**3GPP TSG-RAN WG4 Meeting # 109 R4-2318201**

**Chicago, USA, November 13 – November 17, 2023**

**Agenda item: 8.26.9**

**Source:** Moderator (Ericsson)

**Title:** Topic summary for [109][309] NR\_NTN\_enh\_Part2

**Document for:** Information

# Introduction

This document is a summary of the proposals made in the contributions submitted under AI 8.26.3 and AI 8.26.4 for the RAN4 #108-bis meeting.

# Topic #1: SAN RF

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2318299**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318299.zip) | CATT | Proposal 1: ΔFR2\_REFSENS defined for FR2 TN BS can be reused for FR2-NTN SAN.  Proposal 2: Agree the following Table 2-1 for SAN type 2-O OTA reference sensitivity requirement.  Table 2-1: FR2-NTN OTA reference sensitivity requirement   |  |  |  |  | | --- | --- | --- | --- | | SAN channel Bandwidth  (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | OTA reference sensitivity level, EISREFSENS (dBm) | | 50, 100, 200 | 60 | G-FR2-A1-1 | EISREFSENS\_50M + ΔFR2\_REFSENS | | 50 | 120 | G-FR2-A1-2 | EISREFSENS\_50M + ΔFR2\_REFSENS | | 100, 200, 400 | 120 | G-FR2-A1-3 | EISREFSENS\_50M + 3+ ΔFR2\_REFSENS | | NOTE 1: 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*.  NOTE 2: The declared EISREFSENS\_50M shall be within the range specified above. | | | | |
| [**R4-2318302**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318302.zip) | CATT | Observation 1: For FRF=2, for XPR=20dB, the NFR [dB] @ 95% CDF for GEO, LEO-600 and LEO-1200 is 0.15, 6.45 and 2.68dB, respectively.  Observation 2: For FRF=1, the NFR [dB] @ 95% CDF for GEO, LEO-600 and LEO-1200 is 9.6, 29.3 and 23.32dB, respectively.  Proposal 1: Not to define OTA Rx dynamic range requirements for GEO, LEO-600, LEO-1200 for Ka-band. |
| [**R4-2320331**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320331.zip) | ZTE | Proposal 1: for frequency range between 30MHz and 12.75GHz, to reuse the FR1 OOBB requirement for Ka-band SAN;  Proposal 2: for frequency range between 12.75GHz and 2nd harmonic of upper frequency, the following service should be taken into account.   1. Ku-band satellite UL transmission. 2. Frequency and timing reference signal between satellite nodes; 3. Wireless positioning between satellite.   Observation 1: for FRF=1 without consideration of polarization isolation, then IoT level could reach up to around 21dBc.  Observation 2: Regarding ACLR requirement for SAN transmitter, 0dB ACIR requirement is enough.  Observation 3: Regarding ACS requirement for SAN receiver, 14dB ACIR requirement for GEO and 18dBc for LEO is enough. |
| [**R4-2320972**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320972.zip) | Thales | Proposal 1: Reference sensitivity offset ΔFR2\_REFSENS not needed (can be assumed 0dB for all other directions);  Proposal 2: Do not specify dynamic range requirement for SAN type 2-O and for both GEO and LEO classes.  Proposal 3: Do not specify SAN type 2-O out-of-band blocking requirement for the 12.75 GHz – 2nd harmonic of upper frequency range.  Proposal 4: With respect to NTN in above 10 GHz, separate GEO and LEO in 2 different classes (as also done for NTN-FR1). |

## Open issues summary

### Sub-topic 1-1

*Sub-topic description:* This sub-topic discusses the specification of different SAN classes

**Issue 1-1-1: SAN type 2-O classes**

* Proposals Separate GEO and LEO in 2 different classes (as also done for NTN-FR1).
  + Agree (Thales)
  + Disagree
* Recommended WF
  + Agree, all draft CRs have been written according to this assumption.

### Sub-topic 1-2

*Sub-topic description:* This sub-topic discusses the specification of SAN reference sensitivity in FR2-NTN.

