**3GPP TSG-RAN WG4 Meeting # 104-bis-e R4-2217478**

**Electronic Meeting, October 10 – October 19, 2022 (revision of R4-2216888)**

**Agenda item:** 4.2.8

**Source:** Moderator (THALES)

**Title:** Email discussion summary for [104-bis-e][304] NTN\_Solutions\_RF\_Maintenance

**Document for:** Information

# Introduction

This discussion summary document captures general issues and SAN RF maintenance aspects related to RAN4 RF of Rel-17 NR NTN WI related discussion, and more precisely RF core maintenance (SAN RF, UE RF). It contains a summary of the contributions under sections and subsections of Agenda Items 4.2.1, 4.2.2, 4.2.4 at TSG-RAN WG4 #104-bis-e, together with identified key open issues and recommends topics/questions to be handled via email discussions. The goal of this document is to provide recommendation on prioritization of discussion.

Please also note the draft TSG-RAN WG4 #104-bis-e meeting agenda with respect to NTN topic:

-------------------------------------- Items led by other working group ----------------------------------------------------

4.2 Solutions for NR to support non-terrestrial networks (NTN) [NR\_NTN\_solutions]

4.2.1 System parameters maintenance [NR\_NTN\_solutions-Core]

4.2.2 Satellite Access Node RF requirement maintenance [NR\_NTN\_solutions-Core]

4.2.2.1 Conductive RF requirements [NR\_NTN\_solutions-Core]

4.2.2.2 Radiated RF requirements [NR\_NTN\_solutions-Core]

4.2.3 Satellite Access Node RF conformance testing [NR\_NTN\_solutions-Perf]

4.2.3.1 General and work plan [NR\_NTN\_solutions-Perf]

4.2.3.1.1 Test Model [NR\_NTN\_solutions-Perf]

4.2.3.1.2 Test configuration [NR\_NTN\_solutions-Perf]

4.2.3.1.3 Others [NR\_NTN\_solutions-Perf]

4.2.3.2 Conductive conformance Testing [NR\_NTN\_solutions-Perf]

4.2.3.2.1 Tx requirements NR\_NTN\_solutions-Perf]

4.2.3.2.2 Rx requirements [NR\_NTN\_solutions-Perf]

4.2.3.2.3 MU assessment [NR\_NTN\_solutions-Perf]

4.2.3.3 Radiated conformance Testing [NR\_NTN\_solutions-Perf]

4.2.3.3.1 Tx requirements [NR\_NTN\_solutions-Perf]

4.2.3.3.2 Rx requirements [NR\_NTN\_solutions-Perf]

4.2.3.3.3 MU assessment [NR\_NTN\_solutions-Perf]

4.2.4 UE RF requirement maintenance [NR\_NTN\_solutions-Core]

4.2.5 RRM core requirement maintenance [NR\_NTN\_solutions-Core]

4.2.5.1 Measurement procedure requirements [NR\_NTN\_solutions-Core]

4.2.5.2 Others [NR\_NTN\_solutions-Core]

4.2.6 RRM performance requirements [NR\_NTN\_solutions-Perf]

4.2.6.1 General [NR\_NTN\_solutions-Perf]

4.2.6.2 Test cases for Cell reselection to intra- and inter-frequency neighbor cell [NR\_NTN\_solutions-Perf]

4.2.6.3 Test cases for Intra- and inter-frequency HO with known cell [NR\_NTN\_solutions-Perf]

4.2.6.4 Test cases for Intra- and inter-frequency CHO [NR\_NTN\_solutions-Perf]

4.2.6.5 Test cases for UE transmit timing [NR\_NTN\_solutions-Perf]

4.2.6.6 Test cases for RLM and BFR [NR\_NTN\_solutions-Perf]

4.2.6.7 Test cases for Intra-frequency measurement delay [NR\_NTN\_solutions-Perf]

4.2.6.8 Test cases for Inter-frequency measurement delay [NR\_NTN\_solutions-Perf]

4.2.6.9 Teste cases for L1-RSRP measurement delay [NR\_NTN\_solutions-Perf]

4.2.6.10 Test cases for RRM measurement accuracy [NR\_NTN\_solutions-Perf]

4.2.7 Demodulation requirements [NR\_NTN\_solutions-Perf]

4.2.7.1 General [NR\_NTN\_solutions-Perf]

4.2.7.2 Satellite Access Node demodulation requirements [NR\_NTN\_solutions-Perf]

4.2.7.2.1 PUSCH requirements [NR\_NTN\_solutions-Perf]

4.2.7.2.2 PUCCH requirements [NR\_NTN\_solutions-Perf]

4.2.7.2.3 PRACH requirements [NR\_NTN\_solutions-Perf]

4.2.7.3 UE demodulation requirements [NR\_NTN\_solutions-Perf]

4.2.7.3.1 PDSCH requirements [NR\_NTN\_solutions-Perf]

4.2.8 Moderator summary and conclusions [NR\_NTN\_solutions]

For informative purpose, RAN4#104-bis-e E-meeting Arrangements and Guidelines proposed the following schedule:



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

 (please also see the **Appendix** for the details, with all the observations/proposals):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***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 requirment | 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**.

Identified topics and issues for the 1st round:

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)

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
| THALES | Dorin Panaitopol |  |
| Ericsson | Dominique Everaere | dominique.everaere@ericsson.com |
| CATT | Qiuge Guo | guoqiuge@catt.cn |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: General discussions

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2215337 | THALES | **Proposal 1:** (New Option 5 derived from Option 4) 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 |

**Proposal 2:** Don’t change the ΔfOBUE current definition from TS 38.108, simply add an explanation.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).**Proposal 3:** Add BWChannel definition, remove SANChannel abbreviation (since not used), add new definition for BWAssignedBand, and remove definition of BWContiguous (since not used).~~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.~~**Proposal 4:** 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 bandBWChannel [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*.**Proposal 5:** 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. |

