**3GPP TSG RAN meeting #100 RP-231563**

**Bengalore, India, Sept 11-15, 2023** *revised RP-230913*

## Status Report to TSG

**Title: Status report for WI NR NTN (Non-Terrestrial Networks) enhancements; rapporteur: Thales**

**Agenda item:** 9.3.2.7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **WI / SI Name** | Rel-18 NR NTN (Non-Terrestrial Networks) enhancements | | | | |
| included in this status report | Study Item:  No | Core part:  Yes | Performance part:  Yes | | Testing part:  No |
| **Acronym** | NR-NTN-enh | | | | |
| **Unique ID** | 941006 | | | | |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-231484 | | | | |
| **Target Completion Date**  **(indicate if changed)** | Study Item: | Core part: 12/2023 | Performance part: 06/2024 | Testing part: | |
| **Overall Completion level** | Study Item: | Core part:  Overall: 75%  RAN1: 100%  RAN2: 65%  RAN3: 65%  RAN4: 65% | Performance Part:  Overall: 0%  RAN4: 0% | Testing part: | |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

|  |  |  |
| --- | --- | --- |
| **Leading WG** | | RAN2 |
| **Rapporteur** | **Name** | Nicolas Chuberre |
| **Company** | Thales |
| **Email** | Nicolas.chuberre@thalesaleniaspace.com |

## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | No |

*If you answered No: Then please remove the Excel file from the zip file of this status report.*

*If you answered Yes: Then please fill out the attached Excel template to request a modification of the time budgets for your WI /SI. The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI. The basis are the endorsed time budgets of the last RAN meeting. Please highlight all changes of the values.  
 One time unit (TU) corresponds to ~ 2 hours in the meeting.  
 If this status report covers a WI with Core and Performance part, then please have one line for each in the attached Excel table.  
 Note: If no Excel table is attached, then this means no time budget change.*

## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

NOTE: Agreements and Open issues impacted cross-TSG aspects shall be explicitly highlighted

## 2.1 RAN1

#### 2.1.1 Agreements

* **RAN1#114 meeting, Toulouse, France, August 21st – 25th, 2023:**

**Observation**

There is potential RAN1 discussion on the following aspects to support the RAN4 work on NTN above 10 GHz:

* PRACH configuration
* UE autonomous timing advance in connection with transmit timing errors and their associated requirements.
* Timing issues, e.g. MAC-CE application time in case of VSAT antenna for NR over NTN
* Reference subcarrier spacing for FR2-NTN
* Potential specification impact

No RAN1 specification impact is foreseen on channel raster and synchronization raster for NTN above 10 GHz.

Agreement

The following response to Question 2 in RAN2 LS (R1-2304322) is agreed:

* To monitor target cell PDCCH for dynamic grant for initial UL transmission, RAN1 think that there is no case where multiple beams are indicated for RACH-less handover. In this case, UE doesn’t expect that multiple beams are indicated from NW.

Agreement

For pathloss measurement in case of dynamic scheduled initial PUSCH for RACH-less handover, the UE calculates using a RS resource from an SS/PBCH block with same SS/PBCH block index as the one the UE uses to monitor PDCCH scheduling dynamic UL grant for initial transmission.

Agreement

The following response to Question 3 in RAN2 LS (R1-2304322) is agreed:

* For the initial UL transmission scheduled by dynamic grant in RACH-less handover, RAN1 thinks that it follows the principle for power control for Msg3 (or MsgA) PUSCH as described in clause 7.1.1 in TS 38.213 except for pathloss determination. For pathloss determination, the UE uses a RS resource from an SS/PBCH block with same SS/PBCH block index as the one the UE uses to monitor PDCCH scheduling dynamic UL grant for initial transmission.
* RAN1 may continue further discussion on question 3.

Agreement

The draft LS in R1-2308567 is endorsed.

Final LS in R1-2308568.

Agreement

Endorse the draft LS content below:

**Question 2: If it is feasible to support soft satellite switching without PCI change?**

**Reply:**

Under the following conditions:

* UE is not required to connect to two satellites simultaneously during soft satellite switching.
* Interference avoidance/mitigation between two satellites may potentially be done by gNB implementation at least to ensure non-colliding SSB with same PCI at UE side.
* UE is provided with the information on new common TA, K\_mac, ephemeris and cell-specific K-offset are applied during resynchronization to new satellite.
* UE may be provided with the information if needed to detect the SSB of the new satellite for soft satellite switching.
* The same UE behavior may be applied for soft satellite switching and hard satellite switching

RAN1 concludes it is feasible for soft satellite switching without PCI change.

Agreement

The draft LS in R1-2308441 is endorsed.

Final LS in R1-2308566.

1. Coverage enhancement for NR NTN

Agreement

For NTN-specific PUSCH DMRS bundling,

* As UE capability report,
  + UE reports the max TDW size it can support by fulfilling the phase difference limit requirement.
    - Note: phase difference limit requirement is assumed to be at gNB receiver from RAN1 perspective.
    - Details, e.g., whether FG 30-4 is used without new FG or new FG is introduced, is discussed in UE feature session.
  + No consensus on whether to support Option 1d/1e/1f/1g.

Agreement

For NTN-specific PUSCH DMRS bundling, actual TDW is determined by the existing events and no additional event is defined.

**Conclusion**

For NTN-specific PUSCH DMRS bundling,

* For UE assistance information (i.e., report by signaling other than UE capability report),
  + No consensus on whether to support Option 2b/2c/2d

Agreement

The working assumption at the RAN1#112 meeting is superseded by the following agreement:

For PUCCH repetition for Msg4 HARQ-ACK,

* A RSRP threshold can be configured via SIB when the number of repetitions is configured by SIB.
  + If the RSRP threshold is configured,
    - UE capable of PUCCH repetition for Msg4 HARQ-ACK reports the capability of PUCCH repetition for Msg4 HARQ-ACK only if measured RSRP is lower than the configured RSRP threshold.
  + If the RSRP threshold is not configured,
    - UE capable of PUCCH repetition for Msg4 HARQ-ACK reports the capability of PUCCH repetition for Msg4 HARQ-ACK
  + Alt B: New RSRP threshold is introduced.
    - Note: the same value between the new RSRP threshold and the RSRP threshold for R17 Msg3 repetition can be configured by gNB implementation.
    - The range of RSRP threshold for PUCCH repetition for Msg4 HARQ-ACK is the same as the range of the RSRP threshold for R17 Msg3 repetition.
      * FFS signaling details, e.g. whether RSRP threshold for PUCCH repetition for Msg4 HARQ-ACK is signaled as a relative or absolute value
* Note: UE incapable of PUCCH repetition for Msg4 HARQ-ACK transmits neither repetition request nor capability report
* Note 2: RAN1 considers that there is no difference between “repetition request” and “capability report” in earlier RAN1 agreements

1. “Network verified UE location for NR NTN ”

Agreement

The legacy R17 definition of UE Rx-Tx time difference is adopted for NTN with an offset that is determined based on the following:

* UE reports the actual index difference between subframe j and subframe i
  + The uplink subframe j is closest in time to the DL subframe #i received from the TP
* The DL timing drift due to Doppler over the service link associated with the UE RX-TX time difference measurement period is reported

Agreement

Confirm the working assumption with the additional note below:

Working assumption

In NTN, gNB receive-transmit time difference calculated at uplink time synchronization reference point is reported to the LMF.

