3GPP TSG-RAN WG4 Meeting # 107 R4-230xxxx

Incheon, KR, May 22 – May 26, 2023

**Agenda item:** 8.27.6

**Source:** Moderator (ZTE)

**Title:** Topic summary for [107][143] NR\_NTN\_enh\_UERF

**Document for:** Information

# Introduction

*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** |
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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: UE RF requirement

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2307319**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307319.zip) | Nokia, Nokia Shanghai Bell | Discussion on above 10GHz NTN UEs  [**Observation 1:** VSAT type devices could be compared to a NR FR2 fixed-wireless-access (FWA) device.](#_Toc134562020)  [**Observation 2:** VSAT type devices could be compared to a NR FR2 Vehicular UE.](#_Toc134562021)  [**Observation 3:** ESIM is also in the WID referred to as a “mobile VSAT”.](#_Toc134562022)  [**Observation 4:** None of the in the WID targeted UE types for an NTN band above 10 GHz is assumed to be a handheld device.](#_Toc134562023)  [**Observation 5:** At least in Rel-18 handheld FR2-NTN UEs are out of scope](#_Toc134562024)  [Proposal 1: FR2-NTN UEs shall be separated into Fixed and Mobile types](#_Toc134562025)  [**Observation 6:** Relaying on the current Network Signalling (NS) framework for a NTN UE is not enough to ensure conformance to Protection and Additional protection requirements.](#_Toc134562026)  [Proposal 2: RAN4 shall discuss how the Network Signalling (NS) framework can be extended to cover the needed aspects for NTN operation and if UE autonomous behavior needs to be specified.](#_Toc134562027) |
| [**R4-2308538**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308538.zip) | Ericsson | NTN enhancement: NTN UE requirements  **Proposal1: As starting point, based on the analysis of the regulations, RAN4 shall consider at least 2 types of NTN satellite UE above 10 GHz: one type for NTN mobile device and another type for NTN fixed device.**  **Proposal2: RAN4 should specify antenna pointing stability and accuracy requirements for fixed type of NTN satellite UE.**  **Proposal3: RAN4 should specify antenna pointing accuracy requirement for mobile type of NTN satellite UE (ESIM).**  **Proposal4: RAN4 should specify on-axis and off-axis EIRP requirements based on Regulations.**  **Proposal5: RAN4 should specify on-axis and off-axis spurious requirements.**  **Proposal6: RAN4 should specify power flux density requirements for mobile type of NTN satellite UE , and more specifically for ESIM-A and ESIM-M based on Regulations.**  **Proposal7: RAN4 should further discuss if (and eventually how) those additional requirements (off-axis EIRP density limits self-monitoring) should be captured in RAN4 RF specifications.** |
| [**R4-2308578**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308578.zip) | Huawei, HiSilicon | Discussion on Ka band NTN UE  **Observation 1: mobile and fixed NTN UEs belong to two different services referring to ITU radio regulations.**  **Observation 2: The allocated frequency range for mobile and fixed satellite service are different from regulations’ perspective.**  **Proposal 1: it’s necessary to design some mechanisms to distinguish mobile and fixed NTN UEs. At least, RAN4 need to specify two sets of frequency range requirements for fixed and mobile NTN UEs respectively.**  **Observation 3: referring to WRC-19 agreements, frequency bands 17.7‑19.7 GHz (space-to-Earth) and 27.5-29.5 GHz (Earth-to-space) can be used by the three types of ESIM communicating with geostationary (GSO) space stations in the fixed-satellite service (FSS).**  **Observation 4: In ECC Decision (13)01, the purpose of this ECC Decision is to harmonise the use and allow the free circulation and exemption from individual licensing of ESOMPs of geostationary satellite networks operating within the frequency bands 17.3~20.2 GHz (receive band) and 27.5~30 GHz (transmit band).**  **Proposal 2: it’s necessary to design some mechanisms to distinguish mobile and fixed NTN UEs, since some regulations only allow mobile NTN UEs to operate in FSS frequency range with geostationary satellite networks.**  **Observation 5:** **The NF is not given by the LNA alone, but also by bandwidth, linearity and dynamic range dependencies as there is a delicate balance which should be considered when future requirements are specified.**  **Observation 6: A full RF receiver chain all the way up to radiating elements should be addressed as all parts in the chain would contribute to the overall receiver performance including switch (for TDD), routing and filter losses, etc.**  **Observation 7: For some compact and highly integrated building practices with many transceivers and antennas, the power efficiency and heat dissipation in small area/volume is necessary needs to be considered.**  **Observation 8: Referring to ETSI TR 101 854, the typical noise figure in frequency range 18 – 23GHz is 6 dB.**  **Proposal 3:** **When NTN UE Rx requirements are discussed, at least RAN4 need to assume noise figure as 6 dB considering the outcomes in 7~24GHz SI, ETSI TR 101 854 and IEEE published papers.** |