 |
| R4-2216065 | Huawei, HiSilicon | **Observation 1: the values of ΔfOBUE specified in clause 6.6.1 and 9.7.1 from TS 38.108 are different and incorrect.****Proposal 1: it’s proposed to use a new term to replace “operating band unwanted emission (OBUE)” for SAN, e.g. “spectrum emission mask” which was used in TS 25.104 or “out-of-band mask” or “out-of-band emission”.****Observation 2: ΔfOBUE is used in operating band unwanted emission limits based on the TS 38.104****Observation 3: Even if we specify ΔfOBUE in TS 38.108, but it isn’t used in SAN LEO and GEO Classes OBUE basic limits. In addition, we didn’t specify f\_offsetmax.****Proposal 2: To remove ΔfOBUE in TS 38.108 and improve/modify the corresponding wordings.** |
| R4-2216526 | Ericsson | In this contribution, we discussed the remaining SAN RF open issue from last RAN4#104-e meeting made the following observations and proposals:**Proposal1: Align NTN SAN spurious domain boundary with SM.1541-6 definition.****Observation2: Option 3 of the WF** R4-2214370, **is not aligned with SM.1541-6 spurious domain boundary definition.****Proposal2: Do not define ΔfOBUE and clarify the out of band / spurious domain boundary in TS 38.108.** |
| R4-2216593 | Apple | In this contribution we seek to clarify the assumption on the number of Rx antennas used in deriving the REFSENS requirements for NTN bands n256, n255 and recommend to decouple the support DL MIMO from the number of Rx branches for NTN UEs in general.**Observation 1: Considering the large path loss associated with NTN links, the feasibility of DL MIMO may be restricted to very few UE and SAN implementations and may not be a typical use case.****Proposal 1: As a working principle, RAN4 should decouple the support of DL MIMO from the number of Rx branches for NTN UEs.****Proposal 2: RAN4 should send an LS to RAN2 with the recommendation to introduce a clarification in the maxNumberMIMO-LayersPDSCH IE description that the support of DL MIMO is optional and independent of the specified number of Rx for UEs supporting any NTN band.** |
| R4-2216640 | Ericsson | In this contribution, we present our view on the NTN frequency error requriement with below observations and proposal:Observation 1 There is a need to specify the ideally doppler frequency derivation for TEObservation 2 It will be easier for TE to measure and compensate the pre-compensated doppler shift by UE relative to the nominal UL frequencyProposal-1: Whether to have GNSS access at TE could leave to RAN5 to decide.Proposal-2: The doppler frequency should be specified in annex so that frequency error caused by the deviation from the UE estimated amount and TE pre-set would be minimized.Proposal-3:RAN4 discuss the above changes for the frequency error requirement considering the test discussion above.Proposal-4:Discuss the above annex for the doppler frequency measurement.  |
| R4-2216835 | MediaTek Inc. | The following is concluded:Observation 1: To “realistically” test pre-compensation, the channel used would need to apply all of the characteristics of the channel, in uplink and downlink. Purely applying a shift in UL frequency with everything else remaining the same is not realistic in our view. Observation 2: Existing RF test cases seems to always apply static channels until now. Proposal: Liaise RAN5 to trigger the development of the zero doppler test configuration. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1

*Sub-topic description:* OBUE

*Open issues and candidate options before e-meeting:*

**Issue 1-1-1:** definition of OBUE

* Proposals (see Huawei HiSilicon/R4-2216065/P1)
	+ Option 1: it’s proposed to use a new term to replace “operating band unwanted emission (OBUE)” for SAN, e.g. “spectrum emission mask” which was used in TS 25.104 or “out-of-band mask” or “out-of-band emission”.
* Recommended WF
	+ TBA

**Issue 1-1-2:** definition of ΔfOBUE

* Proposals (see THALES/R4-2215337/P2, Huawei HiSilicon/R4-2216065/P2)
	+ Option 1: Don’t change the ΔfOBUE current definition from TS 38.108, simply add an explanation.

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: To remove ΔfOBUE in TS 38.108 and improve/modify the corresponding wordings.
* Recommended WF
	+ TBA

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

* Proposals (see THALES/R4-2215337/P1)
	+ Option 1: (New Option 5 derived from Option 4) 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 |

* Recommended WF
	+ TBA

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

* Proposals (see THALES/R4-2215337/P4)
	+ Option 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*.

* Recommended WF
	+ TBA

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

* Proposals (see THALES/R4-2215337/P5)
	+ Option 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. |

* Recommended WF
	+ TBA

### Sub-topic 1-2

*Sub-topic description:* Spurious

*Open issues and candidate options before e-meeting:*

**Issue 1-2-1:** NTN SAN spurious

* Proposals (see Ericsson/R4-2216526/P1)
	+ Option 1: Align NTN SAN spurious domain boundary with SM.1541-6 definition.
* Recommended WF
	+ TBA

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

* Proposals (see Ericsson/R4-2216526/P2)
	+ Option 1: Do not define ΔfOBUE and clarify the out of band / spurious domain boundary in TS 38.108.
* Recommended WF
	+ TBA

### Sub-topic 1-3

*Sub-topic description:* SAN Bandwidths

*Open issues and candidate options before e-meeting:*

**Issue 1-3-1:** definitions of SAN Bandwidths

* Proposals (see THALES/R4-2215337/P3)
	+ Option 1: Add BWChannel definition, remove SANChannel abbreviation (since not used), add new definition for BWAssignedBand, and remove definition of BWContiguous (since not used).

~~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.~~

* Recommended WF
	+ TBA

### Sub-topic 1-4

*Sub-topic description:* DL MIMO

*Open issues and candidate options before e-meeting:*

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

* Proposals (see Apple/R4-2216593/P1&P2)
	+ Option 1: As a working principle, RAN4 should decouple the support of DL MIMO from the number of Rx branches for NTN UEs.
	+ Option 2: RAN4 should send an LS to RAN2 with the recommendation to introduce a clarification in the maxNumberMIMO-LayersPDSCH IE description that the support of DL MIMO is optional and independent of the specified number of Rx for UEs supporting any NTN band.
* Recommended WF
	+ TBA

### Sub-topic 1-5

*Sub-topic description:* NTN Frequency error

*Open issues and candidate options before e-meeting:*

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

* Proposals (see Ericsson/R4-2216640/P1&P2&P3&P4)
	+ Option 1: Whether to have GNSS access at TE could leave to RAN5 to decide
	+ Option 2: The doppler frequency should be specified in annex so that frequency error caused by the deviation from the UE estimated amount and TE pre-set would be minimized.
	+ Option 3: RAN4 discuss the above changes for the frequency error requirement considering the test discussion above.
	+ Option 4: Discuss the above annex for the doppler frequency measurement.
* Recommended WF
	+ TBA

**Issue 1-5-2:** NR NTN Frequency Error

* Proposals (see MediaTek Inc./ R4-2216835/P)
	+ Option 1: Liaise RAN5 to trigger the development of the zero doppler test configuration
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1: OBUE