Note: This does not imply that the actual gNB receive-transmit time difference measurement is necessarily made at the uplink time synchronization reference point

**Conclusion**

No need to support common TA information report from UE to LMF with consideration that common TA information report from gNB has been agreed supported.

**Conclusion**

To resolve the mirror positions ambiguity for multi-RTT positioning, the following methods can be used without RAN1 specification impact from RAN1 perspective:

* by gNB or LMF implementation
* existing ECID method
* UL-AoA

Agreement

Ephemeris information for UE location verification, including accurate satellite position and velocity at the time of measurement, should be available at LMF.

Email discussions

#### 2.1.2 Remaining Open issues

Coverage enhancements: -

Network verified UE location: -

## 2.2 RAN2

#### 2.2.1 Agreements

The agreeable Work plan can be found in R2-2301344 R18 WI NR-NTN-enh work plan at RAN1, 2 and 3

* **RAN2#123 meeting, Toulouse, France, August 21st – 25th, 2023:**

Agreements:

1. define an optional without signalling UE capability to indicate the support of skipping neighbour cell measurements for TN neighbour cells in an area where there is no TN network coverage.

2. define an optional without signalling UE capability for location-based measurement initiation in Earth-moving cell for cell selection/reselection.

3. To define an optional without signalling UE capability for time-based measurement initiation in Earth-moving cell for cell selection/reselection.

4. RACH-less support is optional with UE capability signalling (RAN2 WA: this is a per band UE capability).

a) Coverage enhancements

Agreements:

1. RAN2 confirms that the request/capability of PUCCH repetition for Msg4 HARQ-ACK via Msg3 higher layer signaling is feasible (can rediscuss if we cannot converge on a specific solution).

b) Network verified UE location

Agreements:

1. A Rel-18 UE capability is needed for indicating whether UE supports the feature of network verified UE location in NR NTN network (FFS whether this is an additional capability on top of FG 44-3)

1. RAN2 assumption is that how the network handles the access to NR NTN cells for R18 UEs that do not support the new Rel-18 NR NTN “network verified UE location” capability is up to NW implementation, with no need for specs impact (RAN2 can still introduce needed changes to RAN2 specs for this, if requested by other groups)

c) Mobility enhancements

Agreements:

1. Both of the NR TN coverage and EUTRA TN coverage can be provided.

2. We introduce a new SIB to provide the TN coverage information

3. A TN coverage area configuration is associated with a TN coverage Area ID. The frequency information for TN coverage area is indicated by adding TN coverage area IDs in SIB4 and SIB5.

Agreements:

1. The change of serving cell reference location for earth moving cell should neither result in system information change notifications nor in a modification of valueTag in SIB1.

2. In the Earth-moving case, it is up to UE implementation to maintain a valid serving cell reference location in RRC\_IDLE and RRC\_Inactive mode. This will be stated in the specification as a Note (or update of an existing Note)

3. For the IE used to trigger UE neighbor cell measurements prior to feeder link switch, re-use the same field of t-Service-17 as in Rel-17 and update the field description accordingly.

Agreements:

1. An explicit indication will be introduced to enable the unchanged PCI switch

2. The unchanged PCI mechanism can be applied to the case where the coverage gap is zero or negligible (where there is no need to introduce t-gap or t-start). FFS whether we need to support scenarios that require the introduction of t-gap or t-start

3. PCI unchanged procedure can be performed without performing RACH

Agreements:

1. In the unchanged PCI case, the UE considers UL synchronization timer expired at t-Service (current cell stop time) to stop any UL operation. FFS on timeAlignmentTimer handling.

2. In the unchanged PCI case, for RACH-based solution, the UE may trigger RACH immediately after DL synchronizing with the new satellite

3. The UE specific Koffset, if configured, is not used after t-Service and the UE uses the cell specifc Koffset until the UE receives new differential Koffset MAC CE.

Agreements:

1. Single beam can be indicated in HO command to monitor target cell PDCCH for dynamic grant for initial UL transmission

2. The pre-allocated grant is provided with association to SSBs

3. The mapping between type-1 CG and SSBs in CG-SDT can be the baseline of how to configure pre-allocated grant mapped to SSBs (can rediscuss in case of different input from RAN1)

4. UE selects an SSB associated to the pre-allocated grant with RSRP above a configured threshold, use the selected SSB and the corresponding UL grant occasions for the initial UL transmission

5. ta-Report can be included in ServingCellConfigCommon in the RACH-less HO command

6. RAN2 understands that if pre-allocated grant is not configured and dynamic grant is used for first UL transmission, if UL HARQ mode is configured, HARQ mode A is recommended for the HARQ process (this is anyway up to NW implementation and there is no Stage2 and Stage3 spec impact)

7. The MAC entity applies the N\_TA (value 0 or same as source cell) configured in the RACH-less HO command for the PTAG. FFS on when timerAlignmentTimer associated with this TAG starts

8. If no SSB mapping to pre-allocated grant has RSRP above the threshold, fallback to RACH HO (with new SSB selection), while T304 is running

LS out

* -

Email discussions

* [AT123][108][NR NTN Enh] LCID extension (Huawei)
* [AT123][109][NR NTN Enh] RACH-less HO (Samsung)
* [AT123][111][IoT-NTN Enh] Reply LS to RAN1 (Lenovo)
* [Post123][102]NTN Self Ev] CP/UP latency (Ericsson)

#### 2.2.2 Remaining Open issues

a) Coverage enhancements

* Specify signalling and procedures to support UL coverage enhancements

b) Network verified UE location

* specification of necessary enhancements to multi-RTT to support the network verified UE location in NTN assuming a single satellite in view. DL-TDoA methods for verification may be considered as lower priority and if time permits and condition in Note is satisfied

c) NTN-TN and NTN-NTN mobility and service continuity enhancements

* Specify NTN-TN and NTN-NTN measurement/mobility and service continuity enhancements

## 2.3 RAN3

#### 2.3.1 Agreements

* **RAN3#121 meeting, Toulouse, France, August 21st – 25th, 2023:**

1. Mobility enhancements

Agreements

* **Providing the target cell’s servingCellConfigCommon to the source cell is not supported in Rel-18 timeline.**
* **Turn WA to agreement: It’s un-necessary to exchange multiple TACs over Xn for NTN.**
* **No specification impact on TACs exchange.**

Understandings

* **HO cancel is applicable to CHO with time condition over Xn**

Documents agreed

* R3-234360 (TP to BL CR for TS 38.423) Correction to time based CHO (CATT, Ericsson, Nokia, Nokia Shanghai Bell, ZTE, Huawei)R3-233494 NGAP Support for Time-Based HO in NTN (Ericsson, Thales, Intelsat, Lockheed Martin, Hughes Network Systems, CATT, ESA, Nokia, Nokia Shanghai Bell)
* R3-233455 (TP for NR NTN BL CR TS38.413) Support time-based trigger condition in NR NTN NG-HO (Nokia, Nokia Shanghai Bell)
* R3-233526 Time-Based HO for NTN - NGAP Impacts (Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA) CR0891r5, TS 38.413 v17.4.0, Rel-18, Cat. B
* R3-233435 New TP for TS38.300

