**3GPP TSG RAN meeting #102 RP-232858**

**Edinburgh, GB, Dec 11-15, 2023**

## 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-232669 | | | | |
| **Target Completion Date**  **(indicate if changed)** | Study Item: | Core part: 03/2024 | Performance part: 06/2024 | Testing part: | |
| **Overall Completion level** | Study Item: | Core part:  Overall: 98%  RAN1: 100%  RAN2: 100%  RAN3: 100%  RAN4: 95% | Performance Part:  Overall: 10%  RAN4: 10% | 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?** | Yes |

*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.*

Extension request by one quarter for RAN4 as per the exception sheet in RP-232859

## 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#114bis meeting, Xiamen, China, October 9 – 13, 2023:**

**FR2-NTN:**

Agreement

Endorse the attachment in R1-2310650 with the following updates:

* Row 3 column P: the following FFS text should be marked in black:
  + FFS signaling details, e.g. whether RSRP threshold for PUCCH repetition for Msg4 HARQ-ACK is signaled as a relative or absolute value
* Row 3 column P: add the RAN plenary agreement as in row 2
* Row 5 column P: add square brackets as shown below
  + value range: [-265…+265 (-26,5 µs/s… +26,5 µs/s)]

Working assumption

For PRACH configuration for operation in FR2-NTN, Table 6.3.3.2-4 of TS 38.211 is used as baseline.

FFS: Whether further modifications would be needed

**Conclusion**

For operation in FR2-NTN, the value range in ms for K\_offset and K-MAC shall be the same as for Rel-17 NR over NTN.

Working assumption

For operation in FR2-NTN, use a reference SCS of 15 kHz for the indication of K\_offset and K\_MAC.

Working assumption:

For operation in FR2-NTN, for cell search procedure, at least Case D in TS 38.213 is used to allow FDD operation in bands defined by FR2-NTN without any update to SSB pattern.

FFS: whether Case E can also be used

**Conclusion**

For operation in FR2-NTN and for Rel-18, no additional MAC CE TCI application delay is introduced to facilitate mechanical beam steering with VSAT.

Working assumption

From RAN1 perspective, for operation in FR2-NTN, the granularity used for TA reporting is the same as corresponding to the reference subcarrier spacing applied for K\_offset.

RACH-less handover:

**Observation**

There is potential RAN1 discussion for the following aspects to support the RAN2 work on RACH-less handover.

* The pre-allocated grant is provided with association to SSBs
* 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

**Coverage enhancement for NR NTN:**

Agreement

For RSRP threshold to determine whether capability of PUCCH repetition on common PUCCH resources is reported or not,

* Option 1: the RSRP threshold is signaled as an absolute value, i.e. not as a relative value to RSRP threshold for R17 Msg3 repetition

Agreement

With respect to dynamic indication of PUCCH repetition factor by using DAI field in DCI format 1\_0 with CRC scrambled by TC-RNTI for UE that has indicated capability of the PUCCH repetition, when multiple repetition factors are configured:

* the 1st/2nd/3rd/4th configured repetition factors are mapped to ‘00’, ’01’, ‘10’, ‘11’ of 2 bits DAI field, respectively. When the 3rd and/or the 4th repetition factors is/are not configured, the corresponding codepoint(s) (i.e., ‘10’ and/or ‘11’) is(are) not used.

Agreement

The TP below is endorsed for TS38.212 clause 7.3.1.2.1.

* Reason for change

A: How to map the configured repetition factors to DAI bits in DCI format 1\_0 with CRC scrambled by TC-RNTI to indicate the PUCCH repetition factor is unclear in the current specification.

B: The use of DAI bits in DCI format 1\_0 with CRC scrambled by TC-RNTI to indicate the PUCCH repetition factor should be conditioned on that the UE has indicated capability of PUCCH repetition on common PUCCH resources.

* Summary of change

A: Regardless of the number of configured repetition factors, two bits are used for indication of repetition factor. If two or three repetition factors, the third and/or the fourth codepoint(s) is/are not used.

B: It is clarified that the use of DAI bits in DCI format 1\_0 with CRC scrambled by TC-RNTI to indicate the PUCCH repetition factor is conditioned on that the UE has indicated capability of PUCCH repetition on common PUCCH resources.

* Consequences if not approved

A: gNB and UE may have misunderstanding of an indicated repetition factor.

B: The DAI field in DCI format 1\_0 with CRC scrambled by TC-RNTI is incorrectly defined to carry repetition information to UEs that have not indicated support for repetition.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7.3.1.2.1 Format 1\_0  **<Unchanged parts omitted>**  The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by TC-RNTI:  **<Unchanged parts omitted>**  - Downlink assignment index – 2 bits  - 2 bits indicating the number of repetitions for PUCCH as defined in clause 9.2.6 of [5, TS38.213] according to Table 7.3.1.2.1-4, if the higher layer parameter *numberOfPUCCHforMsg4HARQACK-RepetitionsList* is configured with at least two values and the UE has indicated capability of PUCCH repetition on common PUCCH resource [8, TS38.321];  - otherwise, reserved.  **<Unchanged parts omitted>**  **Table 7.3.1.2.1-4: Number of repetitions as a function of 2 bits of Downlink assignment index field**   |  |  | | --- | --- | | **Bit field** |  | | 00 | First value of *numberOfPUCCHforMsg4HARQACK-RepetitionsList* | | 01 | Second value of *numberOfPUCCHforMsg4HARQACK-RepetitionsList* | | 10 | Third value of *numberOfPUCCHforMsg4HARQACK-RepetitionsList* (if provided) | | 11 | Fourth value of *numberOfPUCCHforMsg4HARQACK-RepetitionsList* (if provided) |   **<Unchanged parts omitted>** |