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 1-1-1: definition of OBUE..No very strong view but, if we change requirement’s name, it’s probably better to align with SM.1541 and name this requirement “out of band emission”.Issue 1-1-2: definition of ΔfOBUE..We also proposed to remove the definition of ΔfOBUE (option 2), which would not be needed for SAN. Still, if companies prefer to keep it, that would also be ok, but the name would have to be align with the outcomes of Issue 1-1-1 and this additional text is not needed, it would even be confusing... We would then only agree with “don’t change the current definition” in option 1.Issue 1-1-3: correction of ΔfOBUE valuesfor SAN..We prefer to keep BWchannel pending on the clear definition of BWAssignedBand, the proposed one is still unclear. But ok to update table 9.7.1-1 accordingly.Issue 1-1-4: definitions of OBUE general aspects..Regarding PSDBand, the “assigned band” is unclear and would need clarification. Regarding BWAssignedBand, what means “total”, this has to be clarified as well. Issue 1-1-5: Correction of OBUE minimum requirements for SAN type 1-H..We prefer keeping existing requirement as is, pending on clarification on the new proposed symbols definition. |
| Huawei | Issue 1-1-1: definition of OBUEI’m OK with Ericsson’s suggestion to align with SM.1541 and name this requirement “out of band emission”.Issue 1-1-2: definition of ΔfOBUEOption 2. Keeping the definition of ΔfOBUE is unnecessary. I think companies misunderstand the meaning of ΔfOBUE. I have to highlight that the band specified in ITU-R is not equivalent to the operating band specified in 3GPP spec. In my understanding, the band specified in ITU-R is similar to channel specified in 3GPP.Issue 1-1-3: correction of ΔfOBUE valuesfor SANI think the definition of ΔfOBUE should be removed. Updating this is meaningless.Issue 1-1-4: definitions of OBUE general aspectsI’m so confused with these new concepts. It’s noted that we can’t mix the concepts “band” in ITU-R and channel specified in 3GPP.Issue 1-1-5: Correction of OBUE minimum requirements for SAN type 1-HWe have only 20MHz channel bandwidth in band n256. Does that mean companies want to use 30MHz in band n256? |
| THALES | Issue 1-1-1: definition of OBUEWe can keep “OBUE” to avoid any confusion. Is not wrong and is following ITU-R recommendation. Please see R4-2215337.Figure 1. Out of Band mask vs. percentage of bandwidthFigure 2. Out of Band mask vs. frequency offsetIssue 1-1-2: definition of ΔfOBUEWe prefer Option 1. Please see R4-2215337.Issue 1-1-3: correction of ΔfOBUE valuesfor SANWe prefer Option 1. Please see R4-2215337.Issue 1-1-4: definitions of OBUE general aspectsWe prefer Option 1. Please see R4-2215337. Actually the problem is that in current TS 38.108 there is a confusion between “channel” and “band”. Please also see modifications in OBUE definition from 38.108, the BW of the channel cannot be at the same time the total SAN RF bandwidth and the channel bandwidth, something is wrong.BWChannel [MHz] is the considered NR *channel bandwidth* ~~or SAN total~~ *~~RF bandwidth~~* ~~for a given~~ *~~operating band~~*~~.~~Issue 1-1-5: Correction of OBUE minimum requirements for SAN type 1-HWe prefer Option 1. Please see R4-2215337.Operators may use differently the band. However, the satellite will entirely use all 30 MHz band (e.g. 15 MHz + 15 MHz or other type of potential combination). So the worst case is still 30 MHz, and not 20 MHz. |
| CATT | **Issue 1-1-1: definition of OBUE**No strong view, fine with the proposal that “OBUE” is replaced by “out of band emissions”. Based on CR review, we found the term “out of band emission” already existed in current spec, it should be clarified with the newly introduced “out of band emission”. So if other companies are OK, we are also fine to use other terminology. **Issue 1-1-2: definition of ΔfOBUE**Support option 2 to remove ΔfOBUE since the usage of ΔfOBUE in TS 38.108 causes misunderstanding.**Issue 1-1-3: correction of ΔfOBUE valuesfor SAN**Pending on issue 1-1-2,ΔfOBUE can be removed.**Issue 1-1-4: definitions of OBUE general aspects**Emission requirement based on BWchannel is sufficient.The definition of SAN total *RF bandwidth* for BWAssignedBand is not very clear. If our understanding is right, Thales’s concern is about multi-carrier case? Form our understanding, For a *RIB* operating in multi-carrier, the requirements apply to *BS channel bandwidths* of the outermost carrier for the frequency ranges. So the BWchannel definition and its related requirements are sufficient. We don’t need to define BWAssignedBand.**Issue 1-1-5: Correction of OBUE minimum requirements for SAN type 1-H**Same comment as Issue 1-1-4 |
| THALES | THALES to CATT:If companies prefer OoB or OOB (out of band) or OoBE/OOBE (out-of-band emissions) instead of OBUE (out-of-band unwanted emissions), that is acceptable as well. However, as we previously said, ΔfOBUE is not the issue. The issue is the current value. |

Sub topic 1-2: Spurious

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 1-2-1: NTN SAN spurious..This is related to issue 1-1-2, pending on the removal or not of ΔfOBUEIssue 1-2-2: Out of band / spurious domain boundary clarification..Same as issue 1-2-1, pending on issue 1-1-2. |
| Huawei | Issue 1-2-1: NTN SAN spuriousRemove the definition of ΔfOBUE. OK with Ericsson’s proposalIssue 1-2-2: Out of band / spurious domain boundary clarificationRemove the definition of ΔfOBUE. OK with Ericsson’s proposal |
| THALES | Issue 1-2-1: NTN SAN spuriousThis does not contradict using ΔfOBUEIssue 1-2-2: Out of band / spurious domain boundary clarificationThe ΔfOBUE is not actually the problem. The definition is correct but the value is not. |
| CATT | Issue 1-2-1: NTN SAN spuriousFine with defining spurious emission based on channel edge with 200% of the necessary bandwidth offset to align with SM.1541-6 definition.Issue 1-2-2: Out of band / spurious domain boundary clarificationPending on issue 1-1-2.  |

Sub topic 1-3: SAN Bandwidths

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 1-3-1: definitions of SAN Bandwidths.. BWAssignedBand definition. is still unclear, what“total” means? Why not keeping BWContiguous instead? Thisis clearer definition… |
| Huawei | Not agreeable. BWAssignedBand definition. is still unclear. Does that mean satellite will transmit 30MHz? If so, we need to specify 30MHz. |
| THALES | Issue 1-3-1: definitions of SAN BandwidthsSorry, but this is the definition used by ITU-R recommendation. We did not change anything at all.And BWContiguous is not used at all, so we removed it.As you see, we used same ITU-R definition, we did not invent anything new.The issue seems to be that ITU-R recommendation is not correctly interpreted in current TS 38.108 specification.Using current ITU-R approach, in TS 38.108 we actually obtain similar figures:Figure 1. Out of Band mask vs. percentage of bandwidthFigure 2. Out of Band mask vs. frequency offset |
| Nokia | Thank you, THALES, for providing this explanation. We would like to better understand BWAssignedBand is this equivalent to the configured BW of a TN BS if we are to compare? |
| CATT | Issue 1-3-1: definitions of SAN BandwidthsSame comment as Issue 1-1-4.  |
| THALES | THALES to NOKIA: * BWAssignedBand is e.g. equivalent to 30 MHz bandwidth for the S-Band.
* BWChannel is e.g. equivalent to 5, 10, 15, 20 MHz bandwidth for the S-Band.

