**3GPP TSG-RAN WG4 Meeting # 104-bis-e R4-221xxxx**

**Electronic Meeting, October 10 – October 19, 2022**

**Agenda item:** 4.2.8

**Source:** Moderator (THALES)

**Title:** Way Forward on NTN Solutions SAN RF Maintenance

**Document for:** Agreement

# Introduction

This proposed way forward is based on the outcomes of “Email discussion summary for [104-bis-e][304] NTN\_Solutions\_RF\_Maintenance”, see **R4-221xxxx** (revision of **R4-2216888**). Moreover, as suggested by “**RAN4#104-bis-e E-meeting Arrangements and Guidelines”**, this Way Forward uses WORD document rather than POWERPOINT (.PPTX) in order to facilitate others to comment and easily track the changes.

As described in latest Tdoc version **R4-221xxxx**, the Email discussion summary for [104-bis-e][304] NTN\_Solutions\_RF\_Maintenance identified the following topics and issues:

1. Topic #1: General discussions

Sub-topic 1-1: OBUE

* 1. Issue 1-1-1: definition of OBUE (see Huawei HiSilicon/R4-2216065/P1)
	2. Issue 1-1-2: definition of ΔfOBUE (see THALES/R4-2215337/P2, Huawei HiSilicon/R4-2216065/P2)
	3. Issue 1-1-3: correction of ΔfOBUE valuesfor SAN (see THALES/R4-2215337/P1)
	4. Issue 1-1-4: definitions of OBUE general aspects (see THALES/R4-2215337/P4)
	5. Issue 1-1-5: correction of OBUE minimum requirements for SAN type 1-H (see THALES/R4-2215337/P5)

Sub-topic 1-2: Spurious

* 1. Issue 1-2-1: NTN SAN spurious (see Ericsson/R4-2216526/P1)
	2. Issue 1-2-2: Out of band / spurious domain boundary clarification (see Ericsson/R4-2216526/P2)

Sub-topic 1-3: SAN Bandwidths

* 1. Issue 1-3-1: definitions of SAN Bandwidths (see THALES/R4-2215337/P3)

Sub-topic 1-4: DL MIMO

* 1. Issue 1-4-1: on decoupling DL MIMO from number of Rx branches for NTN UE capabilities (see Apple/R4-2216593/P1&P2)

Sub-topic 1-5: NTN Frequency error

* 1. Issue 1-5-1: on NTN Frequency error requirement (see Ericsson/R4-2216640/P1&P2&P3&P4)
	2. Issue 1-5-2: NR NTN Frequency Error (see MediaTek Inc./ R4-2216835/P)
1. Topic #2: Maintenance discussions - CRs to TS 38.108 and TR 38.863

Sub-topic 2-1: NTN UE

1. Issue 2-1-1: correct the figure and wording based on the TS38.101-1– **see** R4-2216150 (Xiaomi)

Sub-topic 2-2: OBUE

1. Issue 2-2-1: removal of ΔfOBUE definition – **see** R4-2216066 (Huawei, HiSilicon)
2. Issue 2-2-2: removal of ΔfOBUE definition – **see** R4-2216527 (Ericsson)
3. Issue 2-2-3: removal of ΔfOBUE definition – **see** R4-2216528 (Ericsson)

Sub-topic 2-3: OTA unwanted emissions

1. Issue 2-3-1: alignment of requirements with conductive requirements – **see** R4-2216066 (Huawei, HiSilicon)

Sub-topic 2-4: SAN Operating Band

1. Issue 2-4-1: SAN Operating Band: out-of-band emissions - **see** R4-2216064 (Huawei, HiSilicon)
2. Issue 2-4-2: SAN Operating Band: out-of-band emissions - **see** R4-2216066 (Huawei, HiSilicon)

Sub-topic 2-5: Spurious

1. Issue 2-5-1: Receiver spurious emissions/ intermodulation – **see** R4-2216064 (Huawei, HiSilicon)

Sub-topic 2-6: RMS field

1. Issue 2-6-1: modification of value of RMS field-strength – **see** R4-2216064 (Huawei, HiSilicon)

Sub-topic 2-7: Definitions and symbols

1. Issue 2-7-1: correction of order of definitions – **see** R4-2215412 (CATT)
2. Issue 2-7-2: Corrections : typos, symbols, definitions, … – **see** R4-2215336 (THALES)

Sub-topic 2-8: Modulations

1. Issue 2-8-1: corrections related to 64QAM requirements – **see** R4-2216594 (Apple)

Sub-topic 2-9: NTN Frequencies

1. Issue 2-9-1: NTN frequency error requirement – **see** R4-2216641 (Ericsson)

Sub-topic 2-10: Doppler test conditions

1. Issue 2-10-1: Doppler test conditions for RF requirements – **see** R4-2215315 (Qualcomm Incorporated)

# Agreements

**1. Topic #1: General discussions**

**Sub-topic 1-1: OBUE**

Issue 1-1-1: definition of OBUE

**Proposal 1-1-1-1:**

* **Option 1:** replace “operating band unwanted emission (OBUE)” for SAN with “out-of-band emission” (OoBE).
* **Option 2:** do not replace “operating band unwanted emission (OBUE)” for SAN with “out-of-band emission” (OoBE). Keep “OBUE” naming in TS 38.108.