**Issue 1-2-1: Offset to FR2 OTA REFSENS ΔFR2\_REFSENS**

* Proposals: ΔFR2\_REFSENS is still needed for FR2-NTN SAN and could be reused for the definition if OTA REFSENS.
  + Agree, *OTA REFSENS RoAoA* was also used for FR1-NTN SAN (CATT)
  + Disagree, this is not needed. (Thales)
* Recommended WF
  + TBA

**Issue 1-2-2: FR2-NTN SAN REFSENS definition**

* Proposals: The FR2-NTN SAN REFSENS could be specified according to the following:

|  |  |  |  |
| --- | --- | --- | --- |
| SAN channel Bandwidth  (MHz) | Sub-carrier spacing (kHz) | Reference measurement channel | OTA reference sensitivity level, EISREFSENS (dBm) |
| 50, 100, 200 | 60 | G-FR2-A1-1 | EISREFSENS\_50M + ΔFR2\_REFSENS |
| 50 | 120 | G-FR2-A1-2 | EISREFSENS\_50M + ΔFR2\_REFSENS |
| 100, 200, 400 | 120 | G-FR2-A1-3 | EISREFSENS\_50M + 3+ ΔFR2\_REFSENS |
| NOTE 1: 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*.  NOTE 2: The declared EISREFSENS\_50M shall be within the range specified above. | | | |

* + Agree (CATT)
  + Disagree
* Recommended WF
  + This issue is depending on the conclusion of issue 1-1-1. If RAN4 agreed to use ΔFR2\_REFSENS, then this proposal should be acceptable.

### Sub-topic 1-3

*Sub-topic description:* This sub-topic discusses the specification of SAN dynamic range requirement in FR2-NTN.

**Issue 1-3-1:** **SAN type 2-O dynamic range requirement**

* Proposals: Do not specify dynamic range requirement for SAN type 2-O and for both GEO and LEO classes.
  + Agree (CATT, Thales)
  + Disagree
* Recommended WF
  + Based on the simulation results provided by CATT, this proposal should be acceptable: the dynamic range requirement should not be specified for SAN type 2-O.

### Sub-topic 1-4

*Sub-topic description:* This sub-topic is related to the specification of SAN out-of-band blocking requirement in FR2-NTN

**Issue 1-4-1: SAN type 2-O out-of-band blocking requirement for the 12.75 GHz – 2nd harmonic of upper frequency range.**

* Proposals: Considering the following services for the 12.75 GHz – 2nd harmonic of upper frequency range:
  + - Ku-band UL
    - Frequency and timing reference signal between satellite nodes.
    - Wireless positioning between satellite
  + Agree (ZTE)
  + Disagree (Thales)
* Recommended WF
  + TBA