As you see, is not the same thing.We cannot leave the TS 38.108 as it is, the following explanation from TS 38.108 v17.1.0 is misleading:“BWChannel is the considered NR *channel bandwidth* or SAN total *RF bandwidth* for a given *operating band*.”How BWChannel can be **at the same time** two **different things**? |
| THALES | THALES to Ericsson:Please also check the corresponding CR from THALES (R4-2215336), you will understand better. The term “total” is already there. |

Sub topic 1-4: DL MIMO

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| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 1-4-1: on decoupling DL MIMO from number of Rx branches for NTN UE capabilities..Fine with option 1, the LS might not be needed still. |
| Huawei | Issue 1-4-1: on decoupling DL MIMO from number of Rx branches for NTN UE capabilitiesNot agreeable.As we assume NTN UE has both TN and NTN functionality. I don’t see any benefits on decoupling DL MIMO from number of Rx branches for NTN UE capabilities, which is not aligned with TN UE, but to ask RAN2 for the spec changes. |
| Qualcomm | Issue 1-4-1:We don’t agree with option 1/2It is not clear the proposal of decoupling is for 4Rx or 2Rx? If it is for 4Rx, there is no need to make this change since we don’t have 4Rx bands for NTN. If it is for 2Rx, RAN4 has agreed that there will be no DL MIMO requirements for UE demodulation. In this case, we think NTN UE will not indicate the signalling of DL MIMO layer number for NTN bands which means UE does not support DL MIMO in the carrier. |
| THALES | Issue 1-4-1: on decoupling DL MIMO from number of Rx branches for NTN UE capabilitiesThere is no MIMO in Rel-17. Which is the purpose of this proposal? |
| Nokia | We are not sure why RAN4 needs to trigger any RAN2 work here. We cannot agree that given the provided discussion.  |
| Apple | In our view it is important to have a clarification related DL MIMO for NTN, since the current definition of mandatory DL MIMO doesn’t distinguish between NTN and TN. We have raised this issue in our contribution because we think that a clarification is required in RAN4 to stablish that the mandatory MIMO support is optional in NTN bands. We are open to discuss how to capture this in the specification. |
| MediaTek | It seems a valid point that has been raised. However, maybe a more specific proposal needs to be made. |

Sub topic 1-5: NTN Frequency error

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | Issue 1-5-1: on NTN Frequency error requirement ..Agree with all 3 options.Issue 1-5-2: NR NTN Frequency ErrorThe LS to RAN5 should not be needed, we usually don’t do so. |
| Qualcomm | Issue 1-5-1: on NTN Frequency error requirement The proposal we had is that we would add a side condition to the requirements that it is tested with constant doppler, but it was not accepted, maybe Mediatek had concerns. That would remove the doubt about the ideally compensated vs nominally and also would take out the trajectory estimation algoritm which is more time sensitive feature and its verification belongs to the RRM part. Constant Doppler can be achieved by setting the SAT ephemeris and UE position such that SAT approaches the UE directly. The ephemeris IE has a lots of flexibility, parameter ranges are very big and artificial GNSS signal can be used to set the UE to SAT trajectory with large radius. Regarding option 3 text, not fully clear to us what does “after compensation” mean here. UE compensates? Issue 1-5-2: NR NTN Frequency ErrorIn principle this is ok, but before writing LS, can we agree spec language in ran4 for this condition and check if ran5 will work on this based on that? M<Aybe next meeting, then we could also refine what to exactly say and advoice ran5? Seems also the non-zero doppler freq error conditions need more discussions, as per issue 1-5-1.  |
| Huawei | Issue 1-5-1: on NTN Frequency error requirement OK with the principle. Wording details should be further checked.Issue 1-5-2: NR NTN Frequency ErrorI think current RAN5’s specification is based on the development of the zero doppler test configuration. It’s unclear what we want to trigger RAN5. As RAN5 has started to work the conformance test on R17 NR NTN, interested companies can provide some proposals in RAN5 directly. |
| Ericsson | To Qualcomm:  From 38.300, clause 16.14.2.2 : “While the pre-compensation of the instantaneous Doppler shift experienced on the service link is to be performed by the UE, the management of Doppler shift experienced over the feeder link and transponder frequency error is left to the satellite network implementation.”Our understanding is that UE should then make this doppler shift compensation (service link), that’s the meaning of this “after compensation”. To Huawei and Qualcomm: Wording could be further improved, we are open to any suggestion. |
| THALES | Issue 1-5-1: on NTN Frequency error requirement Rel-17 considers GNSS as a compulsory requirement for UE pre-compensation when Tx in UL. UE cannot pre-compensate Doppler without GNSS in Rel-17. Therefore some test with some GNSS assumptions is required. Moreover, as also discussed in RAN4 demodulation (demod.) sessions and RRM sessions, some propagator model can be required by the UE, in order to predict the satellite position from the recovered ephemeris is data (periodically transmitted on SIB19).Issue 1-5-2: NR NTN Frequency ErrorNot sure if really necessary, since this is part of RAN5 work. Agree with Ericsson. |
| Nokia | Issue 1-5-1: on NTN Frequency error requirement We are in principal fine with the proposed options, and we can work further on the wording. Issue 1-5-2: NR NTN Frequency ErrorAt the current stage we see no need or a LS to RAN5. |
| MediaTek | 1-5-1: Keeping the Doppler constant during a test case without a test mode is not feasible in our understanding. When propagating the pre-compensation, the UE has to take into account that the earth is moving, gravity would accelerate the satellite, changing its velocity direction relative to the UE and hence changing the Doppler.Also, in a realistic environment, delay and delay drift pre-compensation needs to be taken into account. Any wrong assumptions made by the TE about what the UE is doing in relation to the real channel condition may lead to a UE failing the test even though it was accurately pre-compensating in the field, or it leads to the UE needing to implement one algorithm for the test case and one for the field, which would be completely undesirable. The Annex proposed by Ericsson takes none of these additional properties into account, so would likely lead to the scenario above. |

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic #1-1**OBUE | **Issue 1-1-1: definition of OBUE***Tentative agreements:***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.

*Candidate options:**Recommendations for 2nd round:***Issue 1-1-2: definition of ΔfOBUE***Tentative agreements:***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**

*Candidate options:**Recommendations for 2nd round:***Issue 1-1-3: correction of ΔfOBUE valuesfor SAN***Tentative agreements:***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.*Candidate options:**Recommendations for 2nd round:***Issue 1-1-4: definitions of OBUE general aspects***Tentative agreements:***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 bandBWChannel [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*.*Candidate options:**Recommendations for 2nd round:***Issue 1-1-5: correction of OBUE minimum requirements for SAN type 1-H***Tentative agreements:***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. |

*Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #1-2**Spurious | **Issue 1-2-1: NTN SAN spurious***Tentative agreements:***Proposal 1-2-1-1: -***Candidate options:**Recommendations for 2nd round:* It does not seem required to discuss “Align NTN SAN spurious domain boundary with SM.1541-6 definition”, since already agreed in previous meeting to use SM.1541-6 for SAN TS 38.108.**Issue 1-2-2: Out of band / spurious domain boundary clarification***Tentative agreements:***Proposal 1-2-2-1: -***Candidate options:**Recommendations for 2nd round:* It seems similar discussion as Issue 1-1-1 and 1-1-2. |
| **Sub-topic #1-3**SAN Bandwidths | **Issue 1-3-1: definitions of SAN Bandwidths***Tentative agreements:***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.~~*Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #1-4**DL MIMO | **Issue 1-4-1: on decoupling DL MIMO from number of Rx branches for NTN UE capabilities***Tentative agreements:***Proposal 1-4-1-1:** Distinguish between NTN and TN for DL MIMO UE capabilities.*Candidate options:**Recommendations for 2nd round:* |
| **Sub-topic #1-5**NTN Frequency error | **Issue 1-5-1: on NTN Frequency error requirement***Tentative agreements:***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.*Candidate options:**Recommendations for 2nd round:* To be further discussed. In any case, RAN4 cannot decide for RAN5.**Issue 1-5-2: NR NTN Frequency Error***Tentative agreements:***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

*Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

**Moderator Note: N/A**

## Discussion on 2nd round (if applicable)

**Moderator Note:** Companies are encouraged to provide feedback:

* Agree (Y)
* Disagree (N)
* Agree with changes (and propose changes to proposals if any comment)

|  |  |
| --- | --- |
| **Company** | **Proposal 1-1-1-1** |
| Ericsson | Option 1 would be fine with us |
| Nokia | Option 1 - We understand “OoBE” is different than OBUE so a change would be fine to avoid confusing |
| Huawei | Option 1 is OK. |
| CATT | Fine with option 1.  |
| THALES | As a compromise, we could agree with Option 1. |

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| **Company** | **Proposal 1-1-2-1** | **Proposal 1-1-3-1** |
| Ericsson | Option 3, we prefer removing **ΔfOBUE**  | Option 3.We shall update table 9.7.1-1 but not according to the current proposals. |
| Nokia | Option 3 – Similar comment as for P1-1-1-1 | This might need further discussions and presentation of a draft. To our understanding this is also discussed via email directly.  |
| Huawei | Option 3, we prefer removing **ΔfOBUE**  | Option 3 |
| CATT | Option 3.  | We think the definition of BWAssignedBand is not aligned with the current requirements and will cause confusion. The current requirements should be based on channel bandwidth level but BWAssignedBand is about operating band level.  |
| THALES | We actually have a preference for Option 1 or Option 2.Since we cannot have an agreement, Ericsson proposed Option 4 (not to change – as described in current WF on NTN Solutions SAN RF Maintenance **R4-2217311**). We therefore agreed with Option 4, and we propose to further discuss Options 1, 2 and 3 during RAN4#105 | See ITU-R recommendation and THALES contribution. ITU-R recommendation is based on assigned band, not channel.We can further discuss this matter during RAN4#105Since we cannot have an agreement, Ericsson proposed Option 4 (not to change – as described in current WF on NTN Solutions SAN RF Maintenance). We therefore agreed with Option 4, and we propose to further discuss Options 1, 2 and 3 during RAN4#105 |

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| **Company** | **Proposal 1-1-4-1** | **Proposal 1-1-5-1** |
| Ericsson | DisagreeThose definitions are ITU terminology, not RAN4.  | DisagreeThose new terms are unclear and might not be needed.  |
| Nokia | Similar comment as Ericsson | Similar comment as Ericsson |
| Huawei | Disagree. To Thales, for your 30MHz (15+15MHz) cases, I assume it’s for contiguous CA or multi-carriers. I think we can further address or specify it instead of modify the requirements for single carrier. | Disagree. To Thales, for your 30MHz (15+15MHz) cases, I assume it’s for contiguous CA or multi-carriers. I think we can further address or specify it instead of modify the requirements for single carrier. |
| THALES | There could be 1 or Multi-operators in the band. The SAN will most probably use entire band (30 MHz) even if the channel bandwidth is 5, 10, 15, 20 MHz (as defined/introduced per operator request)For S-band in 30 MHz, for L-band or other band might be different.We still think ITU-R recommendation is per band and not per channel. There is a confusion in the 3GPP definition.In any case, current (3GPP) definition from TS 38.108 is not correct: BWChannel [MHz] is the considered NR *channel bandwidth* or SAN total *RF bandwidth* for a given *operating band*.A channel (5, 10, 15, 20 MHz) cannot be at the same time SAN total RF bandwidth (30 MHz) with current S-band definitions. | New terms are the ones used by ITU-R. How they can be unclear?ITU-R recommendation is about the “Assigned Band”, not channel. |

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| --- | --- | --- |
| **Company** | **Proposal 1-3-1-1** | **Proposal 1-4-1-1** |
| Ericsson | DisagreeThose new terms are unclear and might not be needed. |  |
| Nokia | Thank you for further explanation. However, we are still not clear about this new definition. Is the offset always 30 MHz, if so then why is a variable needed?  | We are still not sure what implication this has. Further discussion is needed.  |
| Qualcomm |  | We don’t agree with the proposal since the necessity is not clear for us |
| THALES | We agree with the proposal.For other companies: Actually, except for AssignedBand, all the other modifications should be acceptable. We therefore updated CR correspondingly (all modification excepting AssignedBand since companies still have concerns), see also **R4-2217311.** | It seems that there is some misunderstanding. Therefore this proposal not used for the WF **R4-2217311**. |

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| **Company** | **Proposal 1-5-1-1** | **Proposal 1-5-1-2** | **Proposal 1-5-2-1** |
| Qualcomm | Y | N | N |
| Ericsson | Agree | Agree | We don’t think this is needed. |
| Nokia | Y | Further discussion is needed. | N |
| Huawei | Agree.  |  | Option 2. Don’t send LS. Proponent can trigger this issue in RAN5 directly. |
| MediaTek |  | No, as it is only relevant if RAN5 get the full picture about the doppler channel properties, and if RAN5 decide to test frequency error using a variable doppler shift. |  |
| THALES | Agree |  |  |

**Moderator Note:** Please further check recommendations/agreements from WF on NTN Solutions SAN RF Maintenance (**R4-2217311**).

# Topic #2: Maintenance discussions - CRs to TS 38.108 and TR 38.863

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2216150 | Xiaomi | **CR to TR 38.101-5 to be discussed in the dedicated 1st round & 2nd round folders.**Correct the figure and its corresponding wording based on the TS38.101-1. |
| R4-2216064 | Huawei, HiSilicon | **CR to TR 38.863 to be discussed in the dedicated 1st round & 2nd round folders.**Operating band unwanted emission was replaced by out-of-band emissions in SAN specification.Receiver spurious emissions/ intermodulation is declared as “not applicable”.The value of RMS field-strength is modified to align with current specification. |
| R4-2215412 | CATT | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**Adjust some definitions alphabetically. |
| R4-2215336 | THALES | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**Correct typos, symbols, remove symbols not used, correct definitions, correct BWchannel and align text/fonts. |
| R4-2216066 | Huawei, HiSilicon | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**The definition about ΔfOBUE for SAN was removed.Operating band unwanted emission was replaced by out-of-band emissions in SAN specification.To align OTA unwanted emissions requirements with conductive requiremetns. |
| R4-2216527 | Ericsson | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**Remove ΔfOBUE definition. |
| R4-2216528 | Ericsson | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**Remove ΔfOBUE definition. |
| R4-2216594 | Apple | **CR to TR 38.101-5 to be discussed in the dedicated 1st round & 2nd round folders.**Requirement clarifications :Explicitly list which modulations are applicable to the NTN transmission modulation quality requirementCorrect the optional applicability of the 64 QAM RMC to the maximum input level requirement and introduce a placeholder reference to the 16 QAM RMC |
| R4-2216641 | Ericsson | **CR to TR 38.101-5 to be discussed in the dedicated 1st round & 2nd round folders.**Changes :Correct the “compared to” frequency to be UL configured frequencyAdding the annex for the TE to derive the expected “ideal” pre-compensated frequency |
| R4-2215315 | Qualcomm Incorporated | **CR to TR 38.101-5 to be discussed in the dedicated 1st round & 2nd round folders.**Since all RF requriements are applicable to this condition, the condition is placed under clause 4.2 Applicability of minimum requirements:“For all RF requriements other than frequency error in clause 6.4.1 requirements are applicable when Doppler is set to zero.” |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1