LS out:

* [R3-234664](file:///C:\Users\chuberrn\Documents\000_DATA_NICOLAS\02_3GPP%20Nicolas\RAN\Meetings\230911_RAN%23101%20meeting\Satellite%20contributions\A_Preparation\00_SR%20R18_WI_NR_NTN_enh\Inbox\R3-234664.zip) Reply LS to RAN2 on Common Signaling in (C)HO

Email discussions

* R3-234664 # NRNTN1\_ServiceContinuity , (moderator - QC)

1. Network verified UE location

Agreements

* -

Understanding

* **No further discussion on the issue whether the location verification can be performed in parallel with UE service.**

BL CRs agreed

* R3-232541 XnAP BLCR on NTN Functionality (Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC) CR0933r4, TS 38.423 v17.4.0, Rel-18, Cat. B
* R3-232826 (BLCR to 38.300) Stage 2 BL CR for NR NTN (Ericsson, CATT, Thales, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated) draftCR

Email discussions

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#### 2.3.2 Remaining Open issues

To be further discussed as part of NTN-TN and NTN-NTN mobility and service continuity enhancements

* **Need more time to check the wording of the draft LS reply in** [R3-234662](file:///C:\Users\5087526\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\Q1DQU5AC\Inbox\R3-234662.zip)**.**
* **Nwk verified UE location To be continued based on RAN1 progress...**
* **Do not exchange TAC(s) over Xn for NTN. Solution to be further discussed. To be continued...**
* **FFS on details, e.g. Introduce a DL discarding related IE in Early Status Transfer Transparent Container IE.**
* **To address the issue of time delay in CHO with time condition, the target gNB may wait for an additional time after the CHO time window has expired, according to implementation?**
* **Continue on working on stage2 TP and stage3 TPs based on agreements, to be continued...**
* **How to describe which TAC should be used in semantic description?**

## 2.4 RAN4

The applicable work plan in RAN4 can be found under R4-2300973

#### 2.4.1 Agreements

* **RAN4#108 meeting, Toulouse, France, August 21st – 25th, 2023:**

1. BSRF Demod Test session part

Agreements for general part

**Topic #1 System parameters**

Agreement: Postpone the discussion on small CHBW and shorter CP until we receive clear demand/request to support this.

**Topic #2 GSCN**

Agreement:

* + to use following GSCN for Ka-band as (with Excel file from 06/2019 as proof for calculations):

**Table 4: Applicable SS raster entries per *operating band* (FR2-NTN)**

|  |  |  |  |
| --- | --- | --- | --- |
| **NR *operating band*** | **SS Block SCS** | **SS Block pattern (note 1)** | **Range of GSCN**  **(First – <Step size> – Last)** |
| n512 | 120 kHz | Case D | 17448 – <12> – 19428 |
|  | 240 kHz | Case E | 17472 – <24> – 19416 |
| n511 | 120 kHz | Case D | 17448 – <12> – 19428 |
|  | 240 kHz | Case E | 17472 – <24> – 19416 |
| n510 | 120 kHz | Case D | 17448 – <12> – 19428 |
|  | 240 kHz | Case E | 17472 – <24> – 19416 |
| NOTE 1: SS Block pattern is defined in section 4.1 in TS 38.213. | | | |

**Topic #3 DMRS bundling feature**

Agreement:

* RAN4 investigate the feasibility of an NTN UE to meet the DMRS requirement in the new test condition where DL time would be changing for non-GEO satellite.
  + Taking existing requirements specified for the maximum allowable phase difference for DMRS bundling captured in Table 6.4.2.5-1 of TS38.101-1 as starting point
    - FFS any update on the side conditions needed or not which also need to be compliant with RAN1 design
* From RRM requirements perspective to support NTN-specific PUSCH DMRS bundling:
  + - Option 1: update the applicability of the timing requirements such that the requirements apply only for the first transmission in the TDW.
    - Other options not precluded

Agreements for SAN RF requirements

**EISREFSENS\_50M definition**

Agreement:

* BW for EISREFSENS\_50M for Ka-band SAN is 66RB, i.e. 66\*12\*60\*1000Hz
* -1dB SNR can be reused for EIS for Ka-band SAN.

**FRC**

Agreement: The G-FR2-A1-1, G-FR2-A1-2 and G-FR2-A1-3 for FR2-1 TN BS can be reused for Ka-band SAN.

**SAN Noise Figure**

Agreement: GEO and LEO: 3.5 dB

NTN co-existence study

**Scenario**

Agreement:

* + To deprioritize scenario 7 and 8 for SAN elevation angle as 90-degree cases.
    - Scenario 7 and 8 should still be studied for SAN elevation angle as 25-degree cases (with respect to the centre of the central beam).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No. | Combination | Aggressor | Victim | Frequency band | Scope of Coexistence Simulation |
| 7 | TN with NTN | NTN DL | TN UL | 17 GHz | ACLR NTN SAN to be varied/defined  ACS TN gNB fixed |
| 8 | TN with NTN | TN UL | NTN DL | 17 GHz | ACLR TN UE fixed  ACS NTN UE to be varied/defined |
| NOTE 1: For coexistence between Ka-Band DL and adjacent TN bands, there are no 3GPP defined/specified TN bands. | | | | | |

**FRF**

Agreement:

* + FRF=2 for co-existence study with 2 polarization

|  |
| --- |
| FRF=2 if with 2 polarization enabled (referring to TR 38.821) |

* + Do not consider interference leakage from adjacent beams as starting point for co-ex study.
    - For example for the figure above, do not consider the interference leakage from green, blue and purple beams when study SINR for the red beam.

**SAN elevation angle**

Agreement: Considering 25 degree in additional to 90 degree

**NTN UE positioning accuracy**

Agreement: NTN UE antenna points to the satellite accurately

**NTN SAN Channel Bandwidth**

Agreement:200MHz per beam

**NTN SAN SCS**

Agreement:In table 2.3.1-2 (R4-2309971), update SCS values for 400 MHz channel BW to 120 kHz and align HPBW values with the agreed values in section 2.4.1.

**NTN SAN Antenna Pattern**

Agreement: Reusing Antenna pattern in section 6.4.1 of TR38.811

**NTN UE Antenna Pattern**

Agreement:

* Agree on reusing antenna pattern in section 6.4.1 as the assumption for NTN UE with parabolic antenna.
* FFS what pattern /modelling can be applied to NTN UE with phased array antenna.

**NTN SAN and UE NF**

Agreement:

* + Use the following NF sets in co-ex study based on agreement in #108 main and BSRF session.

|  |  |  |
| --- | --- | --- |
|  | SAN NF | UE NF |
| For GEO | 3.5 dB | 2.5 dB |
| For LEO (option 1) | 3.5 dB | 2.5 dB |
| For LEO (option 2) | 5.9 dB | 6 dB |

**NTN UE RB number**

Agreement:

* + To use 13 RBs from NTN UE UL
    - Considering NRB / 10 per NTN UE in UL where NRB is the transmission bandwidth configuration of the signal operating in the NTN beam (i.e NRB= 132 for 200 MHz channel BW signal).