Issue 1-1-2: definition of ΔfOBUE

**Proposal 1-1-2-1:**

* **Option 1: ΔfOBUE** Maximum offset of the *operating band* unwanted emissions mask from the downlink *operating band* edge (i.e. below the lowest frequency of each supported downlink operating band; above the highest frequency of each supported downlink operating band).
* **Option 2: ΔfOoBE** Maximum offset of the *operating band* ~~unwanted~~ emissions mask from the downlink *operating band* edge (i.e. below the lowest frequency of each supported downlink operating band; above the highest frequency of each supported downlink operating band).
* **Option 3: Others**

Issue 1-1-3: correction of ΔfOBUE valuesfor SAN

**Proposal 1-1-3-1:**

* **Option 1:** Keep ΔfOBUE for SAN and correct it with the following values:

Table 6.6.1-1: Maximum offset of OBUE outside the downlink *operating band*

|  |  |  |
| --- | --- | --- |
| SAN type | *Operating band* characteristics | ΔfOBUE (MHz) |
| *SAN type 1-H* | FDL,high – FDL,low < 100 MHz  | ~~2\*BW~~~~Channel~~2×BWAssignedBand |

Table 9.7.1-1: Maximum offset ΔfOBUE outside the downlink *operating band*

|  |  |  |
| --- | --- | --- |
| SAN type | *Operating band* characteristics | ΔfOBUE (MHz) |
| *SAN type 1-O* | FDL,high – FDL,low < 100 MHz | ~~10~~ 2×BWAssignedBand |

* **Option 2:** Correct ΔfOBUE with ΔfOoBE for SAN and correct it with the following values:

Table 6.6.1-1: Maximum offset of OBUE outside the downlink *operating band*

|  |  |  |
| --- | --- | --- |
| SAN type | *Operating band* characteristics | ΔfOoBE (MHz) |
| *SAN type 1-H* | FDL,high – FDL,low < 100 MHz  | ~~2\*BW~~~~Channel~~2×BWAssignedBand |

Table 9.7.1-1: Maximum offset ΔfOBUE outside the downlink *operating band*

|  |  |  |
| --- | --- | --- |
| SAN type | *Operating band* characteristics | ΔfOoBE (MHz) |
| *SAN type 1-O* | FDL,high – FDL,low < 100 MHz | ~~10~~ 2×BWAssignedBand |

* **Option 3:** Do not keep the current definition with ΔfOBUE for SAN in TS 38.108. Do not specify ΔfOBUE for SAN.
* **Option 4: keep current definition and specification.**

Issue 1-1-4: definitions of OBUE general aspects

**Proposal 1-1-4-1:** Correct the following definitions from Clause 6.6.4.1 (General aspects OBUE):

PSD~~channel~~Band represents the Power Spectral Density of the ~~channel for a given channel bandwidth~~ assigned band

BWChannel [MHz] is the considered NR *channel bandwidth* ~~or SAN total~~ *~~RF bandwidth~~* ~~for a given~~ *~~operating band~~*~~.~~

BWAssignedBand [MHz]is the considered SAN total *RF bandwidth* for a given *operating band*.

Issue 1-1-5: correction of OBUE minimum requirements for SAN type 1-H

**Proposal 1-1-5-1:** Correct the following table from Clause 6.6.4.2 (OBUE - Minimum requirements for SAN type 1-H):

Table 6.6.4.2-1: SAN LEO and GEO Classes OBUE basic limits

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency offset of measurement filter ‑3dB point, Δf | Frequency offset of measurement filter centre frequency, f\_offset | Basic limits(dBm) | Measurement bandwidth |
| 0 MHz ≤ Δf < 2× ~~BW~~~~Channel~~ BWAssignedBand | 0.002 MHz ≤ f\_offset < 2× ~~BW~~~~Channel~~ BWAssignedBand + 0.002 MHz | $$max\left(SE limit, PSD\_{channelBand} – Δ\_{Sat\\_Class}\left[dB\right]-40×log10\left(\frac{ f\_{\\_offset}-0.002}{BW\_{ChannelAssignedBand}}×2+1\right)\right)dBm$$ | 4 kHz |
| NOTE 1: PSD~~channel~~Band = Prated,c,sys – 10log10(~~BW~~~~Channel~~BWAssignedBand) – 24, unit dBm/4kHz.NOTE 2: SE limit is spurious emission limit specified in spurious emission clause 6.6.5.NOTE 3: PSD attenuation as in ITU-R SM.1541-6 [9], Annex 5 OoB domain emission limits for space services.NOTE 4: $Δ\_{Sat\\_Class}\left[dB\right]$=0 dB for GEO class and $Δ\_{Sat\\_Class}\left[dB\right]$=3 dB for LEO class. |

**Sub-topic 1-2: Spurious**

Issue 1-2-1: NTN SAN spurious

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Issue 1-2-2: Out of band / spurious domain boundary clarification

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**Sub-topic 1-3: SAN Bandwidths**

Issue 1-3-1: definitions of SAN Bandwidths

**Proposal 1-3-1-1:** Add BWChannel definition, remove SANChannel abbreviation (since not used), add new definition for BWAssignedBand, and remove definition of BWContiguous (since not used) in TS 38.108.