| [**R4-2308784**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308784.zip) | Samsung | Discussions on NTN UE RF   |  |  |  |  | | --- | --- | --- | --- | | **SAN** | **UE** | **Related ITU-R recommendations and regulations:** | **Possible impact on RAN4 requirements** | | GSO | Fixed VSAT | Recommendations:  ITU‑R S.524: off-axis eirp limit  ITU‑R S.1594: Maximum emission level. | 1. Output power requirement 2. Antenna characteristics:  * parabolic antenna size, efficiency, etc; * phased array: element configuration, beamforming characteristics, etc. | | Airborne VSAT (Aero-ESIM) | *Resolves* in **Resolution 156** for ESIM in FSS in 29.5-30GHz band  1.1 with respect to satellite networks of other administrations, the earth station shall remain within the envelope of the coordination agreements of the satellite networks with which this earth station is associated or, in the absence of such agreements, comply with the off-axis e.i.r.p. density levels given in the Annex;  1.4 in case of interference, the administration responsible for the satellite network shall, upon receipt of a report of harmful interference with respect to any terrestrial systems operating in the countries listed in No. 5.542, immediately cease or reduce the interference to the acceptable level;  1.6 that these earth stations be subject to permanent monitoring and control by a Network Control and Monitoring Centre (NCMC) or equivalent facility and be capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NCMC;  *Resolves* in **Resolution 169** for ESIM in FSS in 27.5~29.5GHz  1.1.6 for the protection of non-GSO FSS systems operating in the frequency band 27.5‑28.6 GHz, ESIMs communicating with GSO FSS networks shall comply with the provisions contained in Annex 1 to this Resolution;  1.1.7 for the protection of non-GSO MSS feeder links of non-GSO systems for which complete coordination information was received before, and for which feeder-link earth stations were in service as of, 28 October 2019 in the frequency band 29.1-29.5 GHz, ESIMs communicating with GSO FSS networks should consider Annex 2 to this Resolution;  1.2.2 transmitting aeronautical and maritime ESIMs in the frequency band 27.5-29.5 GHz shall not cause unacceptable interference to terrestrial services to which the frequency band is allocated and operating in accordance with the Radio Regulations, and Annex 3 to this Resolution shall apply;  5.1 for the operation of ESIMs, techniques to maintain pointing accuracy with the associated GSO FSS satellite, without inadvertently tracking adjacent GSO satellites, are employed;  5.2 all necessary measures are taken so that ESIMs are subject to permanent monitoring and control by a network control and monitoring centre (NCMC) or equivalent facility in order to comply with the provisions in this Resolution, and are capable of receiving and acting upon at least “enable transmission” and “disable transmission” commands from the NCMC or equivalent facility; | **Resolution 156**:  *Resolves* 1.1 off-axis e.i.r.p. may impact:   1. Output power requirement 2. Antenna characteristics:  * parabolic antenna size, efficiency, etc; * phased array: element configuration, beamforming characteristics, etc.   *Resolves* 1.4, 1.6 may impact:   1. Uplink power control   **Resolution 169**:  *Resolves* 1.1.6 leads to off-axis e.i.r.p may impact:   1. Output power requirement 2. Antenna characteristics:  * parabolic antenna size, efficiency, etc; * phased array: element configuration, beamforming characteristics, etc.   *Resolves* 1.1.7 leads to e.i.r.p. density limit, off-axis e.i.r.p. mask, carrier burst duty cycle, and number of transmitting ESIMs in a single satellite beam in 15MHz channel, these may impact:   1. Uplink scheduling and channel allocation; 2. Output power requirement; 3. Antenna characteristics:  * parabolic antenna size, efficiency, etc; * phased array: element configuration, beamforming characteristics, etc.   *Resolves* 1.2.2 leads to horizontal e.i.r.p. limit, power flux density (pfd) limit on earth surface, and these may impact:   1. Elevation angle requirement; 2. Output power requirement; 3. Antenna characteristics:  * parabolic antenna size, efficiency, etc; * phased array: element configuration, beamforming characteristics, etc. |   **Proposal 1**: RAN4 to discuss whether and how to categorize UE with above information in terms of regulation, possible impact on RAN4 spec can be power limit, off-axis pattern, tracking accuracy, schemes for uplink transmission, like cease transmission when tracking failed, or reported interference, etc.  **Observation 2**: For the parabolic antenna, the mechanical scanning of the beam will not impact the antenna or beam pattern, it will only shift the antenna pattern to the mechanical-tilted directions.  **Observation 3**: For phased-array antenna, after electrical tilting, the off-axis eirp will exceed the S-524 mask because of the sidelobe distortion due to phased-shift nature of the AAS antenna. In this case, in order to meet S-524 off-axis eirp mask, the NTN UE power had to be reduced to lower its side lobe.  **Proposal 2**: RAN4 to discuss whether or how to build requirements for NTN UE with phased array antenna operation to guarantee its compliance to the off-axis eirp mask.   * The output power limit may be reduced when the phased array antenna perform electronical tilting to point its beam to the desired SAN. * If use same power level, the NTN UE with phased array may also required to perform some mechanical rotation for its antenna to reduce the electrical tilting range, and to reduce the effect of the side lobe distortion. * If mechanical rotation is required for both phased array and parabolic antenna NTN UE, discuss whether or how to define requirements for the rotation speed and accuracy.   **Observation 4**: The NTN UE, especially those mobile VSAT (Land, maritime, aeroplane ESIM), may operate with turbulence circumstances. Under such situations, the NTN UE may point towards an undesired direction which may cause issue. In order to protect satellite in other orbits, power reduction or fast electronical or mechanical beam adjustment may be requested for NTN UE.  **Proposal 3**: RAN4 to discuss whether or how to build requirements for tracking accuracy to guarantee its compliance during turbulence circumstances, and how fast should it adjust its beam back to desired direction.  **Observation 5**: When received interference report, the mobile VSAT (Land, maritime, aeroplane ESIM) is required to perform interference mitigation or stop transmission.  **Proposal 4**: RAN4 to discuss whether or how to build requirements for interference mitigation, for example to update closed-loop power control based on the interference reporting. |