**Minimum distance assumed between VSAT and TN BS**

Agreement:

* + Use 35m as minimum distance assumed between VSAT and TN BS for co-ex study.

**TN ACLR, TN BS TX power, TN BS antenna parameters and TN ISD.**

Agreement:

* + To maintain previous agreements, no change.

**TN UE Tx parameter**

Agreement:

* + To clarify the following for TN UE parameters, and fix the in-consistency in previous assumption document.
    - Tx power: -40dBm as min, 23dBm as max.
    - Element gain: 5dBi

**NTN UE Uplink Power Control**

Agreement:

* + Agree on following UL power control model for both NTN and TN as starting point.



Where,

Pmax = maximum UE Tx power, i.e. 23 dBm for TN UE, and 33 dBm for fixed VSAT NTN UE.

Rmin = minimum power reduction ratio, i.e. -63 dB for TN UE, and [-63 dB by assuming NTN UE min Tx power as -30dBm as starting point] for NTN UE.

γ = 1

CLx-ile = –SNR\_target + Pmax – ThermalNoise – BS/SAN\_NoiseFigure - 10\*log10(BW), considering SNRtarget is 15dB and BW is actual UL BW.

**SINR-Throughput performance metrics.**

Agreement:

* + Continue using the SINR-throughput mapping from TR38.803 for both NTN and TN.
    - FFS the applicability of the mapping for NTN link

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Documents approved/agreed:

* R4-2313864 WF for NTN general part
* R4-2313996 WF for SAN RF requirements
* R4-2313865 WF for NTN co-existence study
* R4-2313890 Simulation assumption for NTN co-existence study

Email discussion summaries:

* R4-2314245 Topic summary for [108][309] NR\_NTN\_enh\_Part1, Moderator (Thales)
* R4-2314246 Topic summary for [108][310] NR\_NTN\_enh\_Part2, Ericsson
* R4-2314247 Topic summary for [108][311] NR\_NTN\_enh\_Part3, Samsung

1. Main RAN4 session part

**Differentiate UE types from mobility perspective**

Agreement:

* Define two set of requirement for fixed and mobile VSAT
  + Differentiate the electronic and mechanical steering for both fixed and mobile VSAT
  + Strive to minimize the number of different requirements.

**Noise figure for NTN UE**

Agreement:

* Define two sets of requirements
  + Two sets of noise figures
    - Set #1: 2.5dB for LEO and GEO
    - Set #2: 6dB only for LEO
  + [Apply to test based on UE declaration for G/T which is used to derive EIS requirements].

**Beam pointing/accuracy related requirements**

Agreement:

For mobile VSAT

* + RAN4 to specify NTN UE VSAT pointing accuracy based on manufacturer declaration. RAN4 to reuse the explanation from EN 303 978:

“The applicant shall declare the peak pointing accuracy (δφ) and the associated statistical basis.

The antenna shall maintain the declared peak pointing accuracy (δφ), such that the off-axis EIRP emission density pattern projected onto the geostationary arc remains within the mask specified in clause [Total EIRP density specification] when shifted by an angle of ±(δφ°), taking into account the following factors:

* the worst case operational environmental conditions;
* maximum ESOMP dynamics; and
* the range of latitude, longitude and altitude relative to the satellite orbital position.”

For fixed VSAT

* + Proposal 3: RAN4 should specify antenna accuracy requirement for fixed VSAT, based on ETSI EN 301 360.

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Documents approved/agreed:

* R4-2314934 WF on UE RF requirements for NR NTN

Email discussion summaries:

* R4-2314225 Topic summary for [108][143] NR\_NTN\_enh\_UERF, ZTE

1. RRM session part

**NR-NTN deployment in above 10 GHz bands**

Agreement:

* The scope of the work needed to define the RRM requirements (i.e. beam steering related) necessary for NR-NTN UEs operating in the NTN example band (i.e. Ka band) based on associated assumptions of the UE architecture
  + RRM requirements shall cover at least the following scenarios
    - Case-1: Stationary UE for GSO
    - Case-2: Stationary UE for LEO
    - Case-3: Mobile UE for GSO
  + The set of requirements shall include all RRM requirements relevant to NTN, based on Rel-17 NR NTN requirements unless critical issues are identified, including
    - UE uplink timing accuracy
    - RRC IDLE and INACTIVE mobility
    - (Conditional) Handover
    - RRC Re-establishment
    - RRC Connection Release with Redirection
    - Radio Link Monitoring
    - Link Recovery procedure (BFD/CBD)
    - Active TCI switching
    - Measurement Procedure
    - (L1/L3 measurement delay and scheduling/measurement restrictions)
    - Measurement Performance
    - FFS: UL spatial relation switching
  + The requirements need to cover the following UE architectures
    - Fully electronically-steered beam UEs (Type 1)
    - Fully mechanically-steered beam UEs (Type 2)
    - FFS if additional types of UEs shall be considered and subject to RAN4 RF session conclusions
  + Aim to reuse Rel-17 NR NTN requirements to the extent possible, except for beam sweeping aspects.
    - For Type 1 UEs the impact of beam sweeping on RRM requirements can be accounted for based on FR2-1 requirements in terms of scaling principles.
    - For Type 2 UEs additional studies are required to identify the methodology to define the requirements

**TN-to-NTN Cell reselection**

Agreement:

* If whether/how to UE obtain TN coverage area information from TN cell is confirmed, the following can be further discussed:
  + Whether or not to define RRM requirements for TN-to-NTN cell reselection.
  + Centre and radius of TN coverage can be used for measurement initiation for cell reselection, e.g.
    - If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, and the distance between UE and TN coverage area centre is smaller than radius, then the UE may not perform measurement of NTN intra- and/or inter-frequency.

**NTN-to-TN Cell reselection**

Agreement:

* Deprioritize the scenario where TN and NTN cells are in the same frequency in RRM requirements.

**Location-based measurement initiation for cell reselection in earth moving cell**

Agreement:

* Define location-based measurement initiation requirements based on the existing requirements on ‘4.2C Cell Re-selection for NR UE for Satellite Access.’ The requirement may update the following aspects:
  + Definition of the reference location to reflect the time varying reference location
    - FFS: how to update the reference location over time based on reference location, epoch time, satellite ephemeris, etc.
  + The location margin for evaluating the distance threshold can be extended by X meters
  + any other updates can be discussed/added later to be compliant with RAN2 spec

**Satellite switching without PCI change**

Agreement:

* Define UE requirements on delay and interruption upon ‘satellite switching without PCI change’ at least for hard switch scenario. Further study the following, based on further progress from RAN2.
  + Starting point of the delay and interruption
  + Values of the components in the delay and interruption, such as ‘UE processing time’, ‘search time for target satellite’ and other delay components if relevant and required.
  + During the interruption period, whether the UE is required to monitor [serving cells/satellites and/or] neighbour cells/satellites
  + Note that the above requirement can be extended to RRC idle/inactive mode. The details will be discussed when the group gets more clarity on the whole framework in detail from RAN2.