*Sub-topic description:* NTN UE

*Open issues and candidate options before e-meeting:*

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

**Note:** The system parameter for NTN UE is not correct

### Sub-topic 2-2

*Sub-topic description:* OBUE

*Open issues and candidate options before e-meeting:*

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

*Sub-topic description:* OTA unwanted emissions

*Open issues and candidate options before e-meeting:*

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

### Sub-topic 2-4

*Sub-topic description:* SAN Operating Band

*Open issues and candidate options before e-meeting:*

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

**Note:** replacement of operating band unwanted emission

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

**Note:** replacement of operating band unwanted emission

### Sub-topic 2-5

*Sub-topic description:* Spurious

*Open issues and candidate options before e-meeting:*

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

**Note:** declared not applicable

### Sub-topic 2-6

*Sub-topic description:* RMS field

*Open issues and candidate options before e-meeting:*

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

### Sub-topic 2-7

*Sub-topic description:* Definitions and symbols

*Open issues and candidate options before e-meeting:*

1. Issue 2-7-1: correction of order of definitions – **see** R4-2215412 (CATT)

**Note:** correct order for definition would be missing

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

**Note:** typos will propagate through other specifications/documents

### Sub-topic 2-8

*Sub-topic description:* Modulations

*Open issues and candidate options before e-meeting:*

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

**Note:** Explicitly list which modulations are applicable to the NTN transmission modulation quality requirement

**Note:** Correct the optional applicability of the 64 QAM RMC to the maximum input level requirement and introduce a placeholder reference to the 16 QAM RMC

### Sub-topic 2-9

*Sub-topic description:* NTN Frequencies

*Open issues and candidate options before e-meeting:*

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

**Note:** Unclearness exists in NTN UE specification

### Sub-topic 2-10

*Sub-topic description:* Doppler test conditions

*Open issues and candidate options before e-meeting:*

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

## Companies views’ collection for 1st round

### Open issues

**Moderator: N/A**

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2216150(Xiaomi) | THALES: Document seems agreeable. |
|  |
|  |
| R4-2216066(Huawei, HiSilicon) | Ericsson: Pending on outcomes of the 1st round issues (OBUE). Also, for spurious emission, "excluding the frequency range of out-of-band Emissions" should be better clarified, we should also exclude the SAN BW, not only the range of OOB emissions… |
| Huawei: OK with Ericsson’s last clarification. |
| THALES: Pending 1st round issues with respect to OBUE and ΔfOBUE, to continue discussion during 2nd round.CATT: pending on issue 1-1-1. And the term “out of band emission” already existed in current spec, it should be clarified with the newly introduced “out of band emission” 6.6.1 GeneralUnwanted emissions consist of out-of-band emissions and spurious emissions according to ITU definitions [2]. In ITU terminology, out of band emissions are unwanted emissions immediately outside the *SAN channel bandwidth* resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions.The out-of-band emissions requirement for the SAN transmitter is specified both in terms of Adjacent Channel Leakage power Ratio (ACLR) and out-of-band emissions. |
| R4-2216527(Ericsson) | Huawei: OK with the principle. Better to merge the wording with R4-2216066. |
| THALES: to continue discussion during 2nd round. |
|  |
| R4-2216528(Ericsson) | Huawei: OK with the principle. Better to merge the wording with R4-2216066. |
| THALES: to continue discussion during 2nd round. |
|  |
| R4-2216064(Huawei, HiSilicon) | Ericsson: Pending on outcomes of the 1st round issues (OBUE). |
| THALES: Pending 1st round issues with respect to OBUE and ΔfOBUE, to continue discussion during 2nd round. |
|  |
| R4-2215412(CATT) | THALES: Document seems agreeable. |
|  |
|  |
| R4-2215336(THALES) | Ericsson: Pending on outcomes of the 1st round issues (BWassignedband clarification, …). |
| Huawei: New concept will lead confusion. Better to merge it into R4-2216066 |
| THALES: Concept is not at all confusing. **And is not a new concept, this is the exact ITU-R definition as explained above. Please see explanations from R4-2215337 (Discussion on SAN Out-of-Band Mask)** THALES2: And why everything has to be merged with R4-2216066? |
| R4-2216594(Apple) | Ericsson: we can’t have TBD in the TS under revision control… |
| Huawei: Similar view with Ericsson. We don’t want to reopen the discussion. We only have 64QAM FRC to measure the maximum input level. |
| Qualcomm: Generally, we are OK with the CR. But the FRC for 16QAM needs to be defined for maximum input level for the UE that doesn’t support 64QAM. TBD it not allowed in the TS. |
| Apple: Our CR aims to correct the optional applicability of the 64 QAM RMC to the maximum input level requirement and introduce 16 QAM RMC. To answer the companies concern about TBD, we can revise the CR and provide the RMC for 16-QAM in the second round. |
| R4-2216641(Ericsson) | Huawei: This CR is not aligned with Ericsson’s proposal R4-2216640. Not sure why IoT UE appear into the NR NTN WI.Question for clarification: how can UE know the UT1(universal time 1)?NOTE with open brackets can be removed. |
| Qualcomm: It should be NR NTN UE rather NR IoT UE. |
|  |
| R4-2215315(Qualcomm Incorporated) | Ericsson: We don’t agree with this CR. Our understanding from last meeting agreement was that the Doppler shift should be set to 0 for testing purpose (only), but the UE RF requirements should still be applicable whatever Doppler shift is considered. If not, the UE RF requirements/performance with doppler frequency pre-compensation would need to be clarified. |
| Qualcomm: So how about text: “For all RF requriements other than frequency error in clause 6.4.1, requirements are verified when Doppler is set to zero.”? |
| Huawei: Will this Applicability of minimum requirements be exported to TN UE? Specifying it in requirements is too strong. |
| To Qualcomm: The proposed update would be fine but most likely this should be made in another clause, this one is related to requirements’ applicability, not testing.  |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2216150(Xiaomi) | *Agreeable* |
| R4-2216066(Huawei, HiSilicon) | *to be revised* |
| R4-2216527(Ericsson) | *to be revised* |
| R4-2216528(Ericsson) | *to be revised* |
| R4-2216064(Huawei, HiSilicon) | *to be revised* |
| R4-2215412(CATT) | *Agreeable* |
| R4-2215336(THALES) | *to be revised* |
| R4-2216594(Apple) | *to be revised* |
| R4-2216641(Ericsson) | *to be revised* |
| R4-2215315(Qualcomm Incorporated) | *to be revised* |