### Draft CRs or proposed changes to specifications

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2318300**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318300.zip) | CATT | Draft CR for TS 38.108, On introduction of above 10GHz bands to clause 10.1-10.4 |
| Moderator’s recommendation: Pending on issue 1-2-1 |
| [**R4-2319570**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319570.zip) | Ericsson | NTN enhancement: draft CR to TS 38.108 NTN Ka-band - system parameters udpate |
| Moderator’s recommendation: Pending on issue in [308] |
| [**R4-2319577**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319577.zip) | Ericsson | NTN enhancement: draft CR to TS 38.108 NTN Ka-band - clause 4.3 |
| Moderator’s recommendation: To be endorsed?  This is a simple draft CR. |
| [**R4-2319578**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319578.zip) | Ericsson | NTN enhancement: draft CR to TS 38.108 NTN Ka-band - clause 4.6 |
| Moderator’s recommendation: Pending on issue 1-3-1 |
| [**R4-2319579**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319579.zip) | Ericsson | NTN enhancement: draft CR to TS 38.108 NTN Ka-band - clause 9.4 |
| Moderator’s recommendation: To be endorsed? |
| [**R4-2319711**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319711.zip) | Keysight Technologies UK Ltd | Draft CR to TS 38.108: correction on EVM measurement annex for FR2-NTN, Rel-18 |
| Moderator’s recommendation: To be endorsed? |
| [**R4-2320153**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320153.zip) | NEC | Draft CR on TS 38.108: Radiated transmit power requirements in extreme conditions |
| Moderator’s recommendation: To be endorsed?  For FR1, it was indeed agreed to not consider extreme conditions, at least in Rel-17. |
| [**R4-2320154**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320154.zip) | NEC | Draft CR on TS 38.108: OTA modulation quality |
| Moderator’s recommendation: To be noted?  It was commented in RAN4#108-bis meeting that we should not mention any manufacturer declaration here, this should be done instead in the conformance specification. |
| [**R4-2320155**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320155.zip) | NEC | Draft CR on TS 38.108: EVM annex for FR2-NTN |
| Moderator’s recommendation: To be merged with R4-2319711 (which has one additional update, fixing a wrong reference) |
| [**R4-2320334**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320334.zip) | ZTE Corporation | Draft CR to TS 38.108 Clause 10.5 OTA in-band selectivity and blocking |
| Moderator’s recommendation: Pending in issue 1-2-1 and coex study outcomes. |
| [**R4-2320335**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320335.zip) | ZTE Corporation | Draft CR to TS 38.108 Clause 10.6 OTA out-of-band blocking |
| Moderator’s recommendation: Pending on issue 1-4-1 |
| [**R4-2320336**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320336.zip) | ZTE Corporation | Draft CR to TS 38.108 Clause 10.7 OTA in-channel selectivity |
| Moderator’s recommendation: Pending on issue 1-2-1 and coex study outcomes. |
| [**R4-2320917**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320917.zip) | THALES | Draft CR on TS 38.108 for Clause 9.7 - OTA unwanted emissions |
| Moderator’s recommendation: This tdoc has been submitted as a CR but, as mentioned in the title, it should be a draft CR for endorsement, to be merged in the big running CR.  Pending on coex study outcomes. |
| [**R4-2319580**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319580.zip) | Ericsson, Huawei, Thales | NTN enhancement: Running CR to TS 38.108 NTN Ka-band |
| Moderator’s recommendation: To be revised to add the draft CRs endorsed during RAN4#109 meeting. |

# Topic #1: SAN RF conformance

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2318301**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318301.zip) | CATT | Proposal 1: MU for 24.25 – 29.5 GHz for FR2 TN BS OTA receiver tests can be reused for MU for 27.5-30GHz for SAN type 2-O OTA receiver tests.  Proposal 2: For MU for 17.3-20.2 GHz for FR2 SAN type 2-O OTA transmitter tests, TE vendors’ inputs are needed.  Proposal 3: *SAN type 1-O t*ransmitter test interfaces are applicable for SAN type 2-O. And *SAN type 1-O* receiver test interfaces are applicable for SAN type 2-O.  Proposal 4: Manufacturer declarations for SAN type 1-O except OSDD-related manufacturer declaration can be reused for SAN type 2-O. In addition, EIS REFSENS for FR2 (EISREFSENS\_50M) need to be added.  Proposal 5: Agree the following test signal in Table 2-2 for SAN type 2-O,  Proposal 6: Agree the test model in following table for Ka-band NTN  Proposal 7: Test configuration NRTC1 is sufficient for SAN type 2-O, no other TC is needed. Existing test configuration NRTC1 in TS 38.181 is applicable for SAN type 2-O.  Proposal 8: RF channels for single carrier and multi-carrier operation for transmitter requirements for SAN type 1-O can be reused for SAN type 2-O. |

## Open issues summary

### Sub-topic 1-1

*Sub-topic description:* This sub-topic discusses MUs for FR2-NTN SAN conformance

**Issue 1-1-1: MU for 27.5-30GHz for SAN type 2-O OTA receiver tests**

* Proposals: Reuse MUs specified for FR2 TN BS type 2-O receiver
  + Agree
  + Disagree
* Recommended WF
  + TBA

**Issue 1-1-2: MU for 17.3-20.2 GHz for SAN type 2-O OTA transmitter tests**

* Proposals: Inputs from TE vendors are needed
* Recommended WF

### Sub-topic 1-2

*Sub-topic description:* This sub-topic is related to the test interfaces (Moderator: should be reference points?).

**Issue 1-2: Reference points**

* Proposals: SAN type 1-O transmitter test interfaces are applicable for SAN type 2-O. And SAN type 1-O receiver test interfaces are applicable for SAN type 2-O.
  + Agree
  + Disagree
* Recommended WF
  + Moderator: The reference points for core and conformance shall be aligned, further discussion should not be needed here.

