**3GPP TSG RAN meeting #98-e RP-222812**

**e-meeting, December 12 - 16th, 2022** *revised RP-222019*

## 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-222654 |
| **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: 20%RAN1: 25%RAN2: 20%RAN3: 25% RAN4: 15% | 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.*

**Additional explanations/motivations for the time budget changes in the attached Excel table:**

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## 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#110-bis-e, October 10 – 19th 2022, e-meeting**
1. Coverage enhancement for NR NTN

**Agreement**

For PUCCH for Msg4 HARQ-ACK,

* Support PUCCH repetition
	+ Further discuss the specification impact for at least the following
		- Procedure and signaling (e.g., cell-specific configuration, request to gNB and dynamic indication from gNB, UE capability indication before Msg4, etc.)
		- Repetition factor
		- Repetition slot counting for FDD
	+ Further study whether to enhance or support the following
		- Frequency hopping
		- DMRS bundling

**Agreement**

For PUCCH repetition for Msg4 HARQ-ACK,

* Discuss the following options of procedure to perform repetitions
	+ Option 1: UE always performs repetition if configured in cell-specific manner
		- FFS: details of cell-specific configuration
		- FFS: behavior of UE being incapable of repetition
	+ Option 2: UE requests repetition and is dynamically indicated to perform repetition
		- FFS: details of repetition request
		- FFS: details of configuration and dynamic repetition indication
	+ Option 3: UE indicates repetition capability and is dynamically indicated to perform repetition
	+ How UE indicates repetition capability before Msg4

**Conclusion**

For PUCCH repetition for Msg4 HARQ-ACK,

* The existing mechanism on repetition slot counting (as in section 9.2.6 of TS 38.213) can be applied.
	+ FFS: whether specification update to apply the existing mechanism to PUCCH repetition for Msg4 HARQ-ACK is needed.

**R1-2210345** Summary #2 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)

**Agreement**

For NTN-specific PUSCH DMRS bundling,

* Discuss further the need of enhancement in consideration of at least the following:
	+ Phase difference due to timing drift and/or doppler shift.
		- e.g., whether/how long a UE can meet phase continuity requirement specified as Table 6.4.2.5-1 in 38.101-1 in consideration of frequency error within ± 0.1 PPM specified in section 6.4.1 of 38.101-5 and timing error specified in Table 7.1C.2-1 of 38.133, whether RAN1 should introduce enhancement to meet the requirement and/or recommend RAN4 to update the requirement or UE should pre-compensate phase difference by UE implementation, etc.
	+ An event which causes power consistency and phase continuity not to be maintained.
		- e.g., whether the new event is necessary to determine actual TDW(s) from each nominal TDW or the existing specification can work without any specification change or whether such event may not occur depending on implementations, etc.
	+ Note: baseline performance for legacy UEs can include antenna switching

**Agreement**

For PUCCH transmission for Msg4 HARQ-ACK, supported number of transmissions are 1, 2, 4, 8.

* Note: single PUCCH transmission is performed as in the existing specification, and/or (if supported for single PUCCH transmission) according to configuration/indication e.g., in signaling with respect to number of transmissions.
* FFS: whether larger number of transmissions is supported
* FFS: whether/how single PUCCH transmission can be configured and/or indicated
1. “Network verified UE location for NR NTN ”

**Agreement**

Deprioritize the discussion on UE location verification during initial access.

**Agreement**

For the evaluation of time based positioning methods, further evaluation results taking into account satellite movement between TX and RX measurements should be provided.

* How this is characterised is also reported by companies

Agreed LS out

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Documents agreed

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Email discussions

* R1-2210346 Summary #3 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2208394 FL Summary #5: Network verified UE location for NR NTN THALES
* **RAN1#111, November 14 – 18th 2022, Toulouse**
1. Coverage enhancement for NR NTN

**Conclusion**

For the study of NTN-specific PUSCH DMRS bundling, RAN1’s understanding is that Phase variation due to constant frequency error within ± 0.1 PPM specified in section 6.4.1 of 38.101-1 does not have impact on the phase continuity requirement for two adjacent slots specified as Table 6.4.2.5-1 in 38.101-1, according to annex F.9 and F.4 of 38.101-1.

**Conclusion**

RAN1 concluded that PUSCH DMRS bundling with sufficient TDW size should be applicable in NTN to meet the performance requirement for VoIP

* FFS: How to determine TDW size, including UE capability.
* Note: The above does not mean the performance requirements will be satisfied with DMRS bundling

**Working assumption**

For PUCCH repetition for Msg4 HARQ-ACK,

* One or more repetition factors may be configured via SIB
	+ If only one repetition factor is configured via SIB and if the value is one of {[1], 2, 4, 8}, UE capable of PUCCH repetition for Msg4 HARQ-ACK can perform repetition with the repetition factor
		- FFS: whether UE requests repetition or indicates repetition capability
	+ If multiple factors from {1, 2, 4, 8} are configured via SIB, PUCCH repetition for Msg4 HARQ-ACK may be dynamically determined and indicated by gNB
		- FFS: whether UE requests repetition or indicates repetition capability
		- FFS: whether repetition factor is indicated by UE
	+ FFS: UE behavior when repetition factor is not configured via SIB
	+ FFS: whether one or more UE capabilities are needed for the above is for further discussion
1. “Network verified UE location for NR NTN ”

**Observation**

For network verified UE location based on multi-RTT positioning method using Rx-Tx time difference measurements with single satellite, assuming the ambiguity of the mirror image position is resolved, if the UE reports needed to perform multi-RTT can be assumed to be trusted:

* Five sources observed that multi-RTT positioning method can meet the NTN UE location verification accuracy requirement for LEO 600km:
* Four sources observed that the positioning horizontal accuracy of less than 10km can be achieved with few seconds over-the-air latency (less or equal to 10s) with 95-percentile confidence level.
	+ Regarding the above observation, the following inputs were reported by companies:
	+ One source reported that the timing measurement error of SRS is smaller than 232 ns with 95% probability. And the timing measurement error of PRS can be smaller than 13ns and 16ns with 95% probability under the bandwidth of 8.64 MHz and 4.5 MHz, respectively. This source, reported also that satellite’s movement between TX and RX measurements is taken into account in the evaluation.
	+ One source reported that the timing measurement error is around 11ns for PRS detection with PRS bandwidth of 9.36 MHz. While for the SRS measurement, the maximum timing error is around 50ns with SRS bandwidth of 9.36 MHz. Further, this source, proposed that the RTT estimation error due to the movement of the satellite should be taken into account.
	+ Note: this source provided results using 2D positioning method.
	+ One source considered the maximum timing measurement error: 30ns, 50ns, 100ns, 200ns and uniform distribution of timing measurement error.
	+ One source reported that the timing measurement error of 95 percentile is equal to 8ns and 12.6ns for PRS and SRS respectively with an oversampling of 8. To take into account satellite movement between TX and RX measurements, for RTT calculation this source observed that the RTT between a satellite and a UE at time t0 can be approximated by the sum of the one-way delay at t0-T and the one-way delay at t0+T when T is small, e.g., less than 200 ms.
* One source observed that the positioning horizontal accuracy of less than 10km can be achieved with 180 seconds latency for earth fixed beam with 90-percentile confidence level
	+ This source reported that the timing measurement error of SRS and PRS can be smaller than 26.7ns and 6.1ns respectively with 95% probability under 30 degree elevation angle for LEO-600. Further, it observed that the satellite movement is taken into consideration when calculating the RTT.
* Two sources observed that multi-RTT positioning method require latency larger than 60 seconds for UE located nearby the orbital plane of a satellite during a certain time duration.

Note 1: Some companies observed that when 2D positioning method is used (e.g. when UE altitude is known to the network) better positioning latency/accuracy can be achieved compared to 3D positioning method.

**Conclusion:**

For network verification of UE location in NR NTN with single satellite in view with multi-RTT positioning:

* From RAN1 perspective, if the UE’s Rx-Tx time difference measurements report can be assumed to be trusted, multi-RTT positioning method using Rx-Tx time difference measurements can meet the accuracy requirement of less than 10km with 90% confidence, in case of:
	+ At least LEO600 based deployment
	+ Earth fixed cells
	+ Earth moving cell at least if UE dwell time within the cell is enough to perform at least two RTT measurements
* Note: the required over-the-air latency reported in evaluations ranged from less than 10s up to 180s

**Observation**

For network verified UE location based on DL-TDOA positioning method with single satellite:

Eight companies commented on the suitability of the method: Assuming the ambiguity of the mirror image position is resolved and if the UE reports needed to perform DL-TDOA can be assumed to be trusted:

* Five sources observed that DL-TDOA positioning method can meet the NTN UE location verification accuracy requirement for LEO 600km without considering UE Clock drift:
	+ Four sources observed that the positioning horizontal accuracy of less than 10km can be achieved with 30 seconds or less:
		- One of these 4 sources observed that horizontal positioning error is equal to 2.5km with 95% probability.
		- This source reported that the timing measurement error is around 11ns for PRS detection with PRS bandwidth of 9.36 MHz
			* Note 1: this source provided results using 2D positioning method.
		- One of these 4 sources observed that horizontal positioning error of DL-TDOA via PRS with 3 RSTDs and a latency of 24s is equal to 5.33km with 90% probability and 8.92km with 95% probability.
		- This source reported that the timing measurement error of PRS can be smaller than 13ns and 16ns with 95% probability under the bandwidth of 8.64 MHz and 4.5 MHz, respectively.
		- This source observed that existing CSI RS can be used to meet the requirement with comparable latency
		- One of these 4 sources observed that horizontal positioning accuracy for a latency of 30s with SNR of 5dB and with 90% probability is equal to 9.44km.
		- This source observed that the maximum timing measurement error that can be allowed to meet the accuracy requirement of 10km is about 80ns.
		- One of these 4 sources observed the horizontal positioning accuracy of less than 10km can be achieved for 90% of UEs with 12 seconds latency and for 95% of UEs with 20 seconds latency.
		- The maximum time measurement error considered by this source is equal to 6ns
	+ One source observed that the horizontal positioning error of DL-TDOA method can be smaller than 10 km with over 80% probability with 180 seconds latency.
		- This source reported that the timing measurement error of PRS can be smaller than 6.1ns with 95%
* One source observed that the geometry of UE location relative to the satellite orbit will impact the positioning performance in DL-TDOA method e.g. for UE’s location at 200km away from the orbital plane, the NTN UE location verification accuracy requirement can be met and the positioning error of DL-TDOA method can be smaller than 10 km with 95% probability (for UE’s location at 200km away from the orbital plane) and a latency of 220 seconds in case of LEO600km and 342 seconds in case of LEO1200km. For UE located under the satellite orbit, NTN UE location verification accuracy requirement can be meet only with 30% probability.
	+ Note 2: This source considered 10 ns UE Clock drift for all time measurement window.
* Note 3: Position accuracy requirements may not be met if realistic assumption on UE clock drift is considered.