Agreement

Update higher layer parameters for R18 NR NTN PUCCH repetitions as follows, and include the RAN plenary agreement in the comment column.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter name in the spec** | **Description** | **Value range** | **Default value aspect** | **Per (UE, cell, TRP, …)** |
| numberOfPUCCHforMsg4HARQACK-RepetitionsList | Indicates the number of repetitions for PUCCH transmission for Msg4 HARQ-ACK. If multiple values are configured, a single value from the configured values is indicated in DCI. | One or more of {1,2,4,8} except for {1} | NA | Per cell |
| rsrp-ThresholdPUCCHforMsg4HARQACK | If this parameter is configured, and numberOfPUCCHforMsg4HARQACK-RepetitionsList is provided, 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 indicated by this parameter. If this parameter is not configured, and numberOfPUCCHforMsg4HARQACK-RepetitionsList is provided, UE capable of PUCCH repetition for Msg4 HARQ-ACK reports the capability of PUCCH repetition for Msg4 HARQ-ACK  ~~[This RSRP threshold is an absolute value / a relative value of the RSRP threshold for R17 Msg3 repetition]~~ | ~~TBD~~  RSRP-range | NA | Per cell |

**Network verified UE location for NR NTN:**

Agreement

The actual index difference between subframe j and subframe i defined in RAN1#114 agreement on UE Rx-Txtime difference is reported in 10 bits with a value range up to 542 subframes.

**Working assumption**

The DL timing drift due to Doppler over the service link associated with the UE RX-TX time difference measurement period is reported with the following range, granularity and bits allocation:

| **Value range** | **Granularity** | **Bits allocation** |
| --- | --- | --- |
| [  **(i.e: )]** |  | **10 bits** |

Note: value range is given in unit of corresponding granularity

Agreement

For network verified UE location in NTN common TA, parameters (ta-Common, ta-CommonDrift, ta-CommonDriftVariant, Epoch time) can be reported from gNB to LMF.

Agreement

Endorse the following TP for TS 38.215

*--- unchanged text omitted ---*

5.2.3 gNB Rx – Tx time difference

|  |  |
| --- | --- |
| **Definition** | The gNB Rx – Tx time difference is defined as TgNB-RX –TgNB-TX  Where:  TgNB-RX is the Transmission and Reception Point (TRP) [18] received timing of uplink subframe #*i* containing SRS associated with UE, defined by the first detected path in time.  TgNB-TX is the TRP transmit timing of downlink subframe #*j* that is closest in time to the subframe #*i* received from the UE.  Multiple SRS resources can be used to determine the start of one subframe containing SRS.  The reference point for TgNB-RX shall be:  - for type 1-C base station TS 38.104 [9]: the Rx antenna connector,  - for type 1-O or 2-O base station TS 38.104 [9]: the Rx antenna (i.e. the centre location of the radiating region of the Rx antenna),  - for type 1-H base station TS 38.104 [9]: the Rx Transceiver Array Boundary connector.  The reference point for TgNB-TX shall be:  - for type 1-C base station TS 38.104 [9]: the Tx antenna connector,  - for type 1-O or 2-O base station TS 38.104 [9]: the Tx antenna (i.e. the centre location of the radiating region of the Tx antenna),  - for type 1-H base station TS 38.104 [9]: the Tx Transceiver Array Boundary connector.  In NTN, the gNB Rx – Tx time difference at the uplink time synchronization reference point [5] is reported. |

*--- End of text proposal ---*

Agreement

Endorse the following TP for TS38.215 clause 5.1.46.

|  |  |
| --- | --- |
| ***Reason for change:*** | Modify the definition of UE Rx – Tx time difference subframe offset to align with the RAN1#114 agreement. |
|  |  |
| ***Summary of change:*** | Modify the definition of UE Rx – Tx time difference subframe offset   * modify measurement naming * add more clarification to the defintion |
|  |  |
| ***Consequences if not approved:*** | The definition of this new UE measurement is ambiguous. It does not reflect the RAN1#114 agreement. And the wording used (i.e. “actual”) is not consistent with specification language |

--- unchanged text omitted ---

5.1.46 UE Rx – Tx time difference subframe offset

|  |  |
| --- | --- |
| **Definition** | UE Rx – Tx time difference offset is the actual index difference between subframe #*j* and subframe #*i* of the subframes used for the UE Rx – Tx time difference measurement as defined in Clause 5.1.30, where uplink subframe #*j* is the closest in time to the DL subframe #*i* received from a transmission point (TP) [18].  UE Rx – Tx time difference subframe offset is the index difference which represents the number of subframes between the uplink subframe #j and the uplink subframe #i, where uplink subframe #j is the closest in time to the DL subframe #i received from a transmission point (TP) [18] as defined in Clause 5.1.30 and i is the index of the DL subframe used for the UE Rx – Tx time difference measurement as defined in Clause 5.1.30.  For frequency range 1, the reference point for UE Rx – Tx time difference subframe offset measurement shall be the same antenna connectors as defined in Clause 5.1.30 for the UE Rx – Tx time difference measurement. For frequency range 2, the reference point UE Rx – Tx time difference subframe offset measurement shall be the same antenna as defined in Section 5.1.30 for ~~of~~ the UE Rx – Tx time difference measurement. |
| **Applicable for** | RRC\_CONNECTED |

--- End of change ---

Agreement

Endorse the following TP for TS 38.215:

|  |  |
| --- | --- |
| ***Reason for change:*** | Modify the definition of DL timing drift in clause 5.1.47 to align with the RAN1#114 agreement. |
|  |  |
| ***Summary of change:*** | Add more clarification to the defintion of DL timing drift |
|  |  |
| ***Consequences if not approved:*** | The definition of this new UE measurement is ambiguous |

*--- unchanged text omitted ---*

5.1.47 DL timing drift

|  |  |
| --- | --- |
| **Definition** | DL timing drift measurement is defined as the variation rate of the downlink delay in ppm due to the as estimated service link Doppler as the DL timing to be shifted due to Doppler over the service link associated with over the UE Rx-Tx time difference measurement period.  For frequency range 1, the reference point for the DL timing drift measurement shall be the Rx antenna connector of the UE. For frequency range 2, the reference point for the DL timing drift measurement shall be the Rx antenna of the UE. |
| **Applicable for** | RRC\_CONNECTED |