| [**R4-2309053**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309053.zip) | Apple | On DMRS bundling with doppler pre-compensation for NTN  Proposal 1: RAN4 should further discuss the applicability of the DMRS bundling feature to Rel-18 NTN and determine whether additional NTN-specific side conditions are needed.  Observation 1: RAN4 should update the TA side condition of the maximum allowable phase difference for DMRS bundling requirement to align with the timing pre-compensation procedure used in NTN networks.  Observation 2: RAN4 should determine whether additional side conditions on the maximum DMRS bundling length and/or RB allocations are needed for the requirement on the maximum allowable phase difference for DMRS bundling in NTN operation.  Observation 3: It is expected that the values of the maximum allowable phase difference for DMRS bundling captured in Table 6.4.2.5-1 of TS38.101-1 will remain applicable for NTN. |
| [**R4-2309183**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309183.zip) | ZTE Corporation | Further discussion on UE RF requirements for NTN in Ka-band  **Proposal 1**: to consider the Off-axis and On-axis EIRP and spurious emission requirement in EN 303 978 and 303 979.  **Proposal 2**: for EIRP of NTN VSAT, propose to use the declaration approach and FFS of any signalling to network.  **Proposal 3**: propose not to consider the spherical coverage requirement for NTN VSAT and no requirement for maximum output power if there are no existing regulation limits. |
| [**R4-2309381**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309381.zip) | Verizon Denmark | Coexistence and off-Axis EIRP requirements for NTN-TN NR-Uu interface  **Proposal-1: ESIM operations cannot exceed the -13 dBm/MHz emission limit required for the band n511.**  **Proposal-2: RAN4 shall define the off-axis EIRP density requirement for both SAN and ESIM type of devices and shall meet the specified envelopes**  **Proposal-3: The off-axis EIRP requirements shall be applied to the ESIM devices operating over the band n511.**  **Proposal-4: The detailed baseline requirements can be based on either FCC order or ITU recommendation S.524.**  **Proposal-5: ESIM device shall be able to perform self-monitoring and be capable of automatically ceasing or reducing emissions based on the specified regulatory procedures** |
| [**R4-2309508**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip) | Qualcomm Incorporated | Ka band UE noise figure and reference sensitivity  **Proposal 1: Noise figure assumption is 6.2 dB for the Ka band UE.**  **Proposal 2: Consider and further discuss beam peak EIS reference sensitivity as follows for GSO receiver**   |  |  |  |  | | --- | --- | --- | --- | | 50 MHz | 100 MHz | 200 MHz | 400 MHz | | -125.5 dBm | -122.5 dBm | -119.5 dBm | -116.5 dBm |   **Proposal 3: Discuss the following options**  **Option 1: The reference sensitivity for the NGSO receiver can be relaxed compared to GSO.**  **Option 2: The same reference sensitivity applies to both NGSO and GSO UE receivers.** |
| [**R4-2309509**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309509.zip) | Qualcomm Incorporated | More on FR2 NTN UE reference architectures  **Proposal 1: For the NTN UE supporting LEO, the reference architecture includes a phased array antenna. For the NTN UE supporting GEO, the reference architecture includes a parabolic antenna. For the NTN UE supporting both LEO and GEO, the reference architecture includes both a parabolic and a phased array antenna.**  **Proposal 2: For the reference architecture with parabolic antenna only, assume two parabolic antennas are available each aimed at different satellites.**  **Proposal 3: For the phased array antenna, the baseline assumption is only a single beam can be formed in one direction at any instant in time.**  **Proposal 4: A more advanced UE with phased array capable of two simultaneous beams should be further discussed as there are some challenges to be addressed. For the sake of expediency of the standardization work, it is proposed to focus only on the baseline ability to form only a single beam at any given instant in time.** |
| [**R4-2309717**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip) | THALES | Updates for NTN UE terminal requirements discussion in above 10 GHz  **Proposal 1:** Do not separate Parabolic/Dish antenna or Phased-Array antenna in different NTN UE-types definitions.RAN4 to consider **Parabolic/Dish antenna or Phased-Array antenna** in a single common NTN UE-type definition for above 10 GHz, since similar performance characteristics.  **Proposal 2: [Option 1]** RAN4 to use the following NTN UE parameters:  Table 1. NTN UE Parameters   |  |  |  |  | | --- | --- | --- | --- | | **NTN UE Parameters** |  | **Tx (Uplink)** | **Rx (Downlink)** | | Polarisation |  | Circular | Circular | | Low Frequency | (MHz) | 27 500 | 17 700 | | Centre frequency |  | 28 750 | 18 950 | | High frequency |  | 30 000 | 20 200 | | Efficiency |  | 60% | 57% | | On-axis antenna gain at Fc | (dBi) | 42,9 | 39,0 | | Output power at antenna input | (W) | 2 |  | | Output power at antenna input | (dBW) | 3,0 |  | | Output loss | (dB) | -1,0 |  | | Peak EIRP (on-axis) |  | **44,9** |  | | Receiver noise figure | (dB) |  | 1,2 | | Feeder loss | (dB) |  | -0,50 | | Sky temperature | (K) |  | 30 | | Ground temperature | (K) |  | 10 | | Antenna temperature | (K) |  | 40 | | G/T figure of merit | (dB/K) |  | **16,5** |   NOTE1: T\_a = T\_Sky + T\_Ground  NOTE2: The antenna temperatures are based on e.g. ITU-R Rec. P372 and Rec. P618.  NOTE3: T\_sky is computed using [ITU-R Rec. P.618-13] as expressed below   |  | | --- | | **3 Noise temperature**  As attenuation increases, so does emission noise. For earth stations with low-noise front-ends, this increase of noise temperature may have a greater impact on the resulting signal-to-noise ratio than the attenuation itself.  