**Observation**

For network verified UE location based on UL-TDOA positioning method with single satellite:

Two companies commented on the suitability of the method: Assuming the ambiguity of the mirror image position is resolved and if the measurements needed to perform UL-TDOA can be assumed to be trusted:

* One source observed that UL-TDOA cannot meet the target requirement for both earth fixed beam and earth moving beam. With 180s latency, positioning error performance that can be achieved is 34 km, CDF=90% and 13km, CDF=80%.
	+ This source reported that the timing measurement error of SRS can be smaller than 26.7ns with 95% probability under 30 degree elevation angle for LEO-600 set-1, rural LOS S-band scenario.
* One source observed that the geometry of UE location relative to the satellite orbit will impact the positioning performance in UL-TDOA method e.g. for UE’s location at 200km away from the orbital plane, the NTN UE location verification accuracy requirement can be met and the positioning error of UL-TDOA method can be smaller than 10 km with 95% probability (for UE’s location at 200km away from the orbital plane) and a latency of 220 seconds in case of LEO600km and 342 seconds in case of LEO1200km. For UE located under the satellite orbit, NTN UE location verification accuracy requirement can be meet only with 30% probability.

**Conclusion**

For network verification of UE location in NR NTN with single satellite in view with DL-TDOA positioning: From RAN1 perspective, if the UE’s RSTD measurements report can be assumed to be trusted, DL-TDOA positioning method can meet the accuracy requirement of less than 10km with 90% confidence, in case of:

* + At least LEO600 based deployment
	+ Earth fixed cells
	+ Earth moving cell at least if UE dwell time within the cell is enough to perform at least two RSTD measurements

Note 1: the above is based on evaluation results that didn’t account for UE Clock drift

Note 2: the required over-the-air latency reported in evaluations ranged from less than 20s up to 180s

Note 3: The requirements of Network verification of UE location may not be met if realistic assumption on UE clock drift is considered.

**Conclusion**

For network verification of UE location in NR NTN based on multi-RTT using UE RX-TX time difference report, if the UE reports needed to perform multi-RTT can be assumed to be trusted, existing multi-RTT framework may be reused with potential enhancements to adapt it to NTN context. This may include, but not limited to:

* If justified: NTN-specific definition of UE RX-TX time difference, including as an example, potential modifications to UE Rx – Tx time difference to enable network verification of UE location without introducing any additional measurements at the UE (with respect to Rel-17 NTN)
	+ The following is not precluded: the UE Rx – Tx time difference is defined as TUE-RX – TUE-TX, where TUE-RX – TUE-TX is directly derived from the timing advance *TTA* applied by the UE at a given subframe.
	+ Above does not imply that the relevant work is prioritized.
* Other assistance data (e.g. ephemeris) to be transferred from gNB to the LMF.
* If justified: Other assistance data (e.g. to resolve ambiguity on mirror position issue) to be transferred from UE to LMF
* If justified: Adaptations enabling Rx-TX measurements for Multi-RTT involving multiple cells within the same satellite

For network verification of UE location in NR NTN based on DL-TDOA positioning, if the UE reports needed to perform DL-TDOA positioning can be assumed to be trusted, existing DL-TDOA positioning framework may be reused with potential enhancements to adapt it to NTN context.

**Chair’s note: one company objected the above conclusion because it does not include a conclusion on using UE-specific TA report for network verification of UE location in NR NTN.**

**Agreement**

For the draft reply LS:

**RAN1 response**:

For scenario 1, from RAN1 perspective the RACH-less handover is possible, assuming the following notes can be satisfied, when UE UL transmission synchronization can be maintained by applying pre-compensation using the assistance information, e.g., epoch time, ephemeris, common TA, of the target cell.

For scenario (2)-(4), from RAN1 perspective the RACH-less handover may be possible, assuming the following notes can be satisfied, when UE UL transmission synchronization can be maintained by applying pre-compensation using the assistance information, e.g., epoch time, ephemeris, common TA, of the target cell.

Note 1: RAN1 assumes that the RAN4 UL synchronization requirement specified in Table 7.1C.2-1 of TS38.133 applies to the first UL transmission in the target cell.

Note 2: gNB is expected to provide valid assistance information of the target cell to UE.

Note 3: gNB is expected to ensure the UE can perform the UL transmission while respecting common TA and UE processing time.

**2. Actions:**

**To RAN2:**

RAN1 respectfully asks RAN2 to take the above response into account in the future work.

**To RAN4:**

RAN1 respectfully asks RAN4 whether RAN1’s assumption in Note 1 is correct.

Agreed LS out

* R1-2213001 reply LS on RACH-less handover in NTN Moderator (OPPO)

Documents agreed

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Email discussions

* R1-2212864 Summary #3 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2210952 FL Summary #4: Network verified UE location for NR NTN THALES

#### 2.1.2 Remaining Open issues

Coverage enhancements

Normative is on going

Network verified UE location

* Scope of the normative phase yet to be consolidated

## 2.2 RAN2

#### 2.2.1 Agreements

* **RAN2#119-bis-e, October 10 – 19th 2022, e-meeting**

a) Coverage enhancements

Agreements:

1. RAN2 thinks a UE may use application layer frame aggregation by implementation (no RAN2 spec impacts). (RAN2 can further discuss whether RAN needs to know whether UE is using frame aggregation in the voice packet)

2. RAN2 understands that it is up to network implementation to decide whether to configure SDAP header and integrity protection for a VoNR DRB to reduce the protocol overhead (no RAN2 spec impacts)

b) Network verified UE location

Agreements:

1. RAN2 assumes that the network is able to compute possible UE locations independently from the GNSS location reported by UE

2. RAN2 assumes that the UE location verification procedure can be triggered by the CN and it is up to the CN to decide when to trigger the procedure

3. RAN2 should consider in priority the NGSO case with earth moving and earth fixed beams for the definition of the UE location verification procedure

4. Multi-connectivity involving multiple NTN NG-RAN nodes or NTN NG-RAN node and TN NG-RAN node is not part of the Rel-18 study on UE location verification

5. RAN2 assumes that the verification of the consistency (within 5-10 km) between the actual reported UE location with the UE location(s) computed by the network is up to the 5GC. (this doesn’t mean that RAN2 has nothing to do for this WI objective)

c) Mobility enhancements

Agreements:

1. For NTN-NTN cell reselection with earth moving cell, RAN2 will consider providing parameters of serving cell to UE, for UE to estimate when the serving cell stops providing coverage at the present UE location (FFS whether this will be an optional UE feature) (this does not exclude any time-based or location-based approach) (other solutions can also be considered)

2. To enhance NTN-TN cell reselection, means are defined for a UE to differentiate when camping in an area only covered by NTN network (earth-moving or earth-fixed) vs an area where TN network(s) is/are also available.

Agreements:

1. System information is the basic means for providing necessary parameters to assist UE to estimate when the serving cell stops providing coverage at the present UE location.

2. UE is not required to perform neighbour cell measurements for TN neighbour cells in an area where there is no TN network coverage.

3. The method of detecting the transmission energy or SIB presence to determine the NTN coverage when a UE currently camps on a TN cell is not pursued.

4. In Earth-moving cell, the reference location and distance threshold of serving cell are provided by network for UE to estimate when the serving cell stops providing coverage at the present UE location. FFS how the reference location and/or distance threshold are provided to the UE

Agreements

1. RAN2 can further consider whether some information in the handover command that can be common to all UEs, can be delivered to UEs in common signalling and if there is real benefit (in terms of signalling overhead reduction) in this

2. Send an LS to RAN1 (cc RAN4) listing the scenarios (intra-satellite, inter-satellite with same or different feeder links) and check with RAN1 in which scenarios RACH-less is possible (with no indication of RAN2 preference)

Agreements:

1. Continue the discussion (in future meeting) on group HO / “UE specific pre-configuration of the target cell + group HO” indication in the next meeting, also on the possible real benefits

Agreements:

1. RAN2 confirms that at least for the moving cell case the next serving cells can be largely predicted in NTN (at least for UEs not at the cell edge) thanks to the existence of predefined satellite orbits and negligible UE’s mobility in comparison to satellite’s motion (we can further discuss at the next meeting whether this applies to idle mode UEs as well)

2. New Proposal 2: RAN2 continues the discussion (e.g. at RAN2#120) on the solution with keeping the same PCI after switching of the satellites. Clarify at least the following:

 • RAN1 impact

 • The need to perform UL beam switching and/or RA

 • Applicability to hard or soft satellite switching

LS out

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Email discussions

* [AT119bis-e][102][NR NTN Enh] NW verified UE location (Thales) in R2-2211044
* [AT119bis-e][103][NR NTN Enh] Coverage enhancements (Qualcomm) in R2-2210842
* [AT119bis-e][117][NR NTN Enh] cell reselection enhancements (Intel) in R2-2210860
* [AT119bis-e][119][NR NTN Enh] HO enhancements (Nokia) in R2-2210862
* [AT119bis-e][121][NR NTN Enh] LS on RACH-less HO (Oppo) in R2-2210864
* **RAN2#120, November 14 – 18th 2022, Toulouse**

a) Coverage enhancements

Agreements:

1. From RAN2 perspective we don’t consider msg3 repetition enhancements in R18 NR NTN (apart from msg3 for CFRA, if decided by RAN1)

Agreements:

1. RAN2 will consider enhancements to enable initial blind Msg3 retransmission grant reception in Rel-18 NTN

Agreements:

1. RAN2 doesn’t consider using shorter PDCP SN for VoNR in NTN.

2. Using RLC TM mode for VoNR in NTN is not supported.

3. RAN2 doesn’t consider MAC enhancement to reduce MAC header size for VoNR in NTN.

Agreements:

1. RAN2 will not specify signalling whereby the RAN knows the UE’s frame aggregation information in a voice packet

b) Network verified UE location

Agreements:

1. From RAN2 point of view, assuming the NW may allow the UEs access to services before verifying the UE reported location, the latency of the NW verification can be handled by the NW.