**Group-based HO for signalling overhead reduction**

Agreement:

* Do not define requirement for group-based HO in R18.

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Documents approved/agreed:

* R4-2314447 WF on R18 NR NTN RRM requirements
* R4-2314484 LS on RAN4 RRM work scope for NR NTN Ka band

Email discussion summaries:

* R4-2314171 Topic summary for [108][226] NR\_NTN\_enh , QC

#### 2.4.1 Remaining Open issues

**NR-NTN deployment in above 10 GHz**

* Study implications of FDD operation in FR2 and derive requirements for the identified example band appropriately.
* Relevant coexistence scenarios and analysis
* Specify Rx/Tx requirements for satellite access node and different VSAT UE class (not only 60 cm aperture) as appropriate for the identified example band
* Identify values for physical layer parameters chosen from the existing FR1 and FR2 sets.

**Coverage enhancements**

* Specify PUCCH enhancements for Msg4 HARQ-ACK (e.g. repetition)

**Network verified UE location**

* Specify necessary enhancements to multi-RTT to support the network verified UE location in NTN assuming a single satellite in view

**NTN-TN and NTN-NTN mobility and service continuity enhancements**

* Specify NTN-TN and NTN-NTN measurement/mobility and service continuity enhancements

## 3. Detailed progress in SA/CT WGs since last TSG meeting (for all involved WGs)

NOTE: This section only needs to be filled in for WI/SIs where there is a corresponding relevant WI/SI in SA/CT.

## 3.1 SA2

#### 3.1.1 Agreements with cross-TSG impacts

#### 3.1.2 Remaining Open issues with cross-TSG impacts

NOTE: This section should also flag any critical dependencies that need TSG attention.

Aspects related to Network verified UE location

## 4. References

## 4.1 RAN1

**RAN1#114 meeting, Toulouse, France, August 21st – 25th, 2023:**

Submitted TDOCs:

* R1-2306704 draftCR Correction on corresponding scaling factors table IPLOOK
* R1-2308567 LS out Draft Reply LS on RACH-less Handover Moderator (Samsung)
* R1-2308432 discussion Moderator Summary for RRC parameters for Rel-18 IoT NTN enhancements Moderator (MediaTek)
* R1-2308441 LS out Draft reply LS to RAN2 on unchanged PCI Moderator (CATT)
* R1-2308442 discussion Discussion on RAN2 LS reply on unchanged PCI CATT
* R1-2308443 discussion Moderator summary on reply LS on RACH-less handover Moderator (Samsung)
* R1-2308416 discussion Discussion on RAN4 LS on FR2-NTN aspects Moderator (Nokia)
* R1-2308547 other Session notes for 9.9 (NTN (Non-Terrestrial Networks) enhancements) Ad-Hoc Chair (Huawei)
* R1-2308480 discussion Summary of offline discussion on RRC parameters for Rel-18 NR NTN enhancements Moderator (Thales)
* R1-2308568 LS out Reply LS on RACH-less Handover RAN1, Samsung
* R1-2308566 LS out Reply LS to RAN2 on unchanged PCI RAN1, CATT
* R1-2306408 discussion Discussion on RAN4 LS on the system parameters for NTN above 10 GHz THALES
* R1-2306409 Work Plan R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R1-2306419 discussion On coverage enhancements for NR NTN Ericsson
* R1-2308050 discussion Coverage enhancement for NR NTN MediaTek Inc.
* R1-2307942 discussion Coverage enhancements for NR NTN Qualcomm Incorporated
* R1-2308322 discussion Summary #1 on 9.9.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2308323 discussion Summary #2 on 9.9.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2308324 discussion Summary #3 on 9.9.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2306765 discussion Discussions on remaining issues of coverage enhancements in NR NTN vivo
* R1-2306660 discussion Discussion on coverage enhancements for NTN Spreadtrum Communications
* R1-2306563 discussion Discussion on coverage enhancement for NTN ZTE
* R1-2306486 discussion Discussion on coverage enhancement for NR NTN Huawei, HiSilicon
* R1-2307102 discussion Further discussion on UL coverage enhancement for NR NTN CATT
* R1-2306943 discussion Coverage enhancement for NR NTN NEC
* R1-2306892 discussion Discussion on coverage enhancement for NR NTN LG Electronics
* R1-2307406 discussion Discussion on coverage enhancement for NR-NTN Panasonic
* R1-2307431 discussion Discussions on Coverage enhancement for NR NTN Sharp
* R1-2307543 discussion Discussion on coverage enhancement for NR NTN OPPO
* R1-2307693 discussion On coverage enhancement for NR NTN Samsung
* R1-2307593 discussion Discussion on coverage enhancement for NR NTN Hyundai Motor Company
* R1-2307614 discussion Coverage enhancement for NR NTN Lenovo
* R1-2307735 discussion Discussion on coverage enhancements for NR NTN CCU, NTPU
* R1-2307750 discussion Discussion on coverage enhancement for NR NTN ETRI
* R1-2307210 discussion Discussion on coverage enhancement for NR NTN CMCC
* R1-2307293 discussion On Coverage Enhancement for NR NTN Apple
* R1-2307486 discussion Discussion on coverage enhancement for NR NTN NTT DOCOMO, INC.
* R1-2307399 discussion Discussion on coverage enhancement for NR-NTN xiaomi
* R1-2307341 discussion Discussion on coverage enhancement for NR NTN Baicells
* R1-2307245 discussion Remaining issues related to NTN coverage enhancements Nokia, Nokia Shanghai Bell
* R1-2307246 discussion Further aspects related to network verified UE location Nokia, Nokia Shanghai Bell
* R1-2307400 discussion Discussion on the network verified location for NR-NTN xiaomi
* R1-2307487 discussion Discussion on Network verified UE location for NR NTN NTT DOCOMO, INC.
* R1-2307294 discussion On Network Verified UE Location Apple
* R1-2307751 discussion Discussion on Network verified UE location for NR NTN ETRI
* R1-2307694 discussion Network verified UE location for NR NTN Samsung
* R1-2307544 discussion Discussion on network verified UE location for NR NTN OPPO
* R1-2307432 discussion Network verified UE location for Rel-18 NR NTN Sharp
* R1-2306893 discussion Discussion on network verified UE location for NR NTN LG Electronics
* R1-2306919 discussion On network verified UE location for NR NTN Sony
* R1-2307103 discussion Further discussion on Network verified UE location for NR NTN CATT
* R1-2306949 discussion On Network verified UE location in NR NTN Ericsson
* R1-2306487 discussion Discussion on network-verified UE location for NR NTN Huawei, HiSilicon
* R1-2306564 discussion Discussion on network verified UE location for NR NTN ZTE
* R1-2306766 discussion Discussions on remaining issues of UE location verification in NR NTN vivo
* R1-2306793 discussion Discussion on Network-verified UE location for NR-NTN PANASONIC
* R1-2306412 discussion Feature Lead Summary #3 on Network verified UE location for NR NTN Moderator (THALES)
* R1-2307943 discussion Network verified UE location for NR NTN Qualcomm Incorporated
* R1-2307837 discussion Network verified UE location for NR NTN Lenovo
* R1-2307875 discussion Discussion on Network Verified UE Location TCL
* R1-2308051 discussion Network verified UE location for NR NTN MediaTek Inc.
* R1-2306410 discussion Feature Lead Summary #1 on Network verified UE location for NR NTN Moderator (THALES)
* R1-2306411 discussion Feature Lead Summary #2 on Network verified UE location for NR NTN Moderator (THALES)
* R1-2306413 discussion Feature Lead Summary #4 on Network verified UE location for NR NTN Moderator (THALES)
* R1-2306404 discussion Discussion on network verified UE location in NR NTN THALES
* R1-2308608 discussion Feature Lead Summary #5 on Network verified UE location for NR NTN Moderator (THALES)