### Sub-topic 1-3

*Sub-topic description:* This sub-topic is related to the manufacturer declaration aspects.

**Issue 1-3: Manufacturer declarations**

* Proposals: The following manufacturer declarations shall be considered for SAN type 2-O:
  + Item1: Manufacturer declarations for SAN type 1-O except OSDD-related manufacturer declaration (CATT)
  + Item2: EIS REFSENS for FR2 (EISREFSENS\_50M) (CATT)
  + Others
* Recommended WF
  + TBA

### Sub-topic 1-4

*Sub-topic description:* This sub-topic is related to the test signal, test models, test configurations and channels to be tested.

**Issue 1-4-1: Test signal**

* Proposals: Following test signal should be used when testing SAN type 2-O

|  |  |  |
| --- | --- | --- |
| *Operating band* characteristics | | FDL\_high – FDL\_low ≤ 3250 MHz |
| TC signal | BWchannel | 100 MHz (Note 1, Note 2) |
| characteristics | Subcarrier spacing | Smallest supported subcarrier spacing declared per operating band (D.7) |
| NOTE 1: SAN vendor can decide to test with 50 MHz *SAN channel bandwidth* and smallest supported SCS declared per *operating band* (D.7) instead of 100 MHz *SAN channel bandwidth* in certain regions, where spectrum allocation and regulation require testing with 50 MHz.  NOTE 2: If this *SAN channel bandwidth* is not supported, the narrowest supported *SAN channel bandwidth* declared per *operating band* (D.7) shall be used. | | |

* + Agree (CATT)
  + Disagree
* Recommended WF
  + TBA

**Issue 1-4-2: Test models**

* Proposals: Following test modelsshould be used when testing SAN type 2-O

|  |  |  |
| --- | --- | --- |
| **Test models for FR2 in TS38.141-2** | **Applicability for NTN SAN** | **Test model for FR2-NTN** |
| NR-FR2-TM1.1 | Applicable, to remove the wording of applying to transmit ON/OFF power, TAE and Receiver spurious emissions compared with TN test specification; | NR-SAN-FR2-TM1.1 |
| NR-FR2-TM2 | Applicable, applicability for 64QAM pending on the further discussion. | NR-SAN-FR2-TM2 |
| NR-FR2-TM3.1 | Applicable | NR-SAN-FR2-TM3.1 |

* + Agree (CATT)
  + Disagree
* Recommended WF
  + TBA

**Issue 1-4-3: Test configurations**

* Proposals: Test configuration NRTC1 is sufficient for SAN type 2-O, no other TC is needed. Existing test configuration NRTC1 in TS 38.181 is applicable for SAN type 2-O
  + Agree (CATT)
  + Disagree
* Recommended WF
  + TBA

**Issue 1-4-1: RF channels to be tested.**

* Proposals: RF channels for single carrier and multi-carrier operation for transmitter requirements for SAN type 1-O can be reused for SAN type 2-O.

|  |  |  |  |
| --- | --- | --- | --- |
| Requirements | | single carrier | Multi-carrier |
| 9.2 | Radiated transmit power | B,M,T | BRFBW, MRFBW, TRFBW |
| 9.3 | OTA SAN output power | B,M,T | BRFBW, MRFBW, TRFBW |
| 9.4 | OTA total power dynamic range | M | - |
| 9.6.2 | OTA Frequency Error | Same as EVM | Same as EVM |
| 9.6.3 | OTA Modulation quality | B, T | BRFBW, TRFBW |
| 9.7.2 | OTA Occupied BW | M | ~~-~~ |
| 9.7.3 | OTA ACLR | B, T | BRFBW,  TRFBW |
| 9.7.4 | OTA Out-of-band emissions | B,M,T | BRFBW, MRFBW, TRFBW |
| 9.7.5 | OTA Transmitter spurious emissions | B for spurious frequencies below the band, T for frequencies above the band | BRFBW for spurious frequencies below the band, TRFBW for frequencies above the band |

* + Agree (CATT)
  + Disagree
* Recommended WF
  + TBA