The sky noise temperature at a ground station antenna may be estimated by:  *Tsky* = *Tmr* (1 – 10–*A*/10) + 2.7 × 10–*A*/10 K (63)  where:  *Tsky* : sky noise temperature (K) at the ground station antenna  *A* : total atmospheric attenuation excluding scintillation fading (dB)  *Tmr*: atmospheric mean radiating temperature (K). |   **Proposal 3: [Option 2]** RAN4 to use the following NTN UE parameters:  Table 2. NTN UE Parameters   |  |  |  |  | | --- | --- | --- | --- | | **NTN UE Parameters** |  | **Tx (Uplink)** | **Rx (Downlink)** | | Polarisation |  | Circular | Circular | | Low Frequency | (MHz) | 27 500 | 17 700 | | Centre frequency |  | 28 750 | 18 950 | | High frequency |  | 30 000 | 20 200 | | Efficiency |  | 60% | 57% | | On-axis antenna gain at Fc | (dBi) | **42,9** | **39,0** | | Output power at antenna input | (W) | 2 |  | | Output power at antenna input | (dBW) | 3,0 |  | | Output loss | (dB) | -1,0 |  | | Peak EIRP (on-axis) |  | **44,9** |  | | Equivalent Receiver Noise Figure | (dB) |  | **2,1** | | Feeder loss | (dB) |  | -0,50 |   **Proposal 4 (resubmitted since agreed WF R4-2306624 indicates “tentative agreement”):** It is assumed for the NTN capable UE operating in above 10 GHz that the (Rx and Tx) beam pointing error are compliant with the relevant ETSI harmonized standard, e.g.:   * EN 303 978, “Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in geostationary orbit, operating in the 27,5 GHz to 30,0 GHz frequency bands”; * EN 303 979, “Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in non-geostationary orbit, operating in the 27,5 GHz to 29,1 GHz and 29,5 GHz to 30,0 GHz frequency bands”.   **Proposal 5:** RAN4 shall specify a generalized NTN UE terminal reference architecture for above 10 GHz as follows (the details can be left for implementation):    **Note 1:** The Up-Converter and the Tx Power Amplifier are part of the Transmission chain.  **Note 2:** The Rx LNA (Low-Noise Amplifier) and the Down-Converter are part of the Reception chain.  **Note 3:** RF represents the Radio Frequency region and IF the Intermediate Frequency region.  **Note 4:** DP is the Duplexer and ACU is the Antenna Control Unit.  **Proposal 6:** NTN UE beam steering, NTN UE beam switching capabilities, NTN UE beam switching granularity, NTN UE beam tracking capability or satellite beam tracking capability, etc. shall be left for implementation (and not part of 3GPP requirements).  **Proposal 7:** NTN UE beam steering, NTN UE beam switching capabilities, NTN UE beam switching granularity, NTN UE beam tracking capability or satellite beam tracking capability, etc. can be considered for implementation for example based on -3 dB NTN UE beam width and satellite constellation parameters (e.g. satellite orbit and velocity).  **Proposal 8:** RAN4 should specify an optional method for the NTN UE or the Network to disable NTN UE UL transmission if and when required.  **Proposal 9:** NTN UE power can be used to differentiate different types of NTN UE depending on the deployment scenario (e.g. land, vessel, aircraft, etc) in concordance with regulatory requirements. However, in order to simplify the normalisation of NTN UE above 10 GHz, only one single NTN UE power class could be specified in Rel-18.  **Proposal 10:** For NTN UE in Ka-band, RAN4 to use/cite/reference ITU recommendation S.524 for radiated off-axis requirement.  **Proposal 11: Further consider the following table for discussion in RAN4**: [this should be RRM discussion]   |  |  |  | | --- | --- | --- | | **Question** | **Initial Working Hypothesis** | **Feedback from Companies** | | Should HO aspects in Ka-band be considered for Rel-18? | **Yes.** Preference for considering HO aspects in Ka-band for Rel-18. | Company X:  Company Y:  Company Z: | | Which is the (minimum) number of satellites to which a VSAT/NTN UE will connect in Ka-band? | **At least 2 satellites in Rel-18.** It is further assumed:  - UE is capable of forming 1 single beam only at any given instant of time (regardless of antenna system implementation).  - At least two cases should be identified based on single-beam re-pointing time between satellites  - The following example cases are considered:  A) 1 mechanically-steered UE beam;  B) 1 electronically-steered UE beam. | Company X:  Company Y:  Company Z: | | Which is the maximum (recommended) interruption time (switching time) between 2 consecutive satellites during HO procedure? | **Preference for seamless HO.** At physical layer, an interruption of ~20-40ms may be acceptable. No packet loss is expected.    TBD | Company X:  Company Y:  Company Z: | | Any view for the initial Satellite search time requirement of the NTN UE? | **Implementation issue not 3GPP related.**    TBD | Company X:  Company Y:  Company Z: | | Any view of the tracking accuracy? | **Implementation issue** based on regulatory requirement (see e.g. EN 303 978 and EN 303 979).    TBD | Company X:  Company Y:  Company Z: | | Other | TBD | Company X:  Company Y:  Company Z: |   **Proposal 12:** HandOver aspects in Ka-band shall be considered for Rel-18 as working hypothesis. [this should be RRM discussion]  **Proposal 13:** RAN4 shall consider at least 2 satellites (as working hypothesis) for NTN UE HandOver procedures in Ka-band. [this should be RRM discussion]  **Proposal 14:** Seamless HandOver shall be considered as working hypothesis by RAN4 for NTN UE in above 10 GHz. [this should be RRM discussion]  **Proposal 15:** Initial satellite search time can be considered as implementation issue by RAN4 (no requirement for initial satellite search time shall be specifically considered by RAN4).[this should be RRM discussion]  **Proposal 16:** Tracking accuracy can be considered as implementation issue by RAN4 based on regulatory requirement (relevant regulatory requirement will be referenced in the NTN UE TS, however no requirement for tracking accuracy will be specifically designed by RAN4). |