Agreements:

1. RAN2 agrees the re-use of the LCS framework of the LMF for the network verification of UE reported location information in NTN.

2. RAN2 will work on the details of radio protocol aspects of the verification procedure based on the solution investigated by RAN1

c) Mobility enhancements

Agreements:

1. RAN2 will first continue the investigation on the details of the TN coverage data (e.g. accuracy requirements for describing where TN network(s) is/are available) and UE storage overhead before deciding how to send the information to the UE.

2. Continue the discussion on whether to introduce explicit indication to identify TN cells from inter-frequency list and inter-RAT frequency list (FFS on the granularity) or whether we rely on implicit information.

LS out

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Email discussions

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#### 2.2.2 Remaining Open issues

a) Coverage enhancements

* Specify signalling and procedures to support UL coverage enhancements

b) Network verified UE location

Scope of the normative phase yet to be defined

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#117-bis-e, October 10 – 18th 2022, e-meeting**
1. Mobility enhancements

Agreements

* **There is no need to exchange the cell coverage stop time in the signaling of time-based CHO parameters.**
* **Agree to add time information for time-based CHO, which includes a start time T1 and time duration T2, in Xn Handover Request message, taking R3-225580 as the starting point.**
* **There is no need to exchange a ‘Hard or Soft Feeder link Switch over indication’ via XN Setup procedure and Configuration Update procedure.**

Documents agreed

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Email discussions

1. Network verified UE location

Agreements

* **RAN3 is not affected by UE location reporting**
* **No additional RAN3 impact if UE location is not correct**

Documents agreed

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Email discussions

• R3-226075 #NTN1\_ServiceContinuity, Huawei

• R3-225952 #NTN2\_LocationVerification, Ericsson

* **RAN3#118, November 14 – 18th 2022, Toulouse**
1. Mobility enhancements

Agreements

* **WA: Uu Cell ID is used in HO signaling.**
* **The earth moving cell scenario described in Section 3.1 of** [**R3-226859**](file:///C%3A%5CUsers%5Cchuberrn%5CDocuments%5C000_DATA_NICOLAS%5C02_3GPP%20Nicolas%5CRAN%5CMeetings%5C221212_RAN%2398-e%20meeting%5CSatellite%20contributions%5CA_Preparation%5C3_SR%20of%20R18%20NR_NTN_enh%5CInbox%5CR3-226859.zip) **is valid.**

Documents endorsed

* R3-226106 XnAP BLCR on NTN Functionality (Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC) CR0933r1, TS 38.423 v17.2.0, Rel-18, Cat. B

Email discussions

* [R3-226859](file:///C%3A%5CUsers%5Cchuberrn%5CDocuments%5C000_DATA_NICOLAS%5C02_3GPP%20Nicolas%5CRAN%5CMeetings%5C221212_RAN%2398-e%20meeting%5CSatellite%20contributions%5CA_Preparation%5C3_SR%20of%20R18%20NR_NTN_enh%5CInbox%5CR3-226859.zip) # 41\_NRNTN Nokia
1. Network verified UE location

Agreements

Documents endorsed

* R3-226102 UE Location Verification by the Network (Ericsson, CATT, Thales, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell) draftCR
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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

* **FFS on what’s the TAC to be used when using Uu cell ID in Xn setup and configuration update procedures.**
* **CHO over NG? Send LS to SA2?**
* **How to support this EMC (Earth Moving Case) case?**
* **Any other impacts, in addition to the support for transferring {T1, duration} over NGAP?**
* **Other issues if any**

## 2.4 RAN4

#### 2.4.1 Agreements

* **RAN4#104-bis-e, October 10 – 19th 2022, e-meeting**

a) NR-NTN deployment in above 10 GHz

**UERF aspects**

UE RF requirement in Ka-band

**Sub-topic #1-1 power class and UE types for VSAT UE**

**Issue 1-1-1: power class**

Agreement:

* *Define one new power class for NTN UE*
* *FFS on whether this power class is applicable to fixed, movable NTN device, or both*
* *The regulation requirements should be considered when defining the new power class*
* *FFS on other new power classes for NTN UE*

**Issue 1-1-2: UE type**

Agreement:

* Handheld smartphone type devices are out of scope for above 10 GHz NTN bands.

**Sub-topic #1-2 Beam correspondence**

**Issue 1-2-1 Beam correspondence**

*Way forward:*

* FFS on Beam correspondence requirements in terms of DL measurements to select UL beams are suitable or not for NTN FDD bands above 10 GHz

Documents approved:

* R4-2217743 WF on NTN UE in Ka-band

Documents agreed:

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[Other documents]

Email discussion summaries:

* R4-2217792 Email discussion summary for [104-bis-e][140] NR\_NTN\_enh\_UERF

**BSRF Test Demod aspects**

NTN system parameters and SAN RF aspects

**1. Topic #1: NTN system parameters**

**Sub-topic 1-1: Terminal types**

Issue 1-1-1: VSAT and/or ESIM

Issue 1-1-2: Power class

**Sub-topic 1-2: Orbit types**

Issue 1-2-1: GSO, NGSO

The following proposals are agreed.

**Proposal 1-2-1-1:**RAN4 shall prioritize GSO, NGSO (LEO-600 km and LEO-1200 km) orbit.

**Proposal 1-2-1-2:**RAN4 should consider MEO and HEO if time allows.

**Sub-topic 1-3: Frequency range**

[see GTW Agreement 18/10/2022]

Following options can be considered as starting point for future RAN4 meetings for above 10GHz Band introduction

* **Option 1:** the downlink frequency range 17.7-20.2 GHz, the uplink frequency range 27.5-30.0 GHz for NTN Ka-band definition (i.e. spectrum allocated by ITU to FSS).
* **Option 2:** the downlink frequency range 19.7-20.2 GHz, the uplink frequency range 29.5-30.0 GHz for NTN Ka-band definition (i.e. spectrum allocated by ITU to MSS and FSS).
* **Option 3:** the downlink frequency range 17.3-17.7 GHz, the uplink frequency range 29.5-30.0 GHz for NTN Ka-band definition (the DL part is out of frequency range of current harmonized Ka band)
* **Option 4:** define multi bands in this frequency range i.e. one band as option 1 and another band as option 2; and/or another band as option 3
* Other options not precluded

**Sub-topic 1-4: Waveform parameters**

Issue 1-4-1: channel bandwidth

The following proposal is agreed. Optional higher channel bandwidths and asymmetric channel bandwidths between DL and UL require further discussion.

**Proposal 1-4-1-1:** For NTN operation above 10 GHz, at least the channel bandwidths 50, 100 and 200 MHz are supported.

**Note:** 400 MHz can be considered as Optional or FFS.

**Proposal 1-4-1-2:** RAN4 to further discuss whether:

1) higher channel bandwidths (e.g. 400 MHz and beyond) are supported (with 120 kHz SCS)

2) Asymmetric channel bandwidths between DL and UL of 50+100, 50+200, and 50+400 MHz are considered for the Ka-band.

Issue 1-4-2: sub-carrier spacing

The following proposal is agreed.

**Proposal 1-4-2-1:** For NTN operation above 10 GHz, 60 kHz and 120 kHz Sub-Carrier Spacing (SCS) are supported.

Issue 1-4-3: Spectral utilization requirement

Further discussion is needed.

Issue 1-4-4: Channel numbering

The following proposals are agreed.

**Proposal 1-4-4-1:** For NTN operation in above 10 GHz, use the same channel raster for NTN Ka-band and the NR-ARFCN in the Table 2.4.1 and GSCN in Table 2.4.2.

Table 2.4.1. NR-ARFCN for NTN Ka-band

|  |  |  |
| --- | --- | --- |
| Operating Band | ΔFRaster(kHz) | Uplink and DownlinkRange of NREF(First – <Step size> – Last) |
|  | 60 | TBD – <1> – TBD  |
|  | 120 | TBD – <2> – TBD  |
| Note: Table adopted for FDD  |

Table 2.4.2. GSCN for NTN Ka-band

|  |  |  |  |
| --- | --- | --- | --- |
| NR Operating Band | SS Block SCS | SS Block pattern1 | Range of GSCN(First – <Step size> – Last) |
|  | 120 kHz | Case D | TBD- <1> - TBD |
|  | 240 kHz | Case E | TBD - <2> - TBD |
| NOTE 1: SS Block pattern is defined in clause 4.1 in TS 38.213 [10]. |

 **Note:** Addressable range of ARFCN and GSCN to be discussed e.g. if extended.

**Proposal 1-4-4-2:** For NTN operation in above 10 GHz, instead of **[n1024]** numbering use **[n512]** as starting number for the first introduced band.

**Note:** It is understood that the NTN band number in above 10 GHz will decrease with new NTN band introductions (as previously done for e.g. n256 and n255 in FR1).

Issue 1-4-5: Tx-Rx separation values

Further discussion is needed

**Sub-topic 1-5: band definition**

Issue 1-5-1: band numbering

Further discussion is needed.

Issue 1-5-2: specific recommendations

The following proposals are agreed.

**Proposal 1-5-2-1:** RAN4 to follow for NTN above 10 GHz bands the usual 3GPP process adopted for adjacent band coexistence.

**Proposal 1-5-2-2:** The recommendations from ITU, WRC and regional entities (FCC, CEPT, etc) have to be considered, as it was done for example for NTN FR1 or any other RAN4 band definition.