~~SAN~~~~Channel~~*~~SAN channel bandwidth.~~*

BWChannel *SAN channel bandwidth.*

BWAssignedBand SAN total *RF bandwidth* for a given *operating band*.

~~BW~~~~Contiguous~~ ~~Contiguous~~ *~~transmission bandwidth~~*~~, i.e.~~ *~~SAN channel bandwidth~~* ~~for single carrier.~~

**Sub-topic 1-4: DL MIMO**

Issue 1-4-1: on decoupling DL MIMO from number of Rx branches for NTN UE capabilities

**Proposal 1-4-1-1:** Distinguish between NTN and TN for DL MIMO UE capabilities.

**Sub-topic 1-5: NTN Frequency error**

Issue 1-5-1: on NTN Frequency error requirement

**Proposal 1-5-1-1:** RAN4 shall leave RAN5 to decide if GNSS access at TE.

**Proposal 1-5-1-2:** RAN4 to specify in the Annex the Doppler frequency values.

Issue 1-5-2: NR NTN Frequency Error

**Proposal 1-5-2-1:**

* **Option 1:** Send LS to RAN5 to trigger the development of the zero Doppler test configuration
* **Option 2:** Do not send LS to RAN5 to trigger the development of the zero Doppler test configuration

# Appendix: Submitted documents for [104-bis-e][304] NTN\_Solutions\_RF\_Maintenance

For the discussion in **[104-bis-e][304] NTN\_Solutions\_RF\_Maintenance**,the following TDoCs are to be considered

* 1 TDoCs submitted under agenda item 4.2.1
* 9 TDoCs submitted under agenda item 4.2.2
* 6 TDoCs submitted under agenda item 4.2.4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***TDoc Number*** | ***TDoc Type*** | ***Title*** | ***Company*** | ***General Purpose*** | ***Agenda Item*** |
| R4-2216150 | CR | CR to 38.101-5: Corrections on section 5.3.3 for NTN UE | Xiaomi | Agreement | 4.2.1 |
| R4-2215412 | CR | CR for TS 38.108, Correct definition order in sub-clause 3.1 | CATT | Agreement | 4.2.2 |
| R4-2215336 | CR | Corrections to SAN TS 38.108 | THALES | Decision | 4.2.2 |
| R4-2215337 | discussion | Discussion on SAN Out-of-Band Mask | THALES | Decision | 4.2.2 |
| R4-2216064 | CR | CR for TR 38.863 to maintain SAN parts | Huawei, HiSilicon | Agreement | 4.2.2.1 |
| R4-2216065 | other | Discussion on definition of delta FOBUE | Huawei, HiSilicon | Approval | 4.2.2.1 |
| R4-2216066 | CR | Draft CR for 38.108 to maintain unwanted emissions clause | Huawei, HiSilicon | Agreement | 4.2.2.1 |
| R4-2216526 | other | NTN FR1 open issues | Ericsson | Approval | 4.2.2.1 |
| R4-2216527 | CR | CR to TS 38.108: ΔfOBUE updates – conducted clauses | Ericsson | Approval | 4.2.2.1 |
| R4-2216528 | CR | CR to TS 38.108: ΔfOBUE updates – conducted clauses | Ericsson | Approval | 4.2.2.2 |
| [R4-2216593](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216593.zip) | discussion | On decoupling DL MIMO from number of Rx branches for NTN UE capabilities | Apple | Decision | 4.2.4  |
| [R4-2216594](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216594.zip) | CR | CR to 38.101-5 on corrections related to 64QAM requirements | Apple | Agreement | 4.2.4  |
| [R4-2216640](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216640.zip) | discussion | On NTN Frequency error requirement | Ericsson | Approval | 4.2.4  |
| [R4-2216641](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216641.zip) | CR | CR on NTN Frequency error requirement | Ericsson | Agreement | 4.2.4  |
| [R4-2216835](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216835.zip) | discussion | NR NTN Frequency Error | MediaTek (Chengdu) Inc. | Discussion | 4.2.4  |
| [R4-2215315](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215315.zip) | CR | CR: 0005 Doppler test conditions for RF requirements 38.101-5 | Qualcomm Incorporated | Agreement | 4.2.4  |

**Moderator note1:** There are **4 CRs** to TR 38.101-5, **5 CRs** to TR 38.108 and **1 CR** to TR 38.863 related to SAN, which the moderator proposes to discuss in the dedicated folders from 1st round and 2nd round.

**Moderator note2:** There are **6 Tdocs** for **discussion**.