## 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 UE types and antenna assumption for NTN UE

*Sub-topic description:\*

**Issue 1-1: Differentiate UE types from mobility perspective**

* + Proposal 1:  [FR2-NTN UEs shall be separated into Fixed and Mobile types](#_Toc134562025) [Nokia,[R4-2307319](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307319.zip)]
  + Proposal 2: As starting point, based on the analysis of the regulations, RAN4 shall consider at least 2 types of NTN satellite UE above 10 GHz: one type for NTN mobile device and another type for NTN fixed device. [Ericsson,[R4-2308538](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308538.zip)]
  + Proposal 3: it’s necessary to design some mechanisms to distinguish mobile and fixed NTN UEs. At least, RAN4 need to specify two sets of frequency range requirements for fixed and mobile NTN UEs respectively. [Huawei,[R4-2308578](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308578.zip)]
  + Proposal 2: it’s necessary to design some mechanisms to distinguish mobile and fixed NTN UEs, since some regulations only allow mobile NTN UEs to operate in FSS frequency range with geostationary satellite networks. [Huawei,[R4-2308578](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308578.zip)]
* Recommended for GTW discussion:
  + Companies’ views are encouraged during the meeting.

**Issue 1-2: Differentiate antenna assumption for GEO and LEO UE**

* Proposal :
  + Proposal 1: Do not separate Parabolic/Dish antenna or Phased-Array antenna in different NTN UE-types definitions. RAN4 to consider Parabolic/Dish antenna or Phased-Array antenna in a single common NTN UE-type definition for above 10 GHz, since similar performance characteristics. [THALES,[R4-2309717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip)]
  + Proposal 2: For the NTN UE supporting LEO, the reference architecture includes a phased array antenna. For the NTN UE supporting GEO, the reference architecture includes a parabolic antenna. For the NTN UE supporting both LEO and GEO, the reference architecture includes both a parabolic and a phased array antenna. [Qualcomm ,[R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
  + Proposal 3: For the reference architecture with parabolic antenna only, assume two parabolic antennas are available each aimed at different satellites. [Qualcomm ,[R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
  + Proposal 4: For the phased array antenna, the baseline assumption is only a single beam can be formed in one direction at any instant in time. [Qualcomm ,[R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
  + Proposal 5: A more advanced UE with phased array capable of two simultaneous beams should be further discussed as there are some challenges to be addressed. For the sake of expediency of the standardization work, it is proposed to focus only on the baseline ability to form only a single beam at any given instant in time. [Qualcomm ,[R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
* Recommended for GTW discussion:
  + Companies’ views are encouraged during the meeting.

**Issue 1-3: Differentiate UE types from RF requirement perspective**

* + Proposal 1: RAN4 to discuss whether and how to categorize UE with above information in terms of regulation, possible impact on RAN4 spec can be power limit, off-axis pattern, tracking accuracy, schemes for uplink transmission, like cease transmission when tracking failed, or reported interference, etc. [Samsung,[R4-2308784](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308784.zip)]
  + Proposal 2: NTN UE power can be used to differentiate different types of NTN UE depending on the deployment scenario (e.g. land, vessel, aircraft, etc) in concordance with regulatory requirements. However, in order to simplify the normalisation of NTN UE above 10 GHz, only one single NTN UE power class could be specified in Rel-18. [THALES,[R4-2309717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip)]
* Recommended for GTW discussion:
  + Companies’ views are encouraged during the meeting.

### Sub-topic 2 Noise figure for NTN UE

*Sub-topic description:*

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

**Issue 2-1: Noise figure**

* Proposals
  + Proposal 1: When NTN UE Rx requirements are discussed, at least RAN4 need to assume noise figure as 6 dB considering the outcomes in 7~24GHz SI, ETSI TR 101 854 and IEEE published papers.[Huawei,[R4-2308578](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308578.zip)]
  + Proposal 2: Noise figure assumption is 6.2 dB for the Ka band UE. [Qualcomm, [R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
  + Proposal 3: Consider and further discuss beam peak EIS reference sensitivity as follows for GSO receiver [Qualcomm, [R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]

|  |  |  |  |
| --- | --- | --- | --- |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| -125.5 dBm | -122.5 dBm | -119.5 dBm | -116.5 dBm |

* + Proposal 4: Discuss the following options [Qualcomm, [R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
* Option 1: The reference sensitivity for the NGSO receiver can be relaxed compared to GSO.
* Option 2: The same reference sensitivity applies to both NGSO and GSO UE receivers.
  + Proposal 5: [Option 1] RAN4 to use the following NTN UE parameters: [THALES,[R4-2309717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip)]

Table 1. NTN UE Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **NTN UE Parameters** |  | **Tx (Uplink)** | **Rx (Downlink)** |
| Polarisation |  | Circular | Circular |
| Low Frequency | (MHz) | 27 500 | 17 700 |
| Centre frequency |  | 28 750 | 18 950 |
| High frequency |  | 30 000 | 20 200 |
| Efficiency |  | 60% | 57% |
| On-axis antenna gain at Fc | (dBi) | 42,9 | 39,0 |
| Output power at antenna input | (W) | 2 |  |
| Output power at antenna input | (dBW) | 3,0 |  |
| Output loss | (dB) | -1,0 |  |
| Peak EIRP (on-axis) |  | **44,9** |  |
| Receiver noise figure | (dB) |  | 1,2 |
| Feeder loss | (dB) |  | -0,50 |
| Sky temperature | (K) |  | 30 |
| Ground temperature | (K) |  | 10 |
| Antenna temperature | (K) |  | 40 |
| G/T figure of merit | (dB/K) |  | **16,5** |

NOTE1: T\_a = T\_Sky + T\_Ground

NOTE2: The antenna temperatures are based on e.g. ITU-R Rec. P372 and Rec. P618.