Issue 1-5-3: Handling of Region/country specific regulatory requirements

Further discussion is needed.

**2. Topic #2: SAN RF aspects**

**Sub-topic 2-1: SAN RF Requirements**

Issue 2-1-1: Radiated

The following proposal is agreed (see GTW Agreement 18/10/2022).

**Proposal 2-1-1-1:** As starting point, at least SAN radiated requirements shall be defined for NTN Ka-band in Rel-18. FFS whether conductive requirements shall be defined or not

Issue 2-1-2: type 2-O

Further discussion is needed.

Issue 2-1-3: SAN RF parameters

**The following parameters can be considered as starting point for Tx and Rx Requirements.**

**Proposal 2-1-3-1:** Further discussion is needed on whether all of the following requirements need to be specified.

* SAN output power
* Output power dynamics
* RE power control dynamic range
* Total power dynamic range
* Transmit ON/OFF power
* Transmitted signal quality
* Frequency error
* Modulation quality
* Time alignment error
* Unwanted emissions
* Occupied bandwidth
* Adjacent Channel Leakage Power Ratio
* Operating band unwanted emissions
* Transmitter spurious emissions
* Transmitter intermodulation

**Proposal 2-1-3-2:** Further discussion is needed on whether all of the following requirements need to be specified.

* Reference sensitivity level
* Dynamic range
* ACS
* In-band blocking
* Out of band blocking
* Receiver spurious emission
* Receiver intermodulation
* In-channel selectivity

Documents approved:

* R4-2217507 NR NTN enhancement workplan
* R4-2217467 WF on NR NTN Enhancements Part1
* R4-2217468 Way forward on [313] NR\_NTN\_enh\_Part2
* R4-2217469 Simulation assumptions for NTN co-existence in bands above 10GHz

Documents agreed:

* -

[Other documents]

Email discussion summaries:

* R4-2217496 Email discussion summary for [104-bis-e][312] NR\_NTN\_enh\_Part1
* R4-2217497 [Email discussion summary for 104-bis-e][313] NR\_NTN\_enh\_Part2

**RRM aspects**

RRM aspects discuccion will be started from RAN4#106

b) Coverage enhancements

Coverage enhancements discussion will be started from RAN4#106

c) Mobility enhancements

Mobility enhancements discussion will be started from RAN4#106

* **RAN4#105, November 14 – 18th 2022, Toulouse**

a) NR-NTN deployment in above 10 GHz

**UERF aspects**

UE RF requirement in Ka-band

**Issue 1-2: The scope of NTN UE in Ka-band from 3GPP perspective**

**Agreement:**

* Define the requirements based on the assumption that the dish antenna is used for GEO and phase antenna for LEO
	+ FFS whether to restrict the assumption to Rel-18 or not.

**Sub-topic 3 Implementation assumption for NTN VSAT UE**

**Issue 3-1: IF conversion**

**Agreement:**

* IF conversion is assumed as the baseline for movable NTN UE

**Sub-topic 4 RF requirements for NTN UE in Ka-band**

**Agreement:**

* For NTN UE with parabolic antenna, to define the conducted requirement and further discuss how to define radiated requirement for it (e.g. EIRP limits, etc)

**Issue 4-2: For NTN UE with phase antenna array, radiated requirement only to be defined?**

**Agreement:**

* For NTN UE with phase antenna array if defined, only radiated requirements are to be specified.

Documents approved:

* R4-2220573 WF on NTN UE RF requirements

Documents agreed:

* -

[Other documents]

Email discussion summaries:

* R4-2220119 Topic summary for [105][139] NR\_NTN\_enh\_UERF

**BSRF Test Demod aspects**

Coexistence scenario

Following agreements have been made:

1. For DL co-existence study, referred to existing FR2 TN system parameters and requirements as starting point for simulation alignment purpose
* FFS how to consider low frequency range within DL part of Ka bands.
* Focus NTN (DL) and TN (DL) for initial co-existence simulation
1. TN 400MHz and NTN 400MHz can be the second priority for the co-existence study.
2. RAN4 should not consider the rural macro deployment scenario for TN. Further discussion on NTN-TN propagation model is needed.
3. Consider Dense Urban scenario of TN system with the Mirco BSs as the second priority for the coexistence study.
* Further discuss the detailed assumption e.g. the density, deployment areas and power assumption, etc.
1. For ESIM type consideration, await conclusions of relevant issues in [139] (UE) and [132] (NR\_NTN\_enh\_Part1)
2. Table 1.1-1 Aggressor and victim table is to be used as starting point.

Table 1.1-1 Aggressor and victim combination

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No. | Combination | Aggressor | Victim | Notes | Study Phase |
| 1  | TN with NTN | NTN UL | TN UL |  |  |
| 2 | TN with NTN | TN UL | NTN UL |  |  |
| 3 | TN with NTN | NTN UL | TN DL |  |  |
| 4  | TN with NTN | TN DL | NTN UL |  |  |
| 5 | TN with NTN | TN DL | NTN DL |  |  |
| 6 | TN with NTN | NTN DL | TN DL |  |  |
| 7 | TN with NTN | NTN DL | TN UL |  |  |
| 8 | TN with NTN | TN UL | NTN DL |  |  |
| NOTE 1: For coexistence between Ka band DL and surrounding TN bands, this need more discussions since currently there are no 3GPP defined TN bands specified. |

Network layout model

1. Further discuss how to consider the deployment of TN Urban areas.
* Option 1: No deployment of TN outside TN Urban areas
* Option 2: [TBD]% active ratio applied to Urban areas
* Option 3: Density of Urban TN
* Option 4: Others

System parameters

1. Use TR 38.821 Set 1 antenna and Set 2 antenna as the starting point. Companies are encouraged to provide more information of existing models as well as possible new parameters, e.g. phased array antenna model, etc.
2. NRB configuration per BandWidth size and SCS is agreed as following

|  |  |
| --- | --- |
| **Configuration FR2 Ka-band** | **NRB** (20**0MHz BW)** |
| SCS 120 kHz | 132 |

1. Await conclusion of [139] NTN UE and [312] NTN\_enh\_Part1 discussion to determine NTN UE and SAN parameters

SAN RF requirements

* **Topic #3:** SAN RF requirements
	+ **Sub-topic 3-1 SAN Type**
		- **Issue 3-1-1:** Radiated Requirements (SAN type 2-O)
		- **Issue 3-1-2:** Conducted Requirements (SAN type 2-H)
	+ **Sub-topic 3-2 OTA requirements**
		- **Issue 3-2-1:** OTA Tx requirements
		- **Issue 3-2-2:** OTA Rx requirements

**Proposals**

* + Option 1: Agree with the list of OTA **Rx** requirements to be specified as listed in Table 2 (R4-2218491/P3).
	+ Option 2: **The OTA sensitivity, OTA dynamic range, OTA in-band blocking,** (OTA receiver spurious emission, and OTA receiver intermodulation) **are not applicable for SAN type 2-O** in Ka band of NTN ([R4-2218466](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_105/Docs/R4-2218466.zip)/O3)
	+ Option 3: To define SAN RF requirement for NTN in Ka-band as proposed below (R4-2219380/P2)

**Recommended WF**

* + Option 1 as starting point
		- FFS whether **OTA sensitivity, OTA dynamic range, OTA in-band blocking** applicable or not for SAN type 2-O in Ka-band
		- Detailed requirements need to be further study
	+ **Sub-topic 3-3 Other SAN Antenna Types**
		- Issue 3-3-1: SAN Antenna

**Proposals**

* + Option 1: further discuss other antenna types e.g. reflection antenna architecture for Ka-band (R4-2219380/P1)

**Recommended WF**

* FFS, depending on workload

Annex: Online Discussion RAN4#105 Brk1 (15/11/2022)

Issue 3-1-1: Radiated Requirements (SAN type 2-O)

* Proposals
	+ Option 1: define SAN type 2-O for Ka band NTN ([R4-2219380](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_105/Docs/R4-2219380.zip)/P1)
	+ Option 2: define SAN type 2-O for Ka band NTN (R4-2218466/P2)
		- Note: Extend FR2-1 downwards.
	+ Option 3: introduce SAN type 2-O, together with extension of the lower bound of the FR2 frequency range to cover both DL and UL of the full Ka band.
		- Note:
			* Option 1: Introduce FR2-0 subrange, to cover the full Ka band within FR2. (R4-2219971/P1 & P2)
			* Option 2: sub-frequency range FR2-0-NTN will extend current FR2 definition for NTN only (R4-2218489/P1)

Issue 3-1-2: Conducted Requirements (SAN type 2-H)

* Proposals
	+ Option 1: Not to define conductive requirements for Ka band NTN (R4-2218466/P1, R4-2218491/P1)
* Agreement: Introduce Type 2-O radiated requirements and FFS for conductive requirements for Ka band/above 10GHz.