*--- End of change ---*

Agreement

Adopt the following TP for TS 38.214:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | ***Reason for change:*** | Existing spec TS 38.214 is still pending with bracket on “actual” which is not used so far in the specifications | |  |  | | ***Summary of change:*** | The detailed definition of UE Rx – Tx time difference subframe offset as well as the DL timing drift has already been defined in section 5.1.46 and 5.1.47 of TS 38.215. Then, to avoid the duplicated description and potential mismatch, in TS 38.214, it is sufficient to update the spec with simply citation on the offset and timing drift defined in TS 38.215 | |  |  | | ***Consequences if not approved:*** | Duplicated description and potential mismatch between specs |   ----------------------------------------TP: Start of TP for TS 38.214 V18.0.0---------------------------  5.1.6.5 PRS reception procedure  <Unchanged parts are omitted>  The UE may be configured to measure and report, via higher layer parameter [undetermined NTN related parameter] subject to UE capability, UE Rx-Tx time difference measurements on a PRS resource associated with a dl-PRS-ID~~. T~~, and report the ~~UE shall report the [actual] index difference between the uplink subframe j and closest in time DL subframe i,~~ UE Rx – Tx time difference subframe offset and the DL timing drift ~~due to Doppler over the radio link associated with the UE RX-TX time difference measurement period~~ as described in [7, TS 38.215].  <Unchanged parts are omitted>  --------------------End of TP for TS 38.214 V18.0.0 --------------------------------- |

* **RAN1#115 meeting, Chicago, US, November 13 – 17, 2023:**

Agreement

The higher layer parameters in R1-2312424 is endorsed.

**TP for TS 38.300**

Agreement

The TP below for TS38.300 is endorsed from RAN1 perspective.

* Note: further text may be provided later for NTN-specific PUSCH DMRS bundling.

---------------------- TEXT PROPOSAL BEGIN ----------------------

**16.14.X Support for NR NTN coverage enhancements**

To improve NR uplink coverage in NTN, the following enhancements are supported:

* PUCCH repetition for Msg4 HARQ-ACK:
* Supported number of transmissions are 1, 2, 4, 8.
  + If a single value from {2, 4, 8} is configured via SIB, the configured repetition factor is applied.
  + If multiple values from {1, 2, 4, 8} are configured via SIB, one of the multiple values is indicated in DAI field of DCI format 1\_0 with CRC scrambled by TC-RNTI.
* The existing mechanism on repetition slot counting (as in section 9.2.6 of TS 38.213) is applied.
* Frequency hopping mechanism in R15/16/17 defined for PUCCH transmission for Msg4 HARQ-ACK, in every slot is applied.
* 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 via Msg3 PUSCH 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 via Msg3 PUSCH.
* The repetition factor applied to Msg4 HARQ-ACK is used also for any PUCCH transmission before dedicated PUCCH resource is provided.
* NTN-specific PUSCH DMRS bundling

**16.14.x Verification of UE location**

For UE location verification based on multi-RTT with single satellite in NTN, at least the following UE and gNB measurements specified in [38.215] are reported: gNB receive-transmit time difference at the uplink time synchronization reference point, UE receive-transmit time difference, UE receive-transmit time difference subframe offset and DL timing drift.

The assistance information reported to the CN may include ephemeris information including accurate satellite position and velocity at the time of multi-RTT measurement, and common TA parameters (ta-Common, ta-CommonDrift, ta-CommonDriftVariant, Epoch time).

\*\*\* Unchanged text is omitted \*\*\*

---------- TEXT PROPOSAL END ---------

Text Proposal for TS38.300:

**<UNCHANGED TEXT IS OMITTED>**

---------------------- TEXT PROPOSAL BEGIN ----------------------

**16.14.X Support for NR NTN coverage enhancements**

* NTN-specific PUSCH DMRS bundling enhancement that enables DMRS bundling in presence of timing drift, whereby UE maintains phase continuity considering effects of transmission delay variation between UE and uplink time synchronization reference point to enable improved channel estimation.

**---------- TEXT PROPOSAL END ---------**

Agreement

The LS in R1-2312670 is endorsed and will be revised and is agreed in R1-2312681 to change the source to RAN1, with the attachment in R1-2312669.

**FR2-NTN**

Agreement

Confirm working assumption from RAN1#114-bis on reference SCS for K\_offset and K\_MAC.

Agreement

Confirm working assumption from RAN1#114-bis on the TA reporting granularity.

Agreement

The working assumption for cell search procedure is replaced with the following, and confirmed:

* For operation in FR2-NTN, for cell search procedure, Case D and Case E in TS 38.213 are used to allow FDD operation in bands defined by FR2-NTN without any update to SSB pattern.

Agreement

Confirm the working assumption from RAN1#114-bis on the PRACH configuration.

Working assumption

For PRACH configuration for operation in FR2-NTN, Table 6.3.3.2-4 of TS 38.211 is used as baseline.

FFS: Whether further modifications to the PRACH configuration Table would be needed

Agreement

Create an LS response for RAN4 with the following text, and copy the relevant RAN1 agreements and conclusions made for FR2-NTN in the LS:

**Overall description**

RAN1 would like to thank RAN4 for their LS R4-2305926 (R1-2304309) on the operation of NR over NTN in frequency bands above 10 GHz.

RAN1 have had discussion on the topic over the past meetings and have reached a number of agreements, but some topics are still under consideration. The topics still under consideration are mainly related to the timing requirements associated to operation in bands defined by FR2-NTN. To help RAN1 progressing on the topic, it would be appreciated if RAN4 could provide the timing requirements for supporting NR over NTN in bands defined by FR2-NTN.

**Actions:**

RAN1 respectfully asks RAN4 to provide a response to the above question in order to aid the RAN1 discussions related to timing accuracy requirements.

Final LS is agreed in R1-2312553.

**RACH-less handover in NR NTN**

Agreement

The text proposal for TS 38.213 in section 3.3 in R1-2312377 is endorsed in principle. Draft CR to be reviewed and endorsed in RAN1#116.