## 4.2 RAN2

**RAN2#123 meeting, Toulouse, France, August 21st – 25th, 2023:**

Submitted TDOCs:

* R2-2308092 discussion UE Capability Discussion for Rel-18 NR NTN Enhancements WI Intel Corporation
* R2-2308093 draftCR UE capabilities for Rel-18 NR NTN Enhancements WI Intel Corporation
* R2-2308094 draftCR UE capabilities for Rel-18 NR NTN Enhancements WI Intel Corporation
* R2-2307323 Work Plan R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R2-2308523 draftCR Stage 3 NTN running CR for 38.321 - RAN2#122 InterDigital
* R2-2307318 draftCR Stage 2 running CR for TS 38.300 for Rel-18 NTN enhancements THALES (Rapporteur)
* R2-2308902 CR Stage 3 Running RRC CR for NR NTN Rel-18 Ericsson
* R2-2308943 draftCR Running 38.304 CR for NTN ZTE Corporation, Sanechips
* R2-2308937 CR Stage 3 Running RRC CR for NR NTN Rel-18 Nanjing Ericsson Panda Com Ltd
* R2-2307008 LS in Reply LS to RAN2 on unchanged PCI (R1-2306210; contact: CATT) RAN1
* R2-2307011 LS in Reply LS on RACH-less Handover (R1-2306217; contact: Samsung) RAN1
* R2-2307035 LS in LS on time-based trigger condition in NG HO for NR NTN (R3-233527; contact: Ericsson) RAN3
* R2-2307416 discussion Discussion on PUCCH repetition for Msg4 HARQ-ACK CATT
* R2-2307195 discussion Discussion on PUCCH repetition for Msg4 HARQ-ACK for NTN NTT DOCOMO INC.
* R2-2307526 discussion Higher layer signalling for PUCCH repetition for Msg4 HARQ-ACK Huawei, HiSilicon
* R2-2307620 discussion UE capability indication for Msg4 ACK repetition Qualcomm Incorporated
* R2-2307253 discussion Discussion on PUCCH enhancement for Msg4 HARQ-ACK in NR NTN OPPO
* R2-2307512 discussion Discussion on coverage enhancement for NR NTN Xiaomi
* R2-2308294 discussion Discussion on the LS on higher layer signaling in Msg3 PUSCH for PUCCH repetition for Msg4 HARQ-ACK CMCC
* R2-2308230 discussion On Msg3 indication for PUCCH repetition for Msg4 HARQ-ACK Nokia, Nokia Shanghai Bell
* R2-2307313 discussion Discussion on signalling for PUCCH repetition for Msg4 HARQ-ACK Samsung
* R2-2307839 discussion HL signaling design for the PUCCH repetition request Apple
* R2-2308539 discussion R18 NR NTN Coverage enhancements Ericsson
* R2-2308507 discussion Consideration on coverage enhancements ZTE Corporation, Sanechips
* R2-2308604 discussion Discussion on coverage enhancement LG Electronics Inc.
* R2-2308450 discussion UE location verification by Network NEC Telecom MODUS Ltd.
* R2-2308706 discussion Discussion on Network Verified UE Location TCL
* R2-2308777 discussion On Network verified UE location for NR NTN MediaTek Inc.
* R2-2307320 discussion Discussion on network verified UE location in NR NTN THALES
* R2-2307908 discussion Discussion on network verified UE location Ericsson
* R2-2308295 discussion Considerations on network verified UE location CMCC
* R2-2308277 discussion Discussion on NTN NW verified UE location Lenovo
* R2-2308263 discussion Discussion on network verified UE location Xiaomi
* R2-2307487 discussion Discussion on the network verfied UE location Huawei, Turkcell, HiSilicon
* R2-2308196 discussion Discussion on multiple-RTT based positioning in NTN Quectel
* R2-2307601 discussion UE support of Network Verified UE Location Feature Samsung R&D Institute UK
* R2-2307314 discussion Discussion on Cell Reselection Enhancements Samsung
* R2-2307321 discussion Discussion on mobility enhancements for VSAT THALES
* R2-2308901 discussion Idle mode mobility enhancements Ericsson
* R2-2308701 discussion Discussion on NTN-TN Cell re-selection ITL
* R2-2308524 discussion NTN-TN mobility and service continuity InterDigital
* R2-2308116 discussion Discussion on NTN-TN enhancements NTT DOCOMO, INC.
* R2-2307840 discussion NTN-TN cell reselection enhancement Apple
* R2-2307739 discussion Discussion on NTN to TN cell reselection enhancements TCL
* R2-2308218 discussion Discussion on remaining issues of NTN-TN cell reselection enhancements Transsion Holdings
* R2-2308054 discussion Discussion on the NTN – TN cell reselection enhancement Turkcell, Huawei, HiSilicon
* R2-2308010 discussion Some remaining issues for TN area information Lenovo
* R2-2308264 discussion Cell reselection enhancements for NTN-TN mobility Xiaomi
* R2-2308283 discussion Signaling of the TN coverage area and the frequency information ZTE corporation, Sanechips
* R2-2308296 discussion Discussion on open issues for NTN-TN cell reselection CMCC
* R2-2308239 discussion Discussion on TN coverage description ETRI
* R2-2307621 discussion TN cell coverage info and measurement relaxation Qualcomm Incorporated
* R2-2307579 discussion On TN Coverage Definition and TN to NTN Reselections Nokia, Nokia Shanghai Bell
* R2-2307254 discussion Discussion on NTN-TN cell reselection enhancement OPPO
* R2-2307217 discussion Discussion on providing TN coverage area information LG Electronics France
* R2-2307166 discussion NTN neighbour cell information in TN cells PANASONIC R&D Center Germany
* R2-2307167 discussion Considerations on TN-NTN cell re-selection Telit Communications S.p.A.
* R2-2307417 discussion Discussion on the mechanism for providing TN coverage information CATT
* R2-2307101 discussion Remaining Issues on Power Saving for NTN-TN Mobility vivo
* R2-2307102 discussion Further discussion NTN-NTN Mobility for Earth-moving Cell vivo
* R2-2307255 discussion Discussion on NTN-NTN cell reselection enhancement OPPO
* R2-2308297 discussion Discussion on remaining issues for NTN-NTN reselection CMCC
* R2-2308265 discussion Cell reselection enhancements for NTN-NTN mobility Xiaomi
* R2-2308011 discussion Feeder link switch time and reference location of NTN moving cells Lenovo
* R2-2308033 discussion Discussion on location-based measurement initiation in moving cells Huawei, Turkcell, HiSilicon
* R2-2307740 discussion Discussion on NTN to NTN cell reselection enhancements TCL
* R2-2308124 discussion Discussion on NTN-NTN mobility enhancements Spreadtrum Communications
* R2-2308525 discussion Cell reselection enhancements for Earth moving cell InterDigital
* R2-2308718 discussion Discussion on description of movingReferenceLocation ASUSTeK
* R2-2308700 discussion Discussion on NTN-NTN cell reselection enhancements CAICT
* R2-2307218 discussion Discussion on NTN-NTN cell reselection enhancements LG Electronics France
* R2-2307219 discussion Discussion on handover enhancements LG Electronics France
* R2-2308719 discussion Discussion on moving cell reference location for CHO ASUSTeK
* R2-2308526 discussion NTN mobility enhancements for RRC\_CONNECTED InterDigital
* R2-2308527 discussion Satellite switching without PCI change InterDigital
* R2-2308373 discussion Satellite Switch, PCI change without L3 handover NEC
* R2-2308374 discussion Support RACH-less CHO NEC
* R2-2308609 discussion Discussion on NTN handover enhancements Fujitsu
* R2-2308900 discussion Handover enhancements Ericsson
* R2-2308752 discussion Discussion on random access in the unchanged PCI scenario ETRI
* R2-2308755 discussion Common signalling of HO common information Sequans Communications
* R2-2308753 discussion “Unchanged PCI” solution vs “PCI change only” solution Sequans Communications
* R2-2307741 discussion Discussion on satellite switch with unchanged PCI Panasonic
* R2-2307841 discussion Hard satellite switching with unchanged PCI Apple
* R2-2307842 discussion NR NTN specific HO enhancement Apple
* R2-2307315 discussion Discussion on Handover Enhancements Samsung
* R2-2307893 discussion Discussion on gap time of unchanged PCI ITRI
* R2-2307894 discussion Discussion on common information of group handover ITRI
* R2-2307896 discussion Discussion on soft satellite switching with PCI unchanged FGI
* R2-2307943 discussion RACH-less signaling design for NTN China Telecom
* R2-2308032 discussion Remaining issues on RACH-less HO in NTN Huawei, Turkcell, HiSilicon
* R2-2308012 discussion Some remaining issues for RACH-less HO in NTN Lenovo
* R2-2308146 discussion Discussion on RACH-less HO Sharp
* R2-2308159 discussion Signaling overhead reduction during NTN-NTN HOs Sony
* R2-2308219 discussion Discussion on open issues of NTN-NTN handover Transsion Holdings
* R2-2308266 discussion Discussion on handover enhancements for NTN-NTN mobility Xiaomi
* R2-2308329 discussion Report of [Post122][114][NR NTN Enh] Unchanged PCI CMCC
* R2-2307258 discussion Discussion on NTN handover enhancements OPPO
* R2-2307476 discussion Discussion on the Unchanged PCI Satellite Switch Google Inc.
* R2-2307580 discussion Resolving Open Points on RACH-less HO in Rel-18 NTN Nokia, Nokia Shanghai Bell
* R2-2307581 discussion On Unchanged PCI and Satellite Switching without L3 Mobility Nokia, Nokia Shanghai Bell
* R2-2307622 discussion RACH-less handover for NTN Qualcomm Incorporated
* R2-2307623 discussion Details on satellite switch with PCI unchange Qualcomm Incorporated
* R2-2307103 discussion Discussion on Handover Enhancement with Common HO Configuration in NR NTN vivo
* R2-2307104 discussion Further Discusison on Service Link Switch with Unchanged PCI vivo
* R2-2307418 discussion Discussion on unchanged PCI scenario CATT
* R2-2307419 discussion Discussion on RACH-less and common (C)HO configuration CATT
* R2-2307343 discussion Handover enhancements Continental Automotive
* R2-2307193 discussion On Triggering Unchanged PCI for Handover Enhancement in LEO NTN MediaTek Inc.