Issue 3-2-1: OTA Tx requirements

* Proposals
	+ Option 1: Agree with the list of OTA Tx requirements to be specified as listed in Table 1 (R4-2218491/P2)
	+ Option 2: The OTA RE power control dynamic range, (OTA transmit ON/OFF power, OTA time alignment error, and OTA transmitter intermodulation) are not applicable for SAN type 2-O in Ka band of NTN. ([R4-2218466](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_105/Docs/R4-2218466.zip)/O2)
	+ Option 3: To define SAN RF requirement for NTN in Ka-band as proposed below (R4-2219380/P2)
* Agreement:
	+ Option 1 as starting point
		- FFS whether (OTA) RE power control dynamic range and (OTA) Total power dynamic range applicable or not
		- Detailed requirements need to be further study

ad-hoc meeting for the NTN Ka band definition

**Issue 1-1-1:** Band definition principles

* Proposals
	+ Option 1: to define separate bands for FSS and MSS to enable some terminal access/barring mechanism. (R4-2219378/P1)
	+ Option 2: do not define separate bands for FSS and MSS
* Recommended WF
	+ TBA

Chair: FSS spectrum should be included in 3GPP band definition for the purpose of enabling ~~ESIM/moving VSAT~~ moveable NTN terminal with priority. [Fixed VSAT in FSS allocation – Companies to check RAN4 ToR to see if there is a restriction on fixed device in fixed spectrum]

**Issue 1-1-2:** Number of Ka-bands to be defined

* Proposals
	+ Option 1: Several NTN Ka-bands
		- To address the diversity of spectrum allocation to ESIM by national regulators, RAN4 should consider specifying several “NTN Ka-bands”. Each band would then be applicable to the corresponding regulator’s country (R4-2218489/P4, [R4-2218488](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_105/Docs/R4-2218488.zip)/P4)
	+ Option 2: One NTN Ka-band
* Recommended WF
	+ TBA

Chair: Define several NTN Ka-bands to address the diversity of spectrum allocation ~~to ESIM~~ by national regulators, RAN4 should consider specifying several “NTN Ka-bands”

Documents approved:

* R4-2220241 WF for NTN coexistence study for above 10GHz
* R4-2220304 WF for above 10GHz SAN RF requirements

Documents agreed:

* -

[Other documents]

Email discussion summaries:

* R4-2220138 Summary for [105][312] NR\_NTN\_enh\_Part1
* R4-2220139 Summary for [105][313] NR\_NTN\_enh\_Part2
* R4-2220224 Ad-hoc minutes for NTN above 10GHz band introduction

**RRM aspects**

RRM aspects discuccion will be started from RAN4#106

b) Coverage enhancements

Coverage enhancements discussion will be started from RAN4#106

c) Mobility enhancements

Mobility enhancements discussion will be started from RAN4#106

#### 2.4.2 Remaining Open issues

NR-NTN deployment in above 10 GHz

* Study and identify NTN example band: Analysis of regulations and adjacent channel co-existence scenarios.
* 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

* Evaluate the coverage performance and identify the candidate physical radio channels that have coverage issues specific to NTN with following target services taking into account the studies in TR38.830 where appropriate, as well as general coverage enhancement techniques specified in Rel-18
	+ VoIP and low-data rate services for commercial handset terminals

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#110-bis-e, October 10 – 19th 2022, e-meeting**

Submitted TDOCs:

* R1-2210694 other Session notes for 9.11 (NTN (Non-Terrestrial Networks) enhancements) Ad-Hoc Chair (Huawei)
* R1-2210186 Work Plan R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R1-2210344 discussion Summary #1 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2210345 discussion Summary #2 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2210346 discussion Summary #3 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2209768 discussion Discussion on coverage enhancement for NR NTN Baicells
* R1-2209656 discussion On coverage enhancements for NR NTN Ericsson
* R1-2209802 discussion Discussion on coverage enhancement for NR NTN LG Electronics
* R1-2209796 discussion Discussion on coverage enhancement for NR-NTN Panasonic
* R1-2210004 discussion Coverage enhancements for NR NTN Qualcomm Incorporated
* R1-2209921 discussion Discussion on coverage enhancement for NR NTN NTT DOCOMO, INC.
* R1-2210023 discussion Discussion on coverage enhancement for NR NTN Lenovo
* R1-2210049 discussion Considerations on coverage enhancements for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2208693 discussion Discussion on coverage enhancement for NTN ZTE
* R1-2208954 discussion Discussion on UL coverage enhancement for NR NTN CATT
* R1-2208834 discussion Discussion on coverage enhancement for NR NTN OPPO
* R1-2208662 discussion Discussions on coverage enhancement for NR NTN vivo
* R1-2208567 discussion Discussion on coverage enhancements for NTN Spreadtrum Communications
* R1-2208388 discussion Discussion on NR NTN coverage enhancement THALES
* R1-2208435 discussion Discussion on coverage enhancement for NR NTN Huawei, HiSilicon
* R1-2208395 discussion Coverage enhancement for NR NTN MediaTek Inc.
* R1-2209750 discussion On coverage enhancement for NR NTN Samsung
* R1-2209599 discussion On Coverage Enhancement for NR NTN Apple
* R1-2209411 discussion Discussion on coverage enhancement for NR NTN ETRI
* R1-2209422 discussion Discussion on coverage enhancements aspects for NR NTN NEC
* R1-2209356 discussion Discussion on coverage enhancement for NR NTN CMCC
* R1-2209264 discussion Discussion on coverage enhancement for NR-NTN xiaomi
* R1-2209114 discussion On coverage enhancement for NR NTN Sony
* R1-2209071 discussion On coverage enhancement for NR NTN Intel Corporation
* R1-2209072 discussion On network verified UE location for NR NTN Intel Corporation
* R1-2209115 discussion Network verified UE location for NR NTN Sony
* R1-2209265 discussion Discussion on the network verified location xiaomi
* R1-2209398 discussion NTN NW verified UE location Lenovo
* R1-2209600 discussion Discussion on Network Verified UE Location Apple
* R1-2209751 discussion Network verified UE location for NR NTN Samsung
* R1-2208396 discussion Network verified UE location for NR NTN MediaTek Inc.
* R1-2208436 discussion Discussion on network-verified UE location for NR NTN Huawei, HiSilicon
* R1-2208389 discussion Discussion on network verified UE location in NR NTN THALES
* R1-2208390 discussion FL Summary #1: Network verified UE location for NR NTN THALES
* R1-2208391 discussion FL Summary #2: Network verified UE location for NR NTN THALES
* R1-2208392 discussion FL Summary #3: Network verified UE location for NR NTN THALES
* R1-2208393 discussion FL Summary #4: Network verified UE location for NR NTN THALES
* R1-2208394 discussion FL Summary #5: Network verified UE location for NR NTN THALES
* R1-2208663 discussion Discussions on network verified UE location for NR NTN vivo
* R1-2208835 discussion Discussion on network verified UE location for NR NTN OPPO
* R1-2208955 discussion Evaluations on network verified UE location for NR NTN CATT
* R1-2208694 discussion Discussion on network verified UE location for NR NTN ZTE
* R1-2210050 discussion Further discussion on Network Verified UE Positioning Nokia, Nokia Shanghai Bell
* R1-2210069 discussion Discussion on network verified UE location for NTN PANASONIC
* R1-2209922 discussion Discussion on Network verified UE location for NR NTN NTT DOCOMO, INC.
* R1-2210005 discussion Network verified UE location for NR NTN Qualcomm Incorporated
* R1-2209649 discussion On network verified UE location in NR NTN Ericsson Limited
* R1-2209643 discussion UE location determination during initial access in NTN InterDigital, Inc.
* R1-2210195 discussion Discussion on network verified UE location for NR NTN LG Electronics
* **RAN1#111, November 14 – 18th 2022, Toulouse**

Submitted TDOCs:

* R1-2212849 other Session notes for 9.11 (NTN (Non-Terrestrial Networks) enhancements) Ad-Hoc Chair (Huawei)
* R1-2213001 LS out Reply LS on RACH-less handover in NTN RAN1, OPPO
* R1-2212997 LS out [Draft] reply LS on RACH-less handover in NTN OPPO
* R1-2212930 LS out [Draft] reply LS on RACH-less handover in NTN OPPO
* R1-2210953 discussion R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R1-2211093 discussion Coverage enhancement for NR NTN MediaTek Inc.
* R1-2211026 discussion Discussions on coverage enhancements for NR NTN vivo
* R1-2210872 discussion Discussion on coverage enhancement for NR NTN Huawei, HiSilicon
* R1-2211176 discussion Further discussion on UL coverage enhancement for NR NTN CATT
* R1-2211109 discussion Discussion on coverage enhancement for NTN ZTE
* R1-2211247 discussion Discussion on coverage enhancements for NTN Spreadtrum Communications
* R1-2211115 discussion Discussion on coverage enhancement for NR NTN Hyundai Motor Company
* R1-2211416 discussion On coverage enhancement for NR NTN Intel Corporation
* R1-2211460 discussion Discussion on coverage enhancement for NR NTN OPPO
* R1-2211342 discussion Discussion on coverage enhancement for NR-NTN xiaomi
* R1-2211328 discussion Discussion on DMRS bundling for NR NTN NTPU
* R1-2211626 discussion On coverage enhancement for NR NTN Sony
* R1-2211594 discussion Discussion on coverage enhancement for NR-NTN Panasonic
* R1-2211567 discussion Discussion on coverage enhancement for NR NTN ETRI
* R1-2211828 discussion Discussion on Coverage Enhancement for NR NTN Apple
* R1-2211754 discussion Coverage enhancement for NR NTN NEC
* R1-2211699 discussion Discussion on coverage enhancement for NR NTN CMCC
* R1-2212064 discussion On coverage enhancement for NR NTN Samsung
* R1-2211929 discussion Discussion on coverage enhancement for NR NTN LG Electronics
* R1-2212136 discussion Coverage enhancements for NR NTN Qualcomm Incorporated
* R1-2212002 discussion Discussion on coverage enhancement for NR NTN NTT DOCOMO, INC.
* R1-2211883 discussion Discussion on coverage enhancement for NR NTN Lenovo
* R1-2212864 discussion Summary #4 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2212865 discussion Summary #5 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2212571 discussion Summary #3 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2212569 discussion Summary #1 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2212570 discussion Summary #2 on 9.11.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2212325 discussion On coverage enhancements for NR NTN Ericsson
* R1-2212401 discussion Considerations on coverage enhancements for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2212240 discussion Coverage enhancement for NR NTN MediaTek Inc.
* R1-2212213 discussion Discussion on coverage enhancement for NR NTN Baicells
* R1-2212241 discussion Network verified UE location for NR NTN MediaTek Inc.
* R1-2212402 discussion Further discussion on Network Verified UE Positioning Nokia, Nokia Shanghai Bell
* R1-2212744 discussion Discussion on how to reply to RAN2 LS on RACH-less handover in NTN Moderator (OPPO)
* R1-2212809 LS out [Draft] reply LS on RACH-less handover in NTN OPPO
* R1-2211765 discussion On network verified UE location in NR NTN Ericsson Limited
* R1-2212003 discussion Discussion on Network verified UE location for NR NTN NTT DOCOMO, INC.
* R1-2212137 discussion Network verified UE location for NR NTN Qualcomm Incorporated
* R1-2211930 discussion Discussion on network verified UE location for NR NTN LG Electronics
* R1-2212065 discussion Network verified UE location for NR NTN Samsung
* R1-2211746 discussion NTN NW verified UE location Lenovo
* R1-2211829 discussion On Network Verified UE Location Apple
* R1-2211601 discussion Discussion on Network-verified UE location for NTN PANASONIC
* R1-2211627 discussion Network verified UE location for NR NTN Sony
* R1-2211343 discussion Discussion on the network verified location xiaomi
* R1-2211461 discussion Discussion on network verified UE location for NR NTN OPPO
* R1-2211417 discussion On network verified UE location for NR NTN Intel Corporation
* R1-2211110 discussion Discussion on network verified UE location for NR NTN ZTE
* R1-2211177 discussion Further evaluations on network verified UE location for NR NTN CATT
* R1-2210873 discussion Discussion on network-verified UE location for NR NTN Huawei, HiSilicon
* R1-2210948 discussion Discussion on network verified UE location in NR NTN THALES
* R1-2210949 discussion FL Summary #1: Network verified UE location for NR NTN THALES
* R1-2210950 discussion FL Summary #2: Network verified UE location for NR NTN THALES
* R1-2210951 discussion FL Summary #3: Network verified UE location for NR NTN THALES
* R1-2210952 discussion FL Summary #4: Network verified UE location for NR NTN THALES
* R1-2211027 discussion Discussions on UE location verification in NR NTN vivo
* R1-2211094 discussion Network verified UE location for NR NTN MediaTek Inc.