* Note: further discuss the TP for search space, repetition, power control, collision with valid PRACH occasion, TDD aspect, etc.
* Note to the TS 38.213 editor: it is not expected to capture this TP for RAN#102

**Conclusion**

Which CORESET to use for RACH-less handover can be further discussed at a future meeting.

### Coverage enhancement for NR NTN

**Conclusion**

For frequency hopping of PUCCH repetition on common PUCCH resources for NR NTN, no specification change in Rel-18.

**Conclusion**

For PUCCH repetition on common PUCCH resources for NR NTN, for the case of SI modification and no DCI format 1\_0 with CRC scrambled by a TC-RNTI, no further discussion for this issue in Rel-18.

**Conclusion**

There is no consensus on the following for PUCCH repetition on common PUCCH resources in Rel-18 NR NTN.

* Whether to introduce dynamic indication when a single repetition factor is configured
* Whether to enhance capacity of common PUCCH resources
* Whether to extend previous agreements for common PUCCH resources to dedicated PUCCH resources

**Conclusion**

No further discussion is necessary for the following for PUCCH repetition on common PUCCH resources in Rel-18 NR NTN.

* UE behavior when no repetition factor is configured
* UE behavior if configured repetition factor(s) does not include ‘1’, the RSRP threshold is configured, and the measured RSRP < the RSRP threshold

**Conclusion**

There is no consensus on antenna switching-related enhancements for PUSCH DMRS bundling in Rel-18 NR NTN.

Agreement

The TP below is endorsed for TS38.213

* Reason for change: It was agreed that this WI can support PUCCH repetition not only for Msg4 HARQ-ACK but also for subsequent PUCCH e.g., to report HARQ-ACK corresponding to a PDSCH conveying RRC configuration parameters.
* Summary of change: It is clarified that the indicated repetition factor is applied to any PUCCH transmission by using common PUCCH resource.
* Consequences if not approved: It is unclear which repetition factor is applied to PUCCH transmissions after Msg4 HARQ-ACK transmission when dedicated PUCCH resource configuration is not provided.

|  |
| --- |
| **9.2.6 PUCCH repetition procedure**  A UE that does not have dedicated PUCCH resource configuration and indicates a capability to transmit with repetitions a PUCCH with HARQ-ACK information [11, TS 38.321], determines a number of slots for repetitions of a PUCCH transmission with HARQ-ACK information based on an indication by numberOfPUCCHforMsg4HARQACK-RepetitionsList. If numberOfPUCCHforMsg4HARQACK-RepetitionsList provides more than one values, the DAI field in a DCI format 1\_0 with CRC scrambled by a TC-RNTI scheduling a PDSCH reception that includes a UE contention resolution identity indicates from the more than one values. The number of repetitions is applied to any PUCCH transmission before dedicated PUCCH resource configuration is provided. The UE transmits each repetition of the PUCCH using frequency hopping as described in Clause 9.2.1.  In the remaining of this clause, a UE without dedicated PUCCH resource configuration determines a value of a parameter, if applicable, according to Table 9.2.1-1 and/or as specified above in this clause for a PUCCH transmission with repetitions from the UE.  \*\*\* Unchanged parts are omitted \*\*\* |

**Conclusion**

For PUCCH repetition on common PUCCH resources, with respect to the number of symbols and the first symbol for PUCCH transmission, no specification change in Rel-18.

### Network verified UE location for NR NTN

Agreement

Confirm the following working assumption with the following modification: replacing µs/s with ppm and removing the brackets.

Working assumption

The DL timing drift due to Doppler over the service link associated with the UE RX-TX time difference measurement period is reported with the following range, granularity and bits allocation

| **Value range** | **Granularity** | **Bits allocation** |
| --- | --- | --- |
| **i.e:** |  | **10 bits** |

Note: value range is given in unit of corresponding granularity

Working assumption

For UE RX-TX measurements in NTN, the time of the beginning of a subframe is determined by assuming the time durations of the OFDM symbols at the receiver are the same as defined in 38.211.

#### 2.1.2 Remaining Open issues

Further corrections may be discussed/implemented at next meeting. However none of these would require category B CR (addition of feature)

FR2-NTN:

* PRACH configuration for operation in FR2-NTN
* Other topics related to the timing requirements associated to operation in bands defined by FR2-NTN
* Waiting for RAN4 LS reply on timing requirements for FR2-NTN

Network verified UE location: -

* Determination of the time of the beginning of a subframe for UE RX-TX measurements in NTN

## 2.2 RAN2

#### 2.2.1 Agreements

* **RAN2#123-bis meeting, Xiamen, China, October 9 – 13, 2023:**

**Coverage enhancements**

RAN2 continues to focus on a solution to address PUCCH repetition for Msg4 HARQ-ACK in Msg3 only for random access procedure triggered by RRC connection establishment, RRC connection re-establishment or RRC connection resume, i.e. to CCCH/CCCH1 (in the future we can consider random access during RRC connected, depending on RAN1)

No explicit NW indication to enable/disable PUCCH repetition for Msg4 HARQ-ACK besides the needed signalling for number of repetition, RSRP configuration in SIB (meaning that if these parameters are signalled, PUCCH repetition for Msg4 HARQ-ACK is enabled)

**Network verified UE location**

Add in NR-Multi-RTT-SignalMeasurementInformation the measurements relevant to RAN1 agreed offset (e.g., the actual index difference between subframe j and subframe i and the DL timing drift due to Doppler over the service link associated with the UE RX-TX time difference measurement period) with detailed definition referred to RAN1 agreements.

Ephemeris and corresponding time information (e.g., epochTime) is not provided by the UE. How this is provided to the LMF is up to RAN3 (can come back to see whether the problem that the UE could use a different ephemeris – and then should report it back to the gNB – is a valid case to consider)

RAN2 assumes that FG 44-3 should be an LPP capability to be reported to the LMF (no need for other capabilities)

RAN2 understands that to solve the mirror point issue, the measurements reported by RAN should include the information of the cells on the opposite side

Send LS to RAN3 clarifying the scenarios of satellite switch cases and ask them how to handle it. Ask question whether existing cause value can be used to handle the satellite switch specially in case of RAN node has not changed.