## 4.3 RAN3

**RAN3#121 meeting, Toulouse, France, August 21st – 25th, 2023:**

Submitted TDOCs:

* R3-233784 draftCR (BLCR to 38.300) Stage 2 BL CR for NR NTN Ericsson, CATT, Thales, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated
* R3-233751 CR NGAP BLCR on NTN Functionality Nokia, Nokia Shanghai Bell, Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated
* R3-233842 Work Plan R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R3-233799 CR XnAP BLCR on NTN Functionality Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC
* R3-234158 discussion Time Margin for CHO in NR NTN Ericsson, Thales, ESA
* R3-234159 other Time Margin for CHO in NR NTN - XnAP Impact Ericsson, ESA, Thales
* R3-233721 LS in LS on common signalling in (C)HO RAN2(OPPO)
* R3-233876 discussion Further discussion on TAC exchange over Xn for NR NTN NEC
* R3-234160 discussion Common Signaling in (C)HO Ericsson LM
* R3-234161 LS out [DRAFT] Reply LS on Common Signaling in (C)HO Ericsson LM
* R3-234015 other (TP for TS38.300 BL CR) Discussion on Support Mobility and Service Continuity Enhancements Nokia, Nokia Shanghai Bell
* R3-233999 discussion Discussion on NTN Service Continuity Enhancements China Telecommunication
* R3-233987 LS out [Draft] Reply LS on Common Signaling in (C)HO Qualcomm Incorporated
* R3-234028 discussion Remaining issue on service continuity enhancement for NTN Samsung
* R3-234057 other Further discussion on mobility issue for NR NTN ZTE
* R3-234058 LS out [DRAFT] Reply LS on common signalling in (C)HO ZTE
* R3-234100 discussion Further discussion on multiple TACs Huawei
* R3-234101 other Discussion on common signalling in CHO Huawei
* R3-234370 discussion Xn enhancement for NR NTN mobility NTT DOCOMO INC..
* R3-234358 discussion Consideration on support of common signalling in (C)HO CATT,OPPO
* R3-234359 discussion Discussion on mobility leftover issues CATT
* R3-234360 other (TP to BL CR for TS 38.423) Correction to time based CHO CATT, Ericsson, Nokia, Nokia Shanghai Bell, ZTE, Huawei
* R3-234361 discussion Consideration on OAM requirements for UE location verification CATT,Ericsson, Huawei,Samsung
* R3-234102 discussion Further discussion on network verified UE location Huawei, Ericsson, CATT, Samsung
* R3-234103 other (TP to 38.300) OAM Requirements for UE Location Verification Huawei, Ericsson, CATT
* R3-233988 discussion Discussion on TRP Information for NR NTN Qualcomm Incorporated
* R3-234016 discussion Discussion on UE location verification Nokia, Nokia Shanghai Bell
* R3-234125 LS out [DRAFT] Reply LS on Latency impact for NTN verified UE location Ericsson, CATT, Huawei
* R3-234124 draftCR OAM Requirements for UE Location Verification Ericsson, CATT, Huawei