## 4.2 RAN2

* **RAN2#119-bis-e, October 10 – 19th 2022, e-meeting**

Submitted TDOCs:

* R2-2210766 Work Plan R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R2-2211032 LS in Response LS on LCS framework for Network verified UE location (NTN) (S2-2209589; contact: CATT) SA2
* R2-2210033 discussion Discussion on coverage enhancement for NR NTN Xiaomi
* R2-2210285 discussion Consideration on coverage enhancements ZTE Corporation, Sanechips
* R2-2210460 discussion Discussion on Coverage Enhancements for NR NTN Hyundai Motor Company
* R2-2210566 discussion Discussion on the L2 header reduction in NTN LG Electronics Inc.
* R2-2210645 discussion Discussion on Coverage Enhancements for NR NTN Nokia, Nokia Shanghai Bell
* R2-2210685 discussion Discussion on RAN protocol overhead reduction Huawei, HiSilicon
* R2-2210758 discussion R18 NR NTN Coverage enhancements Ericsson
* R2-2210842 discussion [offline-103] Coverage enhancements Qualcomm Incorporated
* R2-2209389 discussion Discussion on coverage enhancement in NR NTN CAICT
* R2-2209406 discussion Discussion on NTN Coverage Enhancement CATT
* R2-2209508 discussion Discussion on RAN overhead reduction for VoNR support in NTN vivo
* R2-2209709 discussion Frame aggregation for coverage enhancement Qualcomm Incorporated
* R2-2209710 discussion Protocol overhead reduction for coverage enhancement Qualcomm Incorporated
* R2-2209804 discussion Consideration on NTN Coverage Enhancement Apple
* R2-2209969 discussion Potential issues for Msg3 repetition in NTN Lenovo
* R2-2211044 LS out Latency impact for NTN verified UE location RAN2
* R2-2210004 discussion On NTN NW verified UE location aspects Lenovo
* R2-2210096 discussion Discussion on network verified UE location OPPO
* R2-2210120 discussion Discussion on network verified UE location Xiaomi, CAICT
* R2-2210242 discussion Network Verified UE Location Samsung R&D Institute UK
* R2-2210286 discussion Consideration on NW verified UE location ZTE Corporation, Sanechips
* R2-2210336 discussion On network verified position Nokia, Nokia Shanghai Bell
* R2-2210443 discussion Discussion on Network Verified UE Location NTT DOCOMO INC.
* R2-2210509 discussion Considerations on UE Location Verification via Network CMCC
* R2-2210709 discussion UE location verification in NTN Deutsche Telekom, Huawei, HiSilicon
* R2-2210757 discussion R18 NR NTN Network verified UE location Ericsson
* R2-2210841 discussion [AT119bis-e][102][R18 NR-NTN] NW verified UE location (Thales) Thales
* R2-2209407 discussion Discussion on UE Location Verification CATT
* R2-2209444 discussion On Network Verified UE Location in NR NTN MediaTek Inc.
* R2-2209509 discussion Discussion on Network verification of UE location in Rel-18 NR NTN vivo
* R2-2209579 discussion Discussion on the technical issues of positioning methods in single-satellite NTN Intel Corporation
* R2-2209597 discussion Summary of POST119-e [108] NW verified UE location (Thales) THALES
* R2-2209665 discussion Discussion on the network verfied UE location Huawei, HiSilicon
* R2-2209793 discussion Discussion on network verified UE location Apple
* R2-2209984 discussion Discussion on UE location verify procedure Spreadtrum Communications
* R2-2211017 LS out LS on RACH-less handover in NTN RAN2
* R2-2210045 discussion Discussion on assistance information of cell reselection for NTN-TN mobility ITRI
* R2-2210090 discussion Discussion on mobility enhancements for idle and inactive Ues OPPO
* R2-2210095 discussion Discussion on NTN handover enhancements OPPO
* R2-2210121 discussion Cell reselection enhancements and handover signaling overhead reduction Xiaomi, CAICT
* R2-2210159 discussion Cell reselection enhancements CMCC
* R2-2210160 discussion Mobility enhancements for connected mode CMCC
* R2-2210198 discussion NR NTN connected mode mobility enhancement NEC Telecom MODUS Ltd.
* R2-2210217 discussion NTN-TN mobility enhancements Sony
* R2-2210218 discussion Signaling overhead reduction during NTN-NTN HOs Sony
* R2-2210338 discussion NTN-NTN handover enhancement for RRC\_CONNECTED UEs NEC Telecom MODUS Ltd.
* R2-2210353 discussion Further view on Idle- and Connected-mode NTN mobility in Rel-18 Nokia, Nokia Shanghai Bell
* R2-2210405 discussion Discussion on NTN mobility enhancements Huawei, HiSilicon
* R2-2210438 discussion RRC Idle/Inactive mobility enhancements InterDigital
* R2-2210439 discussion RRC Connected mobility enhancements InterDigital
* R2-2210467 discussion NTN mobility enhancements in connected mode Samsung Research America
* R2-2210468 discussion NTN cell reselection enhancements Samsung Research America
* R2-2210479 discussion Discussion on NTN mobility Sharp
* R2-2210589 discussion Discussion on NTN-TN mobility and NTN-NTN mobility ITL
* R2-2210598 discussion Discussion on mobility and service continuity enhancements for NR NTN Turkcell, Deutsche Telekom
* R2-2210629 discussion Further discussion on NTN-TN and NTN-NTN mobility NTT DOCOMO, INC.
* R2-2210668 discussion Discussion on NTN-NTN and NTN-TN mobility ZTE corporation, Sanechips
* R2-2210732 discussion R18 NR NTN Mobility enhancements Ericsson
* R2-2210737 discussion Discussion on idle mode aspects for NTN LG Electronics Inc.
* R2-2210767 discussion Discussion on cell reselection enhancements for RRC\_IDLE/INACTIVE UEs to reduce UE power consumption PANASONIC
* R2-2210769 discussion Network-driven NTN-NTN Mobility Considerations Lockheed Martin
* R2-2210789 discussion Discussion on NTN-NTN and NTN-TN mobility ZTE Corporation, Sanechips, CAICT
* R2-2209390 discussion Discussion on NTN-NTN mobility CAICT
* R2-2209408 discussion Discussion on NTN Mobility Enhancements CATT
* R2-2209445 discussion Handover Enhancement in LEO NTN with Earth-moving Cells MediaTek Inc.
* R2-2209510 discussion Discussion on mobility and service continuity enhancement vivo
* R2-2209577 discussion Discussion on NTN handover enhancements Intel Corporation
* R2-2209578 discussion Discussion on NTN cell reselection enhancements Intel Corporation
* R2-2209711 discussion Signaling and congestion reduction in satellite switch Qualcomm Incorporated
* R2-2209733 discussion Discussion of NTN-TN and NTN-NTN mobility China Telecom
* R2-2209752 discussion Discussion on NTN-NTN CONNECTED mobility and service continuity enhancements Transsion Holdings
* R2-2209753 discussion Discussion on NTN-TN IDLE and INACTIVATE mobility and service continuity enhancements Transsion Holdings
* R2-2209805 discussion NTN Mobility Enhancement Apple
* R2-2209855 discussion Discussion on RACH-less handover ASUSTeK
* R2-2210990 discussion [offline-117] cell reselection enhancements Intel
* R2-2209921 discussion NTN handover enhancements LG Electronics Inc.
* R2-2210860 discussion Report of [AT119bis-e][117][NR NTN Enh] cell reselection enhancements (Intel) Intel Corporation
* R2-2209970 discussion Further considerations on IDLE/INACTIVE mobility Lenovo
* R2-2210862 discussion Report from [AT119bis-e][119][NR NTN Enh] HO enhancements (Nokia) Nokia, Nokia Shanghai Bell
* R2-2210864 LS out [Draft] LS on RACH-less HO in NTN OPPO
* R2-2209985 discussion Some enhancements in NTN handover Spreadtrum Communications
* **RAN2#120, November 14 – 18th 2022, Toulouse**

Submitted TDOCs:

* R2-2211132 LS in LS on Satellite coverage data transfer to a UE using UP versus CP (S2-2209684; contact: Qualcomm) SA2
* R2-2211129 LS in Response LS on LCS framework for Network verified UE location (NTN) (S2-2209589; contact: CATT) SA2
* R2-2211314 discussion Discussion on NTN coverage enhancements CATT
* R2-2211324 discussion Further discussion on overhead reduction for VoNR in NR NTN vivo
* R2-2211335 discussion Discussion on L2 header reduction in NTN OPPO
* R2-2211571 discussion Discussion on RAN2 aspects of coverage enhancements Qualcomm Incorporated
* R2-2212047 discussion Potential issues for Msg3 repetition in NTN Lenovo
* R2-2212279 discussion Consideration on coverage enhancement in NTN ZTE Corporation, Sanechips
* R2-2212240 discussion Coverage enhancement NEC
* R2-2212336 discussion Blind Msg3 retransmission in Rel-18 NTN InterDigital
* R2-2212951 discussion R18 NR NTN Coverage enhancements Ericsson
* R2-2212937 discussion Discussion on coverage enhancements Huawei, HiSilicon
* R2-2212803 discussion Discussion on coverage enhancement for NR NTN Xiaomi
* R2-2212760 discussion Discussion on the coverage enhancement in NTN LG Electronics Inc.
* R2-2212727 discussion On coverage enhancements for NR NTN Nokia, Nokia Shanghai Bell
* R2-2212613 discussion Discussion on coverage enhancements CMCC
* R2-2212447 discussion Discussion on NR NTN Coverage Enhancement Samsung Research America
* R2-2212403 discussion Further on network verified UE location Nokia, Nokia Shanghai Bell
* R2-2212640 discussion Network verified UE location THALES
* R2-2212705 discussion Remaining Issues of UE Location Verification via Network CMCC
* R2-2212949 discussion R18 NR NTN Network verified UE location Ericsson
* R2-2212334 discussion On Network Verified UE Location in NR NTN Mediatek India Technology Pvt.
* R2-2212280 discussion onsideration on NW verified UE location ZTE Corporation, Sanechips
* R2-2212175 discussion Discussion on UE position verify procedure Spreadtrum Communications
* R2-2211988 discussion Network Verified UE Location Samsung Electronics Nordic AB
* R2-2212078 discussion Discussion on network verified UE location Xiaomi
* R2-2212097 discussion On NTN NW verified UE location aspects Lenovo
* R2-2211733 discussion Discussion on NTN network verified UE location Apple
* R2-2211572 discussion Discussion on network verified UE location Qualcomm Incorporated
* R2-2211517 discussion Discussion on the overall procedure of network verified UE location Huawei, HiSilicon
* R2-2211325 discussion Further discussion on network verified UE location vivo
* R2-2211348 discussion Discussion on network verified UE location OPPO
* R2-2211373 discussion On Network Verified UE Location in NR NTN Mediatek Inc.
* R2-2211372 discussion Handover Enhancement in LEO NTN Mediatek Inc.
* R2-2212177 discussion Some enhancements in NTN handover Spreadtrum Communications
* R2-2211999 discussion Further discussion on NTN-TN cell reselection enhancements NTT DOCOMO, INC.
* R2-2211768 discussion Discussion on NTN-TN cell reselection enhancements LG Electronics France
* R2-2212281 discussion Discussion on cell reselection enhancements in NTN ZTE Corporation, Sanechips
* R2-2212337 discussion Cell reselection enhancements for Earth moving cell InterDigital
* R2-2212338 discussion NTN-TN mobility and service continuity InterDigital
* R2-2212260 discussion On Cell Reselection Enhancements for Intra-NTN and NTN-TN Scenarios Nokia, Nokia Shanghai Bell
* R2-2211734 discussion NTN-NTN cell reselection enhancement Apple
* R2-2211735 discussion NTN-TN cell reselection enhancement Apple
* R2-2211929 discussion Cell selection/reselection enhancements in NTN Sony
* R2-2211835 discussion Further discussion on NTN-NTN and NTN-TN cell reselection enhancements Transsion Holdings
* R2-2211811 discussion Discussion on reference location for moving cell ASUSTeK
* R2-2212079 discussion Cell reselection enhancements for NTN-NTN and NTN-TN mobility Xiaomi
* R2-2212048 discussion IDLE/INACTIVE mobility regarding moving cells and TN area Lenovo
* R2-2211911 discussion Discussion on the no-TN-coverage area FGI
* R2-2211338 discussion Discussion on mobility enhancements for idle and inactive UEs OPPO
* R2-2211315 discussion Discussion on Mobility Enhancements in IDLE state CATT
* R2-2211323 discussion Discussion on cell reselection enhancement in NR NTN vivo
* R2-2211662 discussion Discussion on cell reselection in earth moving cell CAICT,CAST Xi’an
* R2-2211573 discussion TN neighbour cell measurement relaxation Qualcomm Incorporated
* R2-2211410 discussion Discussion on NTN-NTN cell reselection enhancements Intel Corporation
* R2-2211411 discussion Discussion on TN-NTN cell reselection enhancements Intel Corporation
* R2-2212945 discussion Cell reselection enhancements Ericsson
* R2-2212826 discussion Discussion on cell reselection enhancements Huawei, HiSilicon
* R2-2212385 discussion NTN-NTN handover enhancement for RRC\_CONNECTED UEs NEC Telecom MODUS Ltd.
* R2-2212799 discussion Discussion on NTN-TN and NTN-NTN cell re-selection ITL
* R2-2212893 discussion Cell Reselection Enhancement for NTN-NTN and NTN-TN Mobility Google Inc.
* R2-2212614 discussion Discussion on NTN-TN reselection and reselection for earth moving cell CMCC
* R2-2212559 discussion Discussion on cell reselection enhancements Sharp
* R2-2212384 discussion Remaining issues on cell reselection enhancements NEC Telecom MODUS Ltd.
* R2-2211767 discussion Discussion on NTN-NTN cell reselection enhancements LG Electronics France
* R2-2212448 discussion Discussion on NR NTN Cell Reselection Enhancement Samsung Research America
* R2-2212449 discussion Discussion on NR NTN Handover Enhancement Samsung Research America
* R2-2212560 discussion Discussion on handover enhancements Sharp
* R2-2212615 discussion Discussion on handover enhancements CMCC
* R2-2212894 discussion NTN-TN Mobility Enhancement for RRC\_CONNECTED UEs Google Inc.
* R2-2212802 discussion View on NTN HO enhancements ITL
* R2-2212827 discussion Discussion on NTN handover enhancements Huawei, HiSilicon
* R2-2212946 discussion Handover enhancements Ericsson
* R2-2212934 discussion Further discussion on NTN-NTN handover enhancements NTT DOCOMO, INC.
* R2-2212721 discussion HO/CHO Signaling Overhead Reduction by NTN-config omission Sequans Communications
* R2-2211574 discussion Signaling overhead reduction in satellite switch Qualcomm Incorporated
* R2-2211663 discussion Discussion on NTN HO enhancnment CAICT
* R2-2211784 discussion Reduction of handover overhead in NTN China Telecom
* R2-2211322 discussion Discussion on handover enhancement for siganlling overhead reduction in NR NTN vivo
* R2-2211316 discussion Discussion on PCI unchanged scenario CATT
* R2-2211317 discussion Discussion on NTN HO Enhancements CATT
* R2-2211349 discussion Discussion on NTN handover enhancements OPPO
* R2-2211409 discussion Discussion on NTN 2-step handover Intel Corporation
* R2-2212049 discussion Issue analysis for service continuity in TN-NTN and NTN-NTN scenarios Lenovo
* R2-2212080 discussion Discussion on handover enhancements for NTN-NTN mobility Xiaomi
* R2-2211836 discussion Further discussion on NTN-NTN handover enhancements Transsion Holdings
* R2-2211930 discussion Signaling overhead reduction and group handover during NTN-NTN HOs Sony
* R2-2211736 discussion NTN specific handover enhancement Apple
* R2-2212339 discussion NTN mobility enhancements for RRC\_CONNECTED InterDigital
* R2-2212259 discussion On Connected Mode Mobility for Rel-18 NTN Nokia, Nokia Shanghai Bell
* R2-2212282 discussion Discussion on HO enhancements in NTN ZTE Corporation, Sanechips
* R2-2211769 discussion Discussion on HO enhancements for NTN LG Electronics France
* R2-2211998 discussion Further discussion on NTN-NTN handover enhancements NTT DOCOMO, INC.

## 4.3 RAN3

* **RAN3#117-bis-e, October 10 – 18th 2022, e-meeting**

Submitted TDOCs:

* R3-225923 Work Plan R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R3-225396 discussion Cell Identifier for NTN handover Qualcomm India Pvt Ltd
* R3-225397 discussion NTN Mobility and Feeder Link Switch Over Enhancements Qualcomm India Pvt Ltd
* R3-225427 discussion Discussion on NTN mobility enhancements China Telecommunication
* R3-225459 discussion Discussion on the Mobility and Service Continuity Enhancements in NR NTN Nokia, Nokia Shanghai Bell
* R3-225499 discussion Xn interface enhancements in NTN InterDigital
* R3-225579 CR CHO for NTN - NGAP impacts Ericsson, Thales, ZTE, Omnispace, TTP, CATT
* R3-225989 CR CHO for NTN - NGAP impacts Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes, EchoStar
* R3-225580 CR CHO for NTN - XnAP Impacts Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT
* R3-225990 CR CHO for NTN - XnAP Impacts Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, Huawei, CMCC
* R3-226065 CR CHO for NTN - XnAP Impacts Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, Huawei, CMCC
* R3-226066 CR XnAP BLCR on NTN Functionality Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC
* R3-225611 discussion Further discussion on mobility issue for NR NTN ZTE
* R3-225622 discussion Discussion on Mobility enhancement for NR NTN CATT
* R3-225692 discussion Further discussion on mobility of NTN Huawei
* R3-225711 discussion Discussion on service continuity enhancement Samsung
* R3-225800 discussion Discussion on mobility enhancement of NTN CMCC
* R3-225930 discussion CB: # NTN1\_ServiceContinuity - Summary of email discussion Huawei - moderator
* R3-225951 discussion CB: # NTN1\_ServiceContinuity - Summary of email discussion Huawei - moderator
* R3-226075 discussion CB: # NTN1\_ServiceContinuity - Summary of email discussion Huawei - moderator
* R3-225307 LS in LS on LCS framework for Network verified UE location (NTN) RAN2
* R3-225460 discussion Discussion on the network verified UE location Nokia, Nokia Shanghai Bell
* R3-225581 discussion Capturing Initial Agreements on Network Verified UE Location Ericsson, CATT, Thales
* R3-225582 draftCR UE Location Verification by the Network Ericsson, CATT, Thales, Huawei
* R3-225956 draftCR UE Location Verification by the Network Ericsson, CATT, Thales, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell
* R3-225612 CR Cause value on network verified UE location for NR NTN ZTE
* R3-225623 discussion Discussion on UE location verification for NR NTN CATT
* R3-225693 discussion Discussion on network verified UE location Huawei
* R3-225801 discussion Consideration on UE Location Verification via Network CMCC
* R3-225931 discussion CB: # NTN2\_LocationVerification - Summary of email discussion Ericsson - moderator
* R3-225952 discussion CB: # NTN2\_LocationVerification - Summary of email discussion Ericsson - moderator
* **RAN3#118, November 14 – 18th 2022, Toulouse**