Include in the LS the RAN2 assumption that we expect no LPP impact (in HO/satellite switch). It is up to RAN3 to decide if any NRPPa signaling update is needed.

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

The maximum number of TN coverage area information is 32 (5 bits)

RAN2 will not specify restrictions on TN coverage description (i.e., description of TN coverage is left to NW implementation). The signalled TN coverage can describe areas not currently covered by the satellite cell footprint (FFS how to reflect this in the specification)

TN coverage information can be broadcast by both (quasi)earth-fixed and earth-moving cells

The working assumption “We do not introduce new triggers making the UE reacquire the TN coverage information from SI” in Rel-18 is confirmed

The new SIB including the TN coverage information is not an essential SIB for NTN. An NTN-capable UE does not need to consider the cell barred if it is unable to acquire the SIB when scheduled.

Legacy SI update procedure will be used when the network updates the TN coverage information (can further check for moving cell case)

For location-based CHO for earth-moving cells, re-use the procedure from cell reselection as baseline to derive the candidate cell’s reference location as the cell moves (FFS on how to signal the needed parameters, e.g. ephemeris and Epoch time)

Upon T304 expiry, the UE does not fallback to RACH-based HO.

Preallocated UL grant must be configured with an associated RSRP threshold.

UE relies on T304 and RRC Re-establishment procedure to address RACH-less HO failure in Rel-18 NTN (as in LTE). No new NTN-specific enhancements are introduced. If TAT expires, the UE follows the legacy procedures, regardless of the RACH-less HO configuration. RAN2 understands that the NW can ensure a proper configuration for TAT and T304 values (up to NW implementation, no need to capture this in the specs).

As for RACH-less LTM, for RACH-less NTN, the UE determines successful reception of its first UL data based on receiving a PDCCH addressing the UE’s C-RNTI in the target cell scheduling a new transmission as first UL transmission. Can be either DL assignment or UL grant addressed to same HARQ process for the “new transmission”. RAN understands this does not exclude the possibility to use a Contention Resolution MAC CE but this will not be used as a determination of the RACH less HO completion

We follow the LTE baseline for when UE starts the PTAG timeAlignmentTimer in NTN RACH-less HO (option 1 in R2-2311318)

Combination of RACH-less HO with time-based CHO is supported in Rel-18 NTN for both Configured and Dynamic Grant. For the Dynamic Grant case this should be configured by the NW only when the is no risk of confusion about which beam to use (up to NW implementation).

RAN2 confirms satellite switching with unchanged PCI is only applicable on quasi-earth fixed system

Only 1 target satellite information (i.e. NTN-config) of serving cell is provided in SIB19. FFS on exact signalling

SMTC configuration of target satellite needs further discussion: FFS on whether and how to provide the SMTC configuration of target satellite; FFS on how to handle the SMTC adjustment.

We support soft satellite switching in Rel-18

There will be an indication (FFS if explicit or implicit) whether hard switch or soft switch is used.

At least soft satellite switching, network provides SSB information of target satellite to UE. FFS on the details: options include e.g. indicating a time offset/information or indicating a different SSB index for the target satellite (FFS for Hard satellite switch)

In soft satellite switching, UE can start synchronizing with target satellite before T-service of source satellite.

We introduce a T-start which indicates the earliest occasion when the UE can start synchronizing with target satellite (actual signalling is FFS). In soft switch scenario, T-start of target satellite is earlier than T-service of source satellite (FFS if T-start is also used for hard satellite switch)

For soft satellite switching, the exact time when the UE starts synchronizing with target satellite (between T-start and T-service) is up to UE implementation

UE is not required to connect to source satellite when the UE switches to target satellite.

Common signalling (e.g. using servingCellConfigCommon) for the purpose of (C)HO in NTN is not supported in Rel-18

**Email discussions**

* [Post123bis][306][NR-NTN Enh] 38.300 running CR (Thales)
* [Post123bis][307][NR-NTN Enh] 38.331 running CR (Ericsson)
* [Post123bis][308][NR-NTN Enh] 38.321 running CR (Interdigital)
* [Post123bis][309][NR-NTN Enh] 38.304 running CR (ZTE)
* [Post123bis][310][NR-NTN Enh] EU caps running CR (Intel)
* [Post123bis][311][NR-NTN Enh] 37.355 running CR (CATT)
* [Post123bis][312][NR-NTN Enh] Unchanged PCI (CMCC/Apple)

* **RAN2#124 Chicago/USA, November 13th - 17th, 2023:**

**Coverage enhancements**

Use the LCID codepoint within the Rel-18 extension space to indicate the request/capability of PUCCH repetition for Msg4 HARQ-ACK.

Feature combination of NTN, RedCap and eRedCap should be supported for Msg3-based early indication via LCID: 6 LCID codepoints will be specified for this in Rel-18

**Network verified UE location**

Legacy procedure can be reused to indicate the LMF about the happening of CHO.

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

To define a new UE capability, e.g., locationBasedCondHandoverNTN-r18, to indicate whether the UE supports location-based conditional handover for moving cell in NTN bands (which involves the calculation of the present reference location from ephemeris and one reference location at epoch time, as specified in TS 38.331).

This locationBasedCondHandoverNTN-r18 capability is defined per Band, optional with signaling capability, and N/A for FDD/TDD DIFF and FR1/FR2 Diff. This is defined as part of §4.2.7.2 BandNR parameters in TS 38.306.

An editor’s note is added to locationBasedCondHandoverNTN-r18 to capture “FFS whether any change or update is needed considering how locationBasedCondHandover-r17 is defined”, or whether location-based conditional handover for moving cell refers to source cell, target cell or both.

For UE capabilities that indicate the support of satellite switch with re-sync (i.e., unchanged PCI) with hard and soft switch, two UE capabilities are introduced with some dependencies: hardSatelliteSwitch-Resync-NTN-r18 can be supported by itself; but if UE supports softSatelliteSwitch-Resync-NTN-r18, UE is required to also indicate the support of hardSatelliteSwitch-Resync-NTN-r18.