## Discussion on 2nd round (if applicable)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| Revised R4-2216066(Huawei, HiSilicon) | Pending on Dfobue decision |
| THALES: proposed to postpone R4-2216066 discussion for next meeting(see also proposed WF R4-2217311) |
|  |
| Revised R4-2216527(Ericsson) | We proposed to note this CR and focus on R4-2216066 instead |
| THALES: Thank you Ericsson for your understanding |
| THALES: proposed to postpone R4-2216066 discussion for next meeting(see also proposed WF R4-2217311) |
| Revised R4-2216528(Ericsson) | We proposed to note this CR and focus on R4-2216066 instead |
| THALES: Thank you Ericsson for your understanding |
| THALES: proposed to postpone R4-2216066 discussion for next meeting(see also proposed WF R4-2217311) |
| Revised R4-2216064(Huawei, HiSilicon) | Pending on Dfobue decision |
| THALES: Since Dfobue decision, proposed to postpone discussion for next meeting(see also proposed WF R4-2217311) |
|  |
| Revised R4-2215336(THALES) | Pending on Dfobue decision |
| THALES: removed all the Dfobue related aspects, **focus now on typos and minor corrections**. THALES proposing to accept latest version. |
| THALES: Dfobue decision, proposed to postpone discussion for next meeting(see also proposed WF R4-2217311) |
| Revised R4-2216594(Apple) | THALES: since no comment, this CR may be agreeable. |
|  |
|  |
|  |
| Revised R4-2216641(Ericsson) | Qualcomm: Not sure why this appendix is needed, maybe better would be to describe the exact frequencies and ephemeris field values. Still, the constant doppler is what was analysed for 0.1ppM error.And I am not sure what does this mean:” observed over a period of 1 ms of cumulated measurement intervals after compensation with ideally pre-compensated doppler frequency compared with configured reference uplink carrier”Observed after compensation with… so who is doing what compensation with what? Compensation happens in UE and it is tested what it was supposed to be. And “compensate the measured frequency error with ideal doppler frequency.” What is ideal doppler frequency? Doppler is a shift in frequency. |
| Ericsson: The appendix is for the TE to derive the “ideal doppler frequency”, in our view, the necessity of the this is to make sure the TE has same method to derive ideal doppler frequency. The UE make the pre-compensation for the doppler frequency and TE need to compensate the ideal doppler frequency. We are open to discuss the wording here. The key point is the what frequency to compare with, in our understanding, it is the configured uplink frequency to compare with, as when received at network (reference at the SAN antenna), the doppler should be corrected by UE pre-compensation, thus the frequency to compare with is the configured UL frequency. One alternative is to remove the “after compensation with ideaaly pre-compensated doppler frequency” and add a note “ TE should compensate the ideally doppler frequency with Annex Z”Alternative wording:The mean value of basic measurements of NTN UE modulated carrier frequency shall be accurate to within ± 0.1 PPM observed over a period of 1 ms of cumulated measurement intervals ~~after compensation with ideally pre-compensated doppler frequency~~ compared with configured reference uplink carrier frequency. [NOTE: The ideally pre-compensated reference uplink carrier frequency consists of the UL carrier frequency signalled to the UE by SAN and UL pre-compensated Doppler frequency shift. For the test case, the location of the UE is explicitly provided to the UE from the test equipment. TE should compensate the ideally doppler frequency with Annex Z] |
| MediaTek: If this is supposed to be testing the real world, then any doppler channel also needs to include delay variation - NGSO satellites move. If it is acknowledged by Ericsson that we are not trying to replicate the real world, then we would not like to mandate the UE to implement a 2nd pre-compensation algorithm just to pass a test case.Regarding Ericsson’s latest proposed change, the Doppler shift component here is a function of the test case development. Maybe we can come back on this once RAN5 have made some progress on this. It doesn’t seem to be directly impacting the core requirement, so maybe we can have a more informed discussion later on. |
| Revised R4-2215315(Qualcomm Incorporated) | THALES: Agreeable? |
|  |
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|  |
|  |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
| **R4-2217311** | WF on NTN Solutions SAN RF Maintenance | THALES | WF for Email discussion summary for [104-bis-e][304] NTN\_Solutions\_RF\_Maintenance |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-2216888 | **R4-2217478** | Email discussion summary for [104-bis-e][304] NTN\_Solutions\_RF\_Maintenance  | THALES | To be revised for 2nd round | To be noted during 2nd round |
| R4-2216150 | N/A | CR to 38.101-5: Corrections on section 5.3.3 for NTN UE | Xiaomi | Agreeable |  |
| R4-2216066 | **R4-2217312** | Draft CR for 38.108 to maintain unwanted emissions clause | Huawei, HiSilicon | Revised |  |
| R4-2216527 | **R4-2217313** | CR to TS 38.108: ΔfOBUE updates – conducted clauses | Ericsson | Revised |  |
| R4-2216528 | **R4-2217314** | CR to TS 38.108: ΔfOBUE updates – conducted clauses | Ericsson | Revised |  |
| R4-2216064 | **R4-2217315** | CR for TR 38.863 to maintain SAN parts | Huawei, HiSilicon | Revised |  |
| R4-2215412 | N/A | CR for TS 38.108, Correct definition order in sub-clause 3.1 | CATT | Agreeable |  |
| R4-2215336 | **R4-2217316** | Corrections to SAN TS 38.108 | THALES | Revised |  |
| R4-2216594 | **R4-2217317** | CR to 38.101-5 on corrections related to 64QAM requirements | Apple | Revised |  |
| R4-2216641 | **R4-2217318** | CR on NTN Frequency error requirement | Ericsson | Revised |  |
| R4-2215315 | **R4-2217319** | CR: 0005 Doppler test conditions for RF requirements 38.101-5 | Qualcomm Incorporated | Revised |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| **R4-2217478** |  | Email discussion summary for [104-bis-e][304] NTN\_Solutions\_RF\_Maintenance | THALES | Noted |  |
| **R4-2217311** |  | WF on NTN Solutions SAN RF Maintenance | THALES | Agreeable |  |
| **R4-2217312** |  | Draft CR for 38.108 to maintain unwanted emissions clause | Huawei, HiSilicon | Postponed | The dfOBUE part to be discussed at RAN4#105-e |
| **R4-2217313** |  | CR to TS 38.108: ΔfOBUE updates – conducted clauses | Ericsson | Noted | Thank you Ericsson for your understanding. |
| **R4-2217314** |  | CR to TS 38.108: ΔfOBUE updates – conducted clauses | Ericsson | Noted | Thank you Ericsson for your understanding. |
| **R4-2217315** |  | CR for TR 38.863 to maintain SAN parts | Huawei, HiSilicon | Postponed | (can also be agreed without dfOBUE part if revision available at RAN4#104-bis-e) |
| **R4-2217316** |  | Corrections to SAN TS 38.108 | THALES | Agreeable?(All the dfOBUE part has been removed, now only minor changes/typos) | The dfOBUE part to be discussed at RAN4#105-e |
| **R4-2217317** |  | CR to 38.101-5 on corrections related to 64QAM requirements | Apple | Postponed(No revision available in 2nd round) |  |
| **R4-2217318** |  | CR on NTN Frequency error requirement | Ericsson | Postponed(it seems that there are still comments during 2nd round) | Ericsson notifies parallel discussion on the same topic in the IoT NTN |
| **R4-2217319** |  | CR: 0005 Doppler test conditions for RF requirements 38.101-5 | Qualcomm Incorporated | Agreeable |  |
|  |  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
	1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
	2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Appendix: Companies contribution summary