Submitted TDOCs:

* R3-226102 draftCR UE Location Verification by the Network Ericsson, CATT, Thales, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell
* R3-226106 CR XnAP BLCR on NTN Functionality Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC
* R3-226166 LS in LS on Satellite coverage data transfer to a UE using UP versus CP SA2
* R3-226315 discussion Discussion on the Mobility and Service Continuity Enhancements in NR NTN Nokia, Nokia Shanghai Bell
* R3-226316 discussion [draft] LS on CHO with time-based trigger condition in N2-HO Nokia, Nokia Shanghai Bell
* R3-226272 discussion Xn interface enhancements in NTN InterDigital
* R3-226393 discussion Further discussion on mobility enhancement of NTN China Telecommunication
* R3-226411 discussion Time-Based HO for NTN and NGAP Ericsson LM
* R3-226412 CR Time-Based HO for NTN - NGAP impacts Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes, EchoStar, Huawei
* R3-226413 discussion Xn and NTN with Transparent Payload in Rel-18 Ericsson LM
* R3-226619 discussion Further discussion on mobility of NTN Huawei
* R3-226620 discussion Further discussion on XN and NG interface Huawei
* R3-226591 discussion Further discussion on service continuity enhancement Samsung
* R3-226706 discussion Discussion on mobility enhancement of NTN CMCC
* R3-226649 draftCR CR for TS38.300 on Clarification of Cell Identifier used for handover signalling and Xn Interface Qualcomm Incorporated, Huawei, Nokia, ZTE, Deutsche Telekom, Verizon Wireless, CATT, NEC
* R3-226655 discussion Discussion on NR NTN Service Continuity Enhancements Qualcomm Incorporated
* R3-226476 discussion Further discussion on mobility issue for NR NTN ZTE
* R3-226568 discussion Discussion Mobility and Service Continuity Enhancements for NTN CATT
* R3-226569 discussion Discussion on UE location verification for NR NTN CATT
* R3-226654 discussion NRPPa for Network Verified UE location Qualcomm Incorporated
* R3-226184 LS in Latency impact for NTN verified UE location RAN2

## 4.4 RAN4

* **RAN4#104-bis-e, October 10 – 19th 2022, e-meeting**

Submitted TDOCs:

* R4-2217507 Work Plan NR NTN enhancement workplan NTT DOCOMO, INC.
* R4-2215709 Work Plan NR NTN enhancement workplan NTT DOCOMO, INC.
* R4-2216076 other Discussion on Rel-18 NTN regulatory information and ka band Huawei, HiSilicon
* R4-2216148 other Initial discussion for NR to support non-terrestrial networks Xiaomi
* R4-2216372 discussion Discussion on above 10GHz NTN band Nokia, Nokia Shanghai Bell
* R4-2216651 discussion Ka band system parameters for NTN Qualcomm Incorporated
* R4-2216516 other NTN enhancement: System parameters Ericsson
* R4-2216556 other Discussion on system parameter for NTN in Ka band ZTE Corporation
* R4-2216515 other NTN enhancement: Regulatory aspects and band discussion Ericsson
* R4-2215775 discussion Utilization of frequency range 27.50-28.35GHz spectrum in USA Verizon, T-Mobile USA
* R4-2215777 discussion Simulation assumptions for above 10GHz NTN co-existence study Samsung Electronics Nordic AB
* R4-2215348 discussion VSAT UE Characteristics and Initial Simulation Parameters THALES
* R4-2215352 discussion Discussion on Ka-band NTN-TN NR adjacent band coexistence scenarios THALES, Lockheed Martin, Hispasat, Intelsat, Magister Solutions Ltd, Satellite Applications Catapult, ESA, Avanti, Hughes/EchoStar, Inmarsat, Eutelsat, Sateliot
* R4-2216517 other NTN enhancement - coex simulations: scenarios and assumptions Ericsson
* R4-2216557 other Discussion on coexistence evaluation for NTN in Ka-band ZTE Corporation
* R4-2217743 other WF on NTN UE in Ka-band ZTE
* R4-2216558 other Discussion on SAN RF requirements for NTN in Ka-band ZTE Corporation
* R4-2215415 other General consideration on SAN RF requirements for above 10GHz bands CATT
* R4-2216559 other Discussion on UE RF requirements for NTN in Ka-band ZTE Corporation
* R4-2216652 discussion Ka band UE RF requirements for NTN Qualcomm Incorporated
* R4-2216896 other Email discussion summary for [104-bis-e][312] NR\_NTN\_enh\_Part1 Moderator (Thales)
* R4-2216897 other [Email discussion summary for 104-bis-e][313] NR\_NTN\_enh\_Part2 Moderator (Samsung)
* R4-2216976 other Email discussion summary for [104-bis-e][140] NR\_NTN\_enh\_UERF Moderator (ZTE)
* R4-2217019 other Email discussion summary for [104-bis-e][140] NR\_NTN\_enh\_UERF Moderator (ZTE)
* R4-2217467 other WF on NR NTN Enhancements Part1 Thales
* R4-2217468 other Way forward on [313] NR\_NTN\_enh\_Part2 Samsung
* R4-2217469 other Simulation assumptions for NTN co-existence in bands above 10GHz Samsung
* R4-2217792 other Email discussion summary for [104-bis-e][140] NR\_NTN\_enh\_UERF Moderator (ZTE)
* R4-2217496 other Email discussion summary for [104-bis-e][312] NR\_NTN\_enh\_Part1 Moderator (Thales)
* R4-2217497 other [Email discussion summary for 104-bis-e][313] NR\_NTN\_enh\_Part2 Moderator (Samsung)
* **RAN4#105, November 14 – 18th 2022, Toulouse**

Submitted TDOCs:

* R4-2219990 other NTN UE NS requirements Qualcomm Incorporated
* R4-2219378 other Further discussion on system parameter for NTN in Ka band ZTE Corporation
* R4-2219083 other Discussion on above 10GHz NTN band Nokia, Nokia Shanghai Bell
* R4-2219076 discussion Ka-band satellite NTN band definition Inmarsat, Thales, Hughes/Echostar, Lockheed Martin, ESA
* R4-2218489 other NTN enhancement: System parameters - Band(s) definition Ericsson
* R4-2218488 other NTN enhancement: Regulatory aspects Ericsson
* R4-2219141 discussion Regulatory background for satellite NTN Ka band Inmarsat, Thales
* R4-2219629 other Discussion on Rel-18 NTN regulatory information and ka band Huawei, HiSilicon
* R4-2219604 discussion Regulatory information about ESIM OPPO
* R4-2219768 discussion About Ka-band proposed for NR-NTN HUGHES Network Systems Ltd; Hughes/EchoStar, Thales, Inmarsat
* R4-2219971 discussion Ka band definition and related SAN terminology Huawei, HiSilicon
* R4-2219630 other Discussion on Rel-18 NTN coexistence study assumption Huawei, HiSilicon
* R4-2219379 other Further discussion on coexistence evaluation for NTN in Ka-band ZTE Corporation
* R4-2220573 other WF on NTN UE RF requirements ZTE
* R4-2219258 discussion Discussion on Ka-band Coexistence Scenario for GEO THALES
* R4-2218490 other NTN enhancement: coexistence simulations Ericsson
* R4-2218465 other Discussion on remaining issues about simulation assumptions for above 10GHz NTN co-existence study CATT
* R4-2219006 discussion Simulation assumptions and preliminary co-existence study for above 10GHz NTN co-existence study Samsung Electronics Nordic AB
* R4-2218466 other General consideration on SAN RF requirements for above 10GHz bands CATT
* R4-2218491 other NTN enhancement: SAN RF requirements Ericsson
* R4-2219380 other Further discussion on SAN RF requirements for NTN in Ka-band ZTE Corporation
* R4-2219381 other Further discussion on UE RF requirements for NTN in Ka-band ZTE Corporation
* R4-2219631 other Discussion on Ka band NTN UE Huawei, HiSilicon
* R4-2219989 discussion NTN UE device types for >10 GHz Qualcomm Incorporated
* R4-2220027 discussion RF requirements for NTN UE Intel Corporation
* R4-2219336 discussion NTN Terminals in above 10 GHz THALES
* R4-2219041 other Discussion for NR to support non-terrestrial networks Xiaomi
* R4-2220119 other Topic summary for [105][139] NR\_NTN\_enh\_UERF Moderator (ZTE)
* R4-2220138 other Summary for [105][312] NR\_NTN\_enh\_Part1 Moderator (Thales)
* R4-2220139 other Summary for [105][313] NR\_NTN\_enh\_Part2 Moderator (Samsung)
* R4-2220239 other WF for above 10GHz band definition and system parameters Thales
* R4-2220240 other WF for above 10GHz SAN RF requirements Thales, ZTE
* R4-2220241 other WF for NTN coexistence study for above 10GHz Samsung
* R4-2220224 other Ad-hoc minutes for NTN above 10GHz band introduction Qualcomm
* R4-2220304 other WF for above 10GHz SAN RF requirements Thales, ZTE

***END***