A UE only supporting hardSatelliteSwitch-Resync-NTN-r18 will be able to perform hard satellite switch with re-sync (after T-service) in a NW supporting soft satellite switch with re-sync (and then broadcasting “T-start” and "SSB time offset"). To be reflected in the description of hardSatelliteSwitch-Resync-NTN-r18

SIB19 can be broadcast in TN cells to provide satellite assistance information for NTN neighbour cells (e.g., ntn-NeighCellConfigList-r17).

SIB19 is not an essential SIB when provided in a TN serving cell, i.e. UE does not consider the TN serving cell as barred if it fails to acquire SIB19 (no spec impact)

UE in RRC\_IDLE/INACTIVE is not required to ensure having a valid version of SIB19 in a TN serving cell (no spec impact)

The exact time of reacquiring SIB19 for UE in RRC\_IDLE/INACTIVE in TN serving cell is up to UE implementation (no spec impact)

UE in RRC\_CONNECTED does not start T430 when SIB19 is provided in a TN cell (consider clarifying “Upon receiving SIB19 in a NTN cell …” in 5.2.2.4.21)

The SFN and subframe numbers of epoch time indicated in SIB19 in TN serving cell are based on the timing of the serving cell (no spec impact)

If the epoch time indicated in SIB19 in TN serving cell is absent, UE considers the epoch time as the end of SI window where this SIB19 is scheduled in the TN serving cell (no spec impact).

If the validity duration indicated in SIB19 in TN serving cell is absent, the UE follows R17 behaviour (left to UE implementation) (no spec impact)

Legacy SI update procedure will be used for earth moving cell when the network updates the TN coverage information (no spec change)

The new SIB containing TN coverage area information belongs to Other SI, either periodically broadcast, broadcast on-demand, or sent in a dedicated manner.

When SIB19 is broadcast in a TN cell, SIB19 belongs to Other SI in TN, and is provided by either periodically broadcast, broadcast on-demand, or a dedicated manner.

Separate capability description for location-based measurement initiation for quasi-earth-fixed system and earth moving system is used in 38.304 to align with the capability definition in 38.306.

Adopt the terminology “Skipping TN measurement” in both 38.304 and 38.306

For dynamic grant case, beam information is mandatorily included in the RACH-less HO command.

In NTN RACH-less HO, for dynamic grant case, the beam information included in RACH-less HO command is an SSB index (not tci-stateid).

Similar to LTE, UE shall not trigger RACH for SR when rach-lessHO is configured. LTE text is used as a baseline

UE releases preallocated grant after successful RACH-less HO completion without additional signaling from the network. Nothing is needed to address this issue in MAC.

When CG for initial UL transmission is configured, CG occasions mapping to SSB (i.e. ssb position in burst), is optional. If it is not provided, the RACH-less HO configuration is applicable in all SSBs. Adopt similar wording to CG-SDT in the RRC field description.

If CG for initial UL transmission is configured, UE starts to monitor PDCCH according to existing DRX behaviour on the selected SSB from RACH-less HO configuration after initial UL transmission.

If CG is configured in RACH-less HO, UE uses the earliest available CG occasion associated to the selected SSB for the initial UL transmission. Spec impact is FFS and can use CG-SDT as baseline (if applicable)

It is up to NW to configure HARQ mode A or B. RAN2 understands that HARQ mode A should be used the HARQ process of the initial UL transmission using CG

We don’t introduce a threshold-based mechanism for Dynamic Grant

Check during the final [Post124] review of the joint NTN/mIAB MAC CR for RACH-less HO if the CG-LTM-retransmission timer for the initial UL transmission using CG introduced in LTM can be used for NTN as well (possibly with updates to the value range)

Target cell provides the DG so that the UE can complete the RACH-less CHO within the (t1, t2) time window (no spec impact, up to NW implementation)

For time-based only CHO (no RSRP-based criterion) the UE shall start monitoring for DG from t1

For CHO in EMC a new event (e.g. condEventD2) is introduced.

New event comprises a reference location and distance threshold for source and target cell.

Ephemeris and epochTime information for candidate CHO cell is also provided in RRC Reconfiguration (configuring the CHO) within the configuration prepared by the source cell (outside of the new event).

If ephemeris and epochTime information for candidate CHO cell is not provided in RRC Reconfiguration, the UE may use the corresponding neighbour information from SIB19.

Introduce one new target satellite configuration, e.g. ntn-TargetSatConfig, (but we can keep the current terminology in the running CR) and provide the NTN-config of the target satellite in it for the specific signaling format about the target satellite information in SIB19. The presence of this information indicates that satellite switch without PCI change is supported

At least for soft switch, there needs to be an “SSB time offset” between the source and the target satellite. “SSB time offset” is specified as a new IE, with the same format as “offset” in SSB-MTC4

Target satellite SSB tracking is handled autonomously by the UE based on the provided SSB time offset

The “SSB time offset” between the source and the target satellite should be provided in SIB19

Support implicit indication to inform UE it is hard switch or soft switch case

For soft satellite switch, as a baseline, it is sufficient to provide the “SSB time offset” of the target satellite in SIB19. (Can come back in the next meeting to check whether a different SSB index for the target satellite can optionally be provided)

T-start is explicitly signalled (same format as T-service). If T-start is not signalled, T-start is assumed to be equal to T-service, i.e. hard switch.

For R18 we clarify that signalling a T-start higher than T-service is an unforeseen case and the UE will assume T-start = T-service

During satellite switching procedure, UE should reset the L3 filter for serving cell RRM measurement and RLM, and it’s up to UE implementation (i.e. no RAN2 spec impact).

If UE receive the HO command before UE initiates the satellite switching procedure (i.e. before the time point of satellite switching), UE will initiate the HO procedure immediately.

Both CHO and satellite switching procedure can be configured simultaneously.

When both CHO (for a different cell) and satellite switching procedure are configured, the UE initiates the procedure that triggers earlier; it's up to UE implementation if both procedures are triggered at the same time.