Contribution summaries for **[104-bis-e][304] NTN\_Solutions\_SANRF\_Maintenance** thread are as follows:

|  |  |  |
| --- | --- | --- |
| **TDoc Number** | **Company** | **Proposals / Observations** |
| R4-2216150 | Xiaomi | **CR to TR 38.101-5 to be discussed in the dedicated 1st round & 2nd round folders.**Correct the figure and its corresponding wording based on the TS38.101-1. |
| R4-2215412 | CATT | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**Adjust some definitions alphabetically. |
| R4-2215336 | THALES | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**Correct typos, symbols, remove symbols not used, correct definitions, correct BWchannel and align text/fonts. |
| R4-2215337 | THALES | **Proposal 1:** (New Option 5 derived from Option 4) 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 |

**Proposal 2:** Don’t change the ΔfOBUE current definition from TS 38.108, simply add an explanation.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).**Proposal 3:** Add BWChannel definition, remove SANChannel abbreviation (since not used), add new definition for BWAssignedBand, and remove definition of BWContiguous (since not used).~~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.~~**Proposal 4:** 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 bandBWChannel [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*.**Proposal 5:** 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. |

 |
| R4-2216064 | Huawei, HiSilicon | **CR to TR 38.863 to be discussed in the dedicated 1st round & 2nd round folders.**Operating band unwanted emission was replaced by out-of-band emissions in SAN specification.Receiver spurious emissions/ intermodulation is declared as “not applicable”.The value of RMS field-strength is modified to align with current specification. |
| R4-2216065 | Huawei, HiSilicon | **Observation 1: the values of ΔfOBUE specified in clause 6.6.1 and 9.7.1 from TS 38.108 are different and incorrect.****Proposal 1: it’s proposed to use a new term to replace “operating band unwanted emission (OBUE)” for SAN, e.g. “spectrum emission mask” which was used in TS 25.104 or “out-of-band mask” or “out-of-band emission”.****Observation 2: ΔfOBUE is used in operating band unwanted emission limits based on the TS 38.104****Observation 3: Even if we specify ΔfOBUE in TS 38.108, but it isn’t used in SAN LEO and GEO Classes OBUE basic limits. In addition, we didn’t specify f\_offsetmax.****Proposal 2: To remove ΔfOBUE in TS 38.108 and improve/modify the corresponding wordings.** |
| R4-2216066 | Huawei, HiSilicon | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**The definition about ΔfOBUE for SAN was removed.Operating band unwanted emission was replaced by out-of-band emissions in SAN specification.To align OTA unwanted emissions requirements with conductive requiremetns. |
| R4-2216526 | Ericsson | In this contribution, we discussed the remaining SAN RF open issue from last RAN4#104-e meeting made the following observations and proposals:**Proposal1: Align NTN SAN spurious domain boundary with SM.1541-6 definition.****Observation2: Option 3 of the WF** R4-2214370, **is not aligned with SM.1541-6 spurious domain boundary definition.****Proposal2: Do not define ΔfOBUE and clarify the out of band / spurious domain boundary in TS 38.108.** |
| R4-2216527 | Ericsson | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**Remove ΔfOBUE definition. |
| R4-2216528 | Ericsson | **CR to TR 38.108 to be discussed in the dedicated 1st round & 2nd round folders.**Remove ΔfOBUE definition. |
| R4-2216593 | Apple | In this contribution we seek to clarify the assumption on the number of Rx antennas used in deriving the REFSENS requirements for NTN bands n256, n255 and recommend to decouple the support DL MIMO from the number of Rx branches for NTN UEs in general.**Observation 1: Considering the large path loss associated with NTN links, the feasibility of DL MIMO may be restricted to very few UE and SAN implementations and may not be a typical use case.****Proposal 1: As a working principle, RAN4 should decouple the support of DL MIMO from the number of Rx branches for NTN UEs.****Proposal 2: RAN4 should send an LS to RAN2 with the recommendation to introduce a clarification in the maxNumberMIMO-LayersPDSCH IE description that the support of DL MIMO is optional and independent of the specified number of Rx for UEs supporting any NTN band.** |
| R4-2216594 | Apple | **CR to TR 38.101-5 to be discussed in the dedicated 1st round & 2nd round folders.**Requirement clarifications :Explicitly list which modulations are applicable to the NTN transmission modulation quality requirementCorrect the optional applicability of the 64 QAM RMC to the maximum input level requirement and introduce a placeholder reference to the 16 QAM RMC |
| R4-2216640 | Ericsson | In this contribution, we present our view on the NTN frequency error requriement with below observations and proposal:Observation 1 There is a need to specify the ideally doppler frequency derivation for TEObservation 2 It will be easier for TE to measure and compensate the pre-compensated doppler shift by UE relative to the nominal UL frequencyProposal-1: Whether to have GNSS access at TE could leave to RAN5 to decide.Proposal-2: The doppler frequency should be specified in annex so that frequency error caused by the deviation from the UE estimated amount and TE pre-set would be minimized.Proposal-3:RAN4 discuss the above changes for the frequency error requirement considering the test discussion above.Proposal-4:Discuss the above annex for the doppler frequency measurement.  |
| R4-2216641 | Ericsson | **CR to TR 38.101-5 to be discussed in the dedicated 1st round & 2nd round folders.**Changes :Correct the “compared to” frequency to be UL configured frequencyAdding the annex for the TE to derive the expected “ideal” pre-compensated frequency |
| R4-2216835 | MediaTek Inc. | The following is concluded:Observation 1: To “realistically” test pre-compensation, the channel used would need to apply all of the characteristics of the channel, in uplink and downlink. Purely applying a shift in UL frequency with everything else remaining the same is not realistic in our view. Observation 2: Existing RF test cases seems to always apply static channels until now. Proposal: Liaise RAN5 to trigger the development of the zero doppler test configuration. |
| R4-2215315 | Qualcomm Incorporated | **CR to TR 38.101-5 to be discussed in the dedicated 1st round & 2nd round folders.**Since all RF requriements are applicable to this condition, the condition is placed under clause 4.2 Applicability of minimum requirements:“For all RF requriements other than frequency error in clause 6.4.1 requirements are applicable when Doppler is set to zero.” |