NOTE3: T\_sky is computed using [ITU-R Rec. P.618-13] as expressed below

|  |
| --- |
| **3 Noise temperature**  As attenuation increases, so does emission noise. For earth stations with low-noise front-ends, this increase of noise temperature may have a greater impact on the resulting signal-to-noise ratio than the attenuation itself.  The sky noise temperature at a ground station antenna may be estimated by:  *Tsky* = *Tmr* (1 – 10–*A*/10) + 2.7 × 10–*A*/10 K (63)  where:  *Tsky* : sky noise temperature (K) at the ground station antenna  *A* : total atmospheric attenuation excluding scintillation fading (dB)  *Tmr*: atmospheric mean radiating temperature (K). |

* + Proposal 6: [Option 2] RAN4 to use the following NTN UE parameters: [THALES,[R4-2309717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip)]

Table 2. NTN UE Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **NTN UE Parameters** |  | **Tx (Uplink)** | **Rx (Downlink)** |
| Polarisation |  | Circular | Circular |
| Low Frequency | (MHz) | 27 500 | 17 700 |
| Centre frequency |  | 28 750 | 18 950 |
| High frequency |  | 30 000 | 20 200 |
| Efficiency |  | 60% | 57% |
| On-axis antenna gain at Fc | (dBi) | **42,9** | **39,0** |
| Output power at antenna input | (W) | 2 |  |
| Output power at antenna input | (dBW) | 3,0 |  |
| Output loss | (dB) | -1,0 |  |
| Peak EIRP (on-axis) |  | **44,9** |  |
| Equivalent Receiver Noise Figure | (dB) |  | **2,1** |
| Feeder loss | (dB) |  | -0,50 |

* Recommended for GTW discussion:
  + Companies’ views are encouraged during the meeting.

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### Sub-topic 3 RF requirements for NTN UE in Ka-band

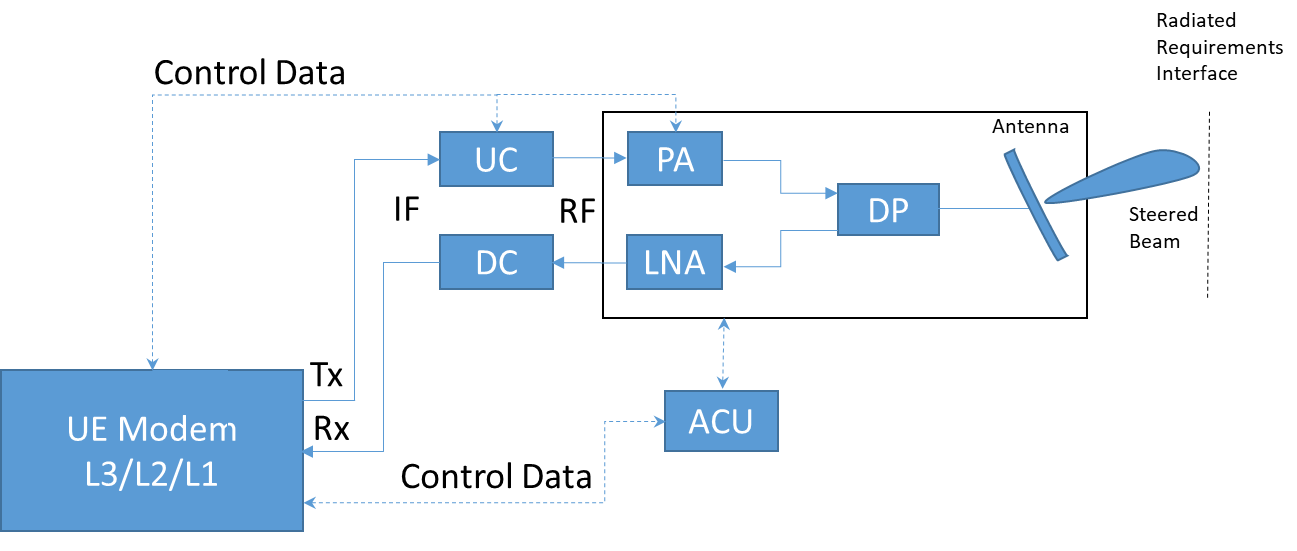
*Sub-topic description:*

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

*Agreement reached in last RAN4#105 meeting.*

**Issue 3-1: NTN UE reference architecture for above 10GHz**

* Proposals
  + Proposal 1: RAN4 shall specify a generalized NTN UE terminal reference architecture for above 10 GHz as follows (the details can be left for implementation): [THALES,[R4-2309717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip) ]



**Note 1:** The Up-Converter and the Tx Power Amplifier are part of the Transmission chain.

**Note 2:** The Rx LNA (Low-Noise Amplifier) and the Down-Converter are part of the Reception chain.

**Note 3:** RF represents the Radio Frequency region and IF the Intermediate Frequency region.

**Note 4:** DP is the Duplexer and ACU is the Antenna Control Unit.

* + Proposal 3: For the NTN UE supporting LEO, the reference architecture includes a phased array antenna. For the NTN UE supporting GEO, the reference architecture includes a parabolic antenna. For the NTN UE supporting both LEO and GEO, the reference architecture includes both a parabolic and a phased array antenna. [Qualcomm ,[R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
  + Proposal 4: For the reference architecture with parabolic antenna only, assume two parabolic antennas are available each aimed at different satellites. [Qualcomm ,[R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
  + Proposal 5: For the phased array antenna, the baseline assumption is only a single beam can be formed in one direction at any instant in time. [Qualcomm ,[R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
  + Proposal 6: A more advanced UE with phased array capable of two simultaneous beams should be further discussed as there are some challenges to be addressed. For the sake of expediency of the standardization work, it is proposed to focus only on the baseline ability to form only a single beam at any given instant in time. [Qualcomm ,[R4-2309508](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309508.zip)]
* Recommended for GTW discussion
  + Companies’ views are encouraged during the meeting.
  + From moderator’s view, this is informative and don’t need any further agreement on it.