This feature will be called “satellite switch with re-sync”

RACH-less satellite switch procedure as shown in Figure-1 in R2-2313877 is endorsed as the baseline to be further checked in the CR review

Check in the RRC CR review whether the UE may need to acquire SIB19 immediately when UE acquires DL sync of target satellite

A UE supporting TA reporting may trigger TAR and TAR-SR based on network configuration (as in legacy)

It is up to NW implementation to signal T-start, e.g. if it does not want to receive UL TX before T-service (if there is no T-start, UL TX cannot happen before T-service)

We don’t introduce specific changes (e.g. no new indication in SIB19) to a support RACH-based procedure but this does not exclude the possibility for the NW to trigger PDCCH order

**Email discussions**

* [Post124][301][NR-NTN Enh] 38.300 CR (Thales)
* [Post124][302][NR-NTN Enh] 38.331 CR (Ericsson)
* [Post124][303][NR-NTN Enh] 38.321 CR (Interdigital)
* [Post124][304][NR-NTN Enh] 38.304 CR (ZTE)
* [Post124][305][NR-NTN Enh] 37.355 CR (CATT)
* [Post124][306][NR-NTN Enh] 38.305 CR (Qualcomm)
* [Post124][312][NR-NTN Enh/mIAB] MAC CR on RACH-less HO (Interdigital)
* [Post124][313][NR-NTN Enh] UE Caps CRs (Intel)

#### 2.2.2 Remaining Open issues

Further corrections may be discussed/implemented at next meeting. However none of these would require category B CR (addition of feature)

## 2.3 RAN3

#### 2.3.1 Agreements

* **RAN3#121-bis meeting, Xiamen, China, October 9 – 13, 2023:**

**Endorsed CR**

* R3-235057 (BL CR to 38.300) Stage 2 BL CR for NR NTN (Ericsson, CATT, Thales, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated) draftCR
* R3-235839 (BLCR to 38.413) BL CR for NR NTN (Nokia, Nokia Shanghai Bell, Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated) CR1008r3, TS 38.413 v17.6.0, Rel-18, Cat. B
* R3-235840 (BLCR to 38.423) BL CR for NR NTN (Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC) CR0933r8, TS 38.423 v17.6.0, Rel-18, Cat. B

**Endorsed TP**

* R3-235945 (TP for TS38.413 BL CR and TS38.423 BL CR) miscellaneous Correction on the BL CRs (Nokia, Nokia Shanghai Bell)
* **RAN3#122 meeting, Chicago, USA, November 13 – 17, 2023:**

**Endorsed CR**

* R3-237058 (BL CR to 38.300) Stage 2 BL CR for NR NTN (Ericsson, CATT, Thales, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated) draftCR
* R3-237060 (BLCR to 38.423) BL CR for NR NTN (Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC) draftCR
* R3-237697 (BLCR to 38.413) BL CR for NR NTN (Nokia, Nokia Shanghai Bell, Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated) draftCR

**Network verified UE location**

For NTN UE location verification, we should assume a TRP is associated to a satellite.

Ephemeris info of the satellites should be configured to the LMF via OAM.

Association between the satellite and TRP ID should also be configured to LMF via OAM.

No consensus to have any enhancements to address Mirror positions ambiguity in R18.

It is proposed to introduce the Common TA Information and capture it in TP for BLCR on 38.455.

Reply to RAN2 that all the proposed scenarios from RAN2 in the LS are supported by current NRPPa.

#### 2.3.2 Remaining Open issues

Further corrections may be discussed/implemented at next meeting. However none of these would require category B CR (addition of feature)

## 2.4 RAN4

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

#### 2.4.1 Agreements

* **RAN4#108-bis meeting, Xiamen, China, October 9 – 13, 2023:**

**UE RF**

**Agreement:**

* Define the UE RF requirements based on the envelope of mathematical antenna model to cover both UE with mechanical steering antenna and UE with electronic steering antenna.
* FFS whether and how to capture the information in the TS.

**Agreement:**

* RAN4 to consider the following UE Types:

1/ Terminal Type 1 (**Electronic** steering **antenna**) with the following NFs:

* 2.5 dB NF (Class 1) - for both LEO and GEO;
* 6 dB NF (Class 2) - for LEO only.

2/ Terminal Type 2 (Mechanical steering antenna) with the following NFs:

* 2.5 dB NF (Class 1) – for both LEO and GEO.

**Agreement:**

* Reuse the existing RF requirement with Modulation limited up to 16QAM and optional to support 64QAM

Agreement/WF:

Take following information as working assumption for beam switching time:

Ø  For mechanical steering: the typical values can be 22 degree/second, 6~8 seconds (if 120 degrees steering is assumed) for inter-satellite beam switching.

Ø  For electronic steering: A typical value is FFS for beam steering.

**Agreement**

For NTN-specific PUSCH DMRS bundling, support Alt 2 for TDW determination.

Alt 2: gNB-centric TDW determination

* + Nominal TDW is determined based on gNB configuration.
  + Actual TDW is determined based on gNB configuration/indication.
  + Note: Alt 2 does not imply that spec impact of actual TDW determination is assumed for NTN.
  + FFS: details, including UE capability and assistance information reporting

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

**BS RF/Demod**

**EISREFSENS\_50M declaration**

* Agreement:

The SAN reference sensitivity to be specified based on manufacturer declared value EISREFSENS\_50M within a specified range

**EISREFSENS\_50M definition – GEO class SAN**

* Agreement:

The interval for the declaration of EISREFSENS\_50M for GEO class SAN shall be [-140] to [-149] as a starting point for decision in the next meeting

**EISREFSENS\_50M definition – LEO class SAN**

* Agreement:
  + The interval for the declaration of EISREFSENS\_50M for LEO class SAN shall be [-120] to [-129] as a starting point for decision in the next meeting

Agreement:

* Circular aperture antenna model for SAN and NTN UE is used in the co-existence study for Rel-18 NTN. Use of phased array antenna model needs further discussion.
* Remove the angle range limitation of ± 90° for NTN UE antenna.
* Equivalent satellite antenna aperture values for co-existence study:

|  |  |  |
| --- | --- | --- |
| **GEO** | **LEO-1200** | **LEO-600** |
| 5.9/3.66m (DL/UL) | 0.6/0.36 m (DL/UL) | 0.6/0.36 m (DL/UL) |