## 4.4 RAN4

**RAN4#108 meeting, Toulouse, France, August 21st – 25th, 2023:**

Submitted TDOCs:

* R4-2311642 other Discussion on the remaining issues for NTN system parameters CATT
* R4-2313172 other Further discussion on system parameter for NTN in Ka band ZTE Corporation
* R4-2313238 other NTN enhancement: System parameters Ericsson
* R4-2313242 CR CR to TS 38.863: NTN Ka-band – Regulatory aspects Ericsson
* R4-2312976 other Discussion on DMRS bundling Huawei, HiSilicon
* R4-2311232 discussion On DMRS bundling with doppler pre-compensation for NTN Apple
* R4-2313643 discussion Discussion on LS on PUSCH DMRS bundling for NR NTN coverage enhancement MediaTek inc.
* R4-2313845 discussion NTN UE types above 10 GHz and beam steering Inmarsat
* R4-2313459 other On PUSCH DMRS bundling for NR NTN coverage enhancement Ericsson
* R4-2312443 discussion Updates on NTN calibration and coexistence simulation results for above 10 GHz THALES, Magister Solutions Ltd
* R4-2311602 discussion Ka-band NTN co-existence calibration result CATT
* R4-2311600 other Further discussion on remaining issues about simulation assumptions for above 10GHz NTN co-existence study CATT
* R4-2312973 other Initial simulation results for Rel-18 NTN coexistence study Huawei, HiSilicon
* R4-2312974 other Discussion on Rel-18 NTN coexistence study assumption Huawei, HiSilicon
* R4-2313101 discussion Simulation calibration assumptions and results for above 10GHz NTN co-existence study Samsung Electronics Nordic AB
* R4-2313087 discussion Discussion of simulation assumptions and temporary results for above 10GHz NTN co-existence study Samsung Electronics Nordic AB
* R4-2312891 other Simulation assumptions for NTN co-existence above 10GHz bands Qualcomm Incorporated
* R4-2313239 other NTN enhancement: coexistence simulations assumptions Ericsson
* R4-2313240 other NTN enhancement: coexistence simulations results Ericsson
* R4-2313173 other Further discussion on simulation assumption and calibration data for NTN in Ka band ZTE Corporation
* R4-2312758 discussion SAN requirements and NF in above 10 GHz THALES
* R4-2311601 other Further discussion on SAN RF requirements for above 10GHz bands CATT
* R4-2312120 discussion Updates for NTN UE terminal requirements and NF in above 10 GHz THALES
* R4-2313818 discussion NTN UE NF and requirements above 10 GHz Inmarsat
* R4-2312280 other Discussions on NTN UE RF Samsung
* R4-2312975 other Discussion on Ka band NTN UE Huawei, HiSilicon
* R4-2313174 other Further discussion on UE RF requirements for NTN in Ka-band ZTE Corporation
* R4-2313241 other NTN enhancement: UE requirements Ericsson
* R4-2313424 discussion Adaptation of requirements for operation at 10 GHz in NTN Nokia, Nokia Shanghai Bell
* R4-2312844 discussion Discussion on RRM requirements for NTN in above 10 GHz bands Huawei, HiSilicon
* R4-2312261 discussion Discussion on measurement and mobility RRM requirements for NR NTN in above 10GHz bands LG Electronics Inc.
* R4-2312366 discussion NR-NTN deployment in above 10 GHz bands Ericsson
* R4-2312126 discussion Discussion on RRM requirements for NR-NTN deployment in above 10 GHz bands vivo
* R4-2312219 discussion Specific NTN in above 10 GHz working hypothesis for RRM requirements THALES
* R4-2311860 discussion Discussion on RRM requirements for NTN deployment in above 10 GHz bands Xiaomi
* R4-2311621 discussion Discussion on RRM requirements for NR-NTN deployment in above 10 GHz bands CATT
* R4-2311677 discussion Discussion on RRM requirements for NTN above 10 GHz bands MediaTek inc., Airbus, Eutelsat, SES, THALES
* R4-2311324 discussion On NR NTN RRM in above 10 GHz bands Apple
* R4-2311431 discussion Discussion on RRM requirements for NR-NTN in above 10GHz bands Samsung
* R4-2313819 discussion NTN UE types above 10 GHz and beam steering impact on RRM Inmarsat
* R4-2313768 other [NR\_NTN\_enh-Core] NTN support for frequency band above 10GHz Qualcomm Incorporated
* R4-2311678 discussion Discussion on RRM requirements for Network verified UE location MediaTek inc.
* R4-2312127 discussion Discussion on RRM impacts on Network verified UE location for NTN enhancement vivo
* R4-2312080 other Discussion on RRM impacts on Network verified UE location ZTE Corporation
* R4-2312367 discussion Network verified UE location Ericsson
* R4-2312845 discussion Discussion on RRM requirements for NW verified location Huawei, HiSilicon
* R4-2313425 discussion Discussion on updating the RX-TX measurements for NTN Nokia, Nokia Shanghai Bell
* R4-2313426 discussion Service continuity and mobility enhancements between TN and NTN Nokia, Nokia Shanghai Bell
* R4-2312846 discussion Discussion on mobility enhancements in NTN Huawei, HiSilicon
* R4-2312368 discussion NTN-TN and NTN-NTN mobility and service continuity enhancements Ericsson
* R4-2312263 discussion Discussion on NTN service continuity enhancement LG Electronics Inc.
* R4-2312125 discussion Discussion on RRM requirements for mobility on NTN enhancement vivo
* R4-2311861 discussion Discussion on RRM requirements for NTN-TN and NTN-NTN mobility and service continuity enhancements Xiaomi
* R4-2311800 discussion Discussion on RRM core requirement for NR NTN mobility enhancements CMCC
* R4-2312079 other Discussion on RRM requirements for NTN enhancement ZTE Corporation
* R4-2311679 discussion Discussion on RRM requirements for NR NTN mobility enhancement MediaTek inc.
* R4-2311622 discussion Discussion on RRM requirements for NTN-TN and NTN-NTN mobility and service continuity enhancements CATT
* R4-2311432 discussion Discussion on RRM requirements for NTN-NTN and NTN-TN mobility Samsung
* R4-2311325 discussion On mobility and service continuity for eNTN Apple
* R4-2313769 other [NR\_NTN\_enh-Core] NTN mobility Qualcomm Incorporated
* R4-2314171 other Topic summary for [108][226] NR\_NTN\_enh Moderator (Qualcomm)
* R4-2314225 other Topic summary for [108][143] NR\_NTN\_enh\_UERF Moderator (ZTE)
* R4-2314245 other Topic summary for [108][309] NR\_NTN\_enh\_Part1 Moderator (Thales)
* R4-2314246 other Topic summary for [108][310] NR\_NTN\_enh\_Part2 Moderator (Ericsson)
* R4-2314247 other Topic summary for [108][311] NR\_NTN\_enh\_Part3 Moderator (Samsung)

***END***