**Issue 3-2: Beam pointing/accuracy related requirements**

* Proposals
  + Proposal 1: RAN4 should specify antenna pointing stability and accuracy requirements for fixed type of NTN satellite UE. [Ericsson,[R4-2308538](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308538.zip)]
  + Proposal 2: RAN4 should specify antenna pointing accuracy requirement for mobile type of NTN satellite UE (ESIM). [Ericsson,[R4-2308538](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308538.zip)]
  + Proposal 3: RAN4 to discuss whether or how to build requirements for tracking accuracy to guarantee its compliance during turbulence circumstances, and how fast should it adjust its beam back to desired direction. [Samsung,[R4-2308784](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308784.zip)]
  + Proposal 4 (resubmitted since agreed WF R4-2306624 indicates “tentative agreement”): It is assumed for the NTN capable UE operating in above 10 GHz that the (Rx and Tx) beam pointing error are compliant with the relevant ETSI harmonized standard, e.g.: [THALES,[R4-2309717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip)]
* EN 303 978, “Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in geostationary orbit, operating in the 27,5 GHz to 30,0 GHz frequency bands”;
* EN 303 979, “Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in non-geostationary orbit, operating in the 27,5 GHz to 29,1 GHz and 29,5 GHz to 30,0 GHz frequency bands”.
  + Proposal 5: Tracking accuracy can be considered as implementation issue by RAN4 based on regulatory requirement (relevant regulatory requirement will be referenced in the NTN UE TS, however no requirement for tracking accuracy will be specifically designed by RAN4). [THALES,[R4-2309717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip) ]
* Recommended for GTW discussion
  + Companies’ views are encouraged during the meeting.

**Issue 3-3: on-axis and off-axis EIRP requirements**

* Proposals
  + Proposal 1: RAN4 should specify on-axis and off-axis EIRP requirements based on Regulations. [Ericsson,[R4-2308538](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308538.zip)]
  + Proposal 2: RAN4 to discuss whether or how to build requirements for NTN UE with phased array antenna operation to guarantee its compliance to the off-axis eirp mask. [Samsung,[R4-2308784](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308784.zip)]
* The output power limit may be reduced when the phased array antenna perform electronical tilting to point its beam to the desired SAN.
* If use same power level, the NTN UE with phased array may also required to perform some mechanical rotation for its antenna to reduce the electrical tilting range, and to reduce the effect of the side lobe distortion.
* If mechanical rotation is required for both phased array and parabolic antenna NTN UE, discuss whether or how to define requirements for the rotation speed and accuracy.
  + Proposal 3: For NTN UE in Ka-band, RAN4 to use/cite/reference ITU recommendation S.524 for radiated off-axis requirement.[THALES,[R4-2309717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip) ]
  + Proposal 4: to consider the Off-axis and On-axis EIRP and spurious emission requirement in EN 303 978 and 303 979. [ZTE,[R4-2309183](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309183.zip)]
  + Proposal 5: RAN4 shall define the off-axis EIRP density requirement for both SAN and ESIM type of devices and shall meet the specified envelopes [Verizon,[R4-2309381](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309381.zip)]
  + Proposal 6: The off-axis EIRP requirements shall be applied to the ESIM devices operating over the band n511. [Verizon,[R4-2309381](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309381.zip)]
  + Proposal 7: The detailed baseline requirements can be based on either FCC order or ITU recommendation S.524. [Verizon,[R4-2309381](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309381.zip)]
* Recommend
  + Companies’ views are encouraged during the meeting.

**Issue 3-4: on-axis and off-axis spurious requirements.**

* Proposals
  + Proposal 1: RAN4 should specify on-axis and off-axis spurious requirements. [Ericsson,[R4-2308538](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308538.zip)]
  + Proposal 2: ESIM operations cannot exceed the -13 dBm/MHz emission limit required for the band n511. [Verizon,[R4-2309381](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309381.zip)]
* Recommend
  + Companies’ views are encouraged during the meeting.

**Issue 3-5: Power Flux density for NTN UE**

* Proposals
  + Proposal 1: RAN4 should specify power flux density requirements for mobile type of NTN satellite UE , and more specifically for ESIM-A and ESIM-M based on Regulations. [Ericsson,[R4-2308538](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308538.zip)].
* Recommend
  + Companies’ views are encouraged during the meeting.

**Issue 3-6: off-axis EIRP density limits related self-monitoring**

* Proposals
* [Proposal 1: RAN4 shall discuss how the Network Signalling (NS) framework can be extended to cover the needed aspects for NTN operation and if UE autonomous behavior needs to be specified.](#_Toc134562027) [Nokia, [R4-2307319](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307319.zip)]
* Proposal 2: RAN4 should further discuss if (and eventually how) those additional requirements (off-axis EIRP density limits self-monitoring) should be captured in RAN4 RF specifications. [Ericsson,[R4-2308538](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308538.zip)].
* Proposal 3: RAN4 to discuss whether or how to build requirements for interference mitigation, for example to update closed-loop power control based on the interference reporting. [Samsung,[R4-2308784](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308784.zip)]
  + Proposal 4: ESIM device shall be able to perform self-monitoring and be capable of automatically ceasing or reducing emissions based on the specified regulatory procedures [Verizon,[R4-2309381](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309381.zip)]
  + Proposal 5: RAN4 should specify an optional method for the NTN UE or the Network to disable NTN UE UL transmission if and when required. [THALES,[R4-2309717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309717.zip) ]
* Recommend
  + Companies’ views are encouraged during the meeting.

