex A.2 for each supported polarization.

### 10.4.5 Test requirement

#### 10.4.5.1 General

The test requirement is calculated from the OTA wanted signal mean power level offset by the OTA dynamic range Test Tolerance specified in clause 4.1.

#### 10.4.5.2 Test requirements for *SAN type 1-O*

For each measured carrier, the throughput measured in step 6 of clause 10.4.4.2 shall be ≥ 95 % of the maximum throughput of the reference measurement channel as specified in annex A.2 with parameters specified in tables 10.4.5.2-1.

Table 10.4.5.2-1: SAN LEO class dynamic range

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SAN channel bandwidth (MHz)** | **Subcarrier spacing (kHz)** | **Reference measurement channel** | **Wanted signal mean power (dBm)** | **Interfering signal mean power (dBm) / BWConfig** | **Type of interfering signal** |
| 5 | 15 | G-FR1-NTN-A2-1 | -76.1 - ΔOTAREFSENS | -88.2 - ΔOTAREFSENS | AWGN |
| 30 | G-FR1-NTN-A2-2  | -76.8 - ΔOTAREFSENS |  |  |
| 10 | 15 | G-FR1-NTN-A2-1 | -76.1 - ΔOTAREFSENS | -85.0 - ΔOTAREFSENS | AWGN |
| 30 | G-FR1-NTN-A2-2  | -76.8 - ΔOTAREFSENS |  |  |
| 60 | G-FR1-NTN-A2-3  | -73.8 - ΔOTAREFSENS |  |  |
| 15 | 15 | G-FR1-NTN-A2-1 | -76.1 - ΔOTAREFSENS | -83.2 - ΔOTAREFSENS  | AWGN |
| 30 | G-FR1-NTN-A2-2  | -76.8 - ΔOTAREFSENS |  |  |
| 60 | G-FR1-NTN-A2-3 | -73.8 - ΔOTAREFSENS |  |  |
| 20 | 15 | G-FR1-NTN-A2-4 | -69.9 - ΔOTAREFSENS | -81.9 - ΔOTAREFSENS | AWGN |
| 30 | G-FR1-NTN-A2-5 | -69.9 - ΔOTAREFSENS |  |  |
| 60 | G-FR1-NTN-A2-6 | -70.2 - ΔOTAREFSENS |  |  |
| NOTE: The wanted signal mean power is the power level of a single instance of the corresponding reference measurement channel. This requirement shall be met for each consecutive application of a single instance of the reference measurement channel mapped to disjoint frequency ranges with a width corresponding to the number of resource blocks of the reference measurement channel each, except for one instance that might overlap one other instance to cover the full *SAN channel bandwidth*. |

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

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

# A.1 Fixed Reference Channels for RF Rx requirement (QPSK, R=1/3)

The parameters for the reference measurement channels are specified in table A.1-1 for FR1-NTN reference sensitivity level, ACS, out-of-band blocking, in-channel selectivity, OTA sensitivity, OTA reference sensitivity level, OTA ACS, OTA out-of-band blocking and OTA in-channel selectivity.

The reference measurement channels for the dynamic range requirement are captured in annex A.2.

**Table A.1-1: Fixed Reference Channels for SAN Rx requirements, FR1-NTN**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-NTN-A1-1 | G-FR1-NTN-A1-2 | G-FR1-NTN-A1-3 | G-FR1-NTN-A1-4 | G-FR1-NTN-A1-5 | G-FR1-NTN-A1-6 | G-FR1-NTN-A1-7 | G-FR1-NTN-A1-8 | G-FR1-NTN-A1-9 |
| Subcarrier spacing (kHz) | 15 | 30 | 60 | 15 | 30 | 60 | 15 | 30 | 60 |
| Allocated resource blocks | 25 | 11 | 11 | 106 | 51 | 24 | 15 | 6 | 6 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK | QPSK |
| Code rate (Note 2) | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 | 1/3 |
| Payload size (bits) | 2152 | 984 | 984 | 9224 | 4352 | 2088 | 1320 | 528 | 528 |
| Transport block CRC (bits) | 16 | 16 | 16 | 24 | 24 | 16 | 16 | 16 | 16 |
| Code block CRC size (bits) | - | - | - | 24 | - | - | - | - | - |
| Number of code blocks – C | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| Code block size including CRC (bits) (Note 3) | 2168 | 1000 | 1000 | 4648 | 4376 | 2104 | 1336 | 544 | 544 |
| Total number of bits per slot | 7200 | 3168 | 3168 | 30528 | 14688 | 6912 | 4320 | 1728 | 1728 |
| Total symbols per slot | 3600 | 1584 | 1584 | 15264 | 7344 | 3456 | 2160 | 864 | 864 |
| NOTE 1: *UL-DMRS-config-type* = 1 with *UL-DMRS-max-len* = 1, *UL-DMRS-add-pos* = 1 with *l0*= 2, *l* = 11 as per table 6.4.1.1.3-3 of TS 38.211 [5].NOTE 2: MCS index 4 and target coding rate = 308/1024 are adopted to calculate payload size for receiver sensitivity and in-channel selectivity.NOTE 3: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [7]. |

# A.2 Fixed Reference Channels for dynamic range (16QAM, R=2/3)

The parameters for the reference measurement channels are specified in table A.2-1 for FR1-NTN dynamic range and OTA dynamic range.

Table A.2-1: Fixed Reference Channels for dynamic range and OTA dynamic range, FR1-NTN

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Reference channel | G-FR1-NTN-A2-1 | G-FR1-NTN-A2-2 | G-FR1-NTN-A2-3 | G-FR1-NTN-A2-4 | G-FR1-NTN-A2-5 | G-FR1-NTN-A2-6 |
| Subcarrier spacing (kHz) | 15 | 30 | 60 | 15 | 30 | 60 |
| Allocated resource blocks | 25 | 11 | 11 | 106 | 51 | 24 |
| CP-OFDM Symbols per slot (Note 1) | 12 | 12 | 12 | 12 | 12 | 12 |
| Modulation | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM | 16QAM |
| Code rate (Note 2) | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 | 2/3 |
| Payload size (bits) | 9224 | 4032 | 4032 | 38936 | 18960 | 8968 |
| Transport block CRC (bits) | 24 | 24 | 24 | 24 | 24 | 24 |
| Code block CRC size (bits) | 24 | - | - | 24 | 24 | 24 |
| Number of code blocks – C | 2 | 1 | 1 | 5 | 3 | 2 |
| Code block size including CRC (bits) (Note 3) | 4648 | 4056 | 4056 | 7816 | 6352 | 4520 |
| Total number of bits per slot | 14400 | 6336 | 6336 | 61056 | 29376 | 13824 |
| Total symbols per slot | 3600 | 1584 | 1584 | 15264 | 7344 | 3456 |
| NOTE 1: DM-RS configuration type = 1 with DM-RS duration = single-symbol DM-RS, additional DM-RS position = pos1 with *l0*= 2, *l* = 11 as per table 6.4.1.1.3-3 of TS 38.211 [5].NOTE 2: MCS index 16 and target coding rate = 658/1024 are adopted to calculate payload size.NOTE 3: Code block size including CRC (bits) equals to *K'* in clause 5.2.2 of TS 38.212 [7]. |

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