* Simulation of VSAT with 1.5m height can be covered by ESIM cases taking into account the agreement of Issue 1-1.
* Assume 1 dB of atmospheric losses and the scintillation losses in the co-existence study.
* To use FRF=2 with ideal polarization isolation for the coexistence study.
* Stick with TN 20% active ratio rather than changing the TN cell diameter and the Scaling Factors of TN to NTN
* Stick with previous agreements to continue study on cases with 90 and 25 degree elevation angles.
* Do not discuss on the change of TN ACLR & ACS values @ 17GHz at this stage and as the normal approach, ACIR values will be achieved first and ACLR and ACS values of NTN will be derived based on those ACIR when TN values @17GHz may be discussed and referred to.
* Use the flat ACIR model for both NTN & TN. 10 NTN UEs in UL and 1 TN UE in UL.
* Not to consider the NTN UL TxP increase as a potential way forward to improve LEO orbits in scenario 4 at this stage but noting in some scenarios those parameters may not satisfy the desired performance.
* Update simulation assumption document with latest agreements.

Agreement:

* While running the NTN-TN coexistence simulations, RAN4 should continue investigating why the TN UL results are so diverging (especially for 27GHz)
* Assume shadowing correlation between beams of the same satellite as 1.
* Companies are encouraged to share exact uplink Tx power control value used for calibration and as well to share UL TxP statistics and UL CLx-tile actual values between companies to align UL SINR.

- Single beam UL SINR (no interference) should be 15 dB for all users in LEO! Moreover, some GEO users may be power limited.

Agreement:

* Update and use the table in Attachment 2 of R4-2316265 to collect results of the co-existence study of NTN in above 10GHz bands.
* Further discuss considerations on Scenario 5 taking into account related Issues in Topic 1.

**Issue 1-1: Workplan**

* Agreement
  + Workplan is agreed at RAN4#108-bis meeting.

|  |  |
| --- | --- |
| **RAN4#108-bis Oct 2023** | |
|  | Discussion and agreement on work plan.  Initial round of discussion on performance requirements scope.  Initial round of discussion on simulation assumptions. |
| **RAN4#109 Nov 2023** | |
|  | Second round of discussion on performance requirements scope.  Second round of discussions on simulation assumptions.  Initial round of simulation results collection and alignment. |
| **RAN4#110 Feb 2024** | |
|  | Finalize discussions on performance requirements scope.  Discussions on CR split.  Second round of simulation results collection and alignment. |
| **RAN4#110-bis Apr 2024** | |
|  | Finalize discussions on simulation assumptions.  Third round of simulation results collection and alignment.  Endorse draft CRs. |
| **RAN4#111 May 2024** | |
|  | Final round of simulation results collection and alignment.  Agree formal CRs. |

**Issue 2-1-1: Scenario**

* Agreement
  + At least NGSO scenario to be considered for requirement definition, companies can check whether GSO can also be considered for NTN demod.
  + Focus on the mobility scenario assumed by RRM. (Mobility VSAT with LEO is not considered)

**Issue 2-1-2: Channel model**

* Agreement
  + For FR2-NTN, consider NTN-TDLA and/or NTN-TDL-C with down selection if necessary.
  + FFS delay and Doppler
  + For delay selection, consider the worst case based on typical angle selection, e.g. [30 degree].
  + How to derive the Doppler:
    - Option 1: Based on residual frequency error.
    - Option 2: Based on UE speed
      * FFS UE speed: [120km/h, 1000km/h], other Options are not precluded.
    - Interested companies are encourage to propose values for doppler and delay spread.
  + Other options are not precluded

**Issue 3-1-1: Whether to define UE PDSCH demodulation performance requirements for above 10 GHz bands**

* Agreement
  + Agree to define UE PDSCH demodulation performance requirements for above 10 GHz bands.

**Issue 3-1-2: HARQ processes for above 10 GHz bands**

* Agreement
  + FFS 16 HARQ process, 32 HARQ process, HARQ process disabled.
  + Interested Companies can provide further analysis for 16 HARQ process, 32 HARQ process, HARQ process disabled.

**Issue 3-1-5: Whether to define UE CSI reporting requirements for above 10 GHz bands?**

* Agreement
  + Do not consider PMI reporting and RI reporting.
  + Companies can provide feasibility analysis on CQI reporting under AWGN or fading channels.

**Issue 3-2-1: Frequency/timing drift**

* Agreement
  + Assumption: UE is assumed to do compensation for frequency and timing drift , and is not part of baseband processing for demod.
  + No frequency and timing drift are modelled in Rel-18 NTN UE requirements.

**Issue 3-2-5: Receiver assumption**

* Agreement
  + MMSE-IRC

**Issue 3-2-6: Duplex**

* Agreement
  + FDD

**Issue 3-2-7: Payload**

* Agreement
  + Transparent payload for both GSO and NGSO scenarios.

**Issue 4-1-1: Which feature can be considered for SAN PUSCH demodulation performance requirements for above 10 GHz bands?**

* Agreement
  + Define PUSCH with DFT-S-OFDM and CP-OFDM demodulation performance requirements for above 10 GHz bands.
  + FFS PUSCH repetition Type A, companies can do some analysis on the link budget.
  + Do not consider UL timing adjustment

**Issue 4-1-2: Which format can be considered for SAN PUCCH demodulation performance requirements for above 10 GHz bands?**

* Agreement
  + Define PUCCH format 0/1/2/3/4 demodulation performance requirements for above 10 GHz bands.

**Issue 4-1-3: Which format can be considered for SAN PRACH demodulation performance requirements for above 10 GHz bands?**

* Agreement
  + Define PRACH burst format B4/C2 demodulation performance requirements for above 10 GHz bands.
  + Do not consider PRACH burst format A2.

**Issue 4-1-4: Whether to define SAN PUSCH demodulation performance requirements for DMRS bundling?**