**Issue 3-7: Others**

* Proposals
  + Proposal 1: for EIRP of NTN VSAT, propose to use the declaration approach and FFS of any signalling to network. [ZTE,[R4-2309183](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309183.zip)]
  + Proposal 2: propose not to consider the spherical coverage requirement for NTN VSAT and no requirement for maximum output power if there are no existing regulation limits. [ZTE,[R4-2309183](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309183.zip)]
  + Proposal 3: propose not to consider the spherical coverage requirement for NTN VSAT and no requirement for maximum output power if there are no existing regulation limits. [ZTE,[R4-2309183](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309183.zip)]
  + Proposal 4: If mechanical rotation is required for both phased array and parabolic antenna NTN UE, discuss whether or how to define requirements for the rotation speed and accuracy.

**Table 1. Summary of related UE RF requirement**

|  |  |  |
| --- | --- | --- |
|  | **Band-specific or not** | **Applicability** |
| **Transmitter Characteristics** |  |  |
| General | No | To follow the existing text from TN UE in TS 38.101-2 |
| Tx power | Yes | Please see the above analysis |
| MPR | No | Since EIRP value is up to the vendor’s declaration, it is not necessary to define MPR requirement similar as IAB and ATG CPE. |
| A-MPR | Yes | Not necessary to define A-MPR requirement for it similar as MPR. |
| Configured Tx power | No | Not necessary to define configured Tx power requirement since all values in equation would be up to declaration at the end. |
| Output Power Dynamics | No | The minimum output power for NTN VSAT, this could be further discussed.  Transmitter OFF power and ON-OFF time mask and power control related parameter in TS 38.101-1/2 could be good starting point. |
| Transmit signal quality |  |  |
| - Frequency error | No | to follow the requirement defined in TS38.101-5 where UE UL pre-compensation is still needed. |
| - Transmit modulation quality | No | To follow the existing requirement defined for TS 38.101-2, however the maximum modulation order could be further discussed similar as Rel-17 NR over NTN  Carrier leakage and in-band emission are also power class specific requirement and this could be further discussed.  Carrier leakage and in-band emission requirement might be not necessary as Rel-16 FR2 IAB device. |
| Output RF spectrum emissions |  |  |
| - Occupied bandwidth | No | To follow the existing requirement defined for TS 38.101-1/2. |
| - Out of band emission |  |  |
| - SEM | No | This depends on the outcome of coexistence study. The following RF spectrum from FCC 47CFR25.138, 47CFR25.202 could further checked |
| - Additional SEM | Yes | additional requirement are expected for ITU resolution 169 in WRC-19 and [156] for WRC-15 |
| - ACLR | No | This depends on the outcome of coexistence study. |
| - Spurious emission |  |  |
| - General | No | To follow the existing requirement defined for TS 38.101-2. |
| - For UE coexistence | Yes | Coexistence requirement for the surrounding TN bands should be considered. |
| Transmit intermodulation | No | Not applicable similar as FR2 UE RF |
| Beam correspondence | No | Please see the above analysis |
| **Receiver characteristics** |  |  |
| General | No |  |
| Diversity characteristics | No |  |
| Reference sensitivity | Yes | For NTN VSAT, the following requirements should be defined for NTN VSAT UE.   * EIS on-axis up to the declaration |
| Maximum input level | No | Further system level evaluation is needed and this requirement might be relaxed similar as Rel-17 NR NTN. |
| ACS | No | This depends on the outcome of coexistence study. |
| Blocking characteristics |  |  |
| - In-band | No | This depends on the outcome of coexistence study. |
| - Out-of-band | NA | NA |
| - Narrow band | NA | NA |
| Spurious response | NA | NA. |
| Intermodulation | NA | NA |
| Spurious emissions | No | To follow the existing requirement defined for TS 38.101-1/2. |

### Sub-topic 4 Reply LS for DMRS bundling with doppler pre-compensation for NTN

**Issue 4-1: DMRS bound**

* Proposal :
  + Proposal 1: RAN4 should further discuss the applicability of the DMRS bundling feature to Rel-18 NTN and determine whether additional NTN-specific side conditions are needed. [Apple, [**R4-2309053**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309053.zip)]
  + Observation 1: RAN4 should update the TA side condition of the maximum allowable phase difference for DMRS bundling requirement to align with the timing pre-compensation procedure used in NTN networks. [Apple, [**R4-2309053**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309053.zip)]
  + Observation 2: RAN4 should determine whether additional side conditions on the maximum DMRS bundling length and/or RB allocations are needed for the requirement on the maximum allowable phase difference for DMRS bundling in NTN operation. [Apple, [**R4-2309053**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309053.zip)]
  + Observation 3: It is expected that the values of the maximum allowable phase difference for DMRS bundling captured in Table 6.4.2.5-1 of TS38.101-1 will remain applicable for NTN. [Apple, [**R4-2309053**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309053.zip)]
* Recommended for GTW discussion:
  + Companies’ views are encouraged during the meeting.

## Companies views’ collection for 1st round

### Open issues

Sub-topic 1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A |  |
| Company B |  |

Sub-topic 2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A |  |
| Company B |  |

Sub-topic 3

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A |  |
| Company B |  |

Sub-topic 4

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Company A |  |
| Company B |  |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **New Tdoc number** | **Title** | **Source** | **Comments** |
|  | WF on … | YYY |  |
|  | LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |  |

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

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** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

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

# Annex

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
|  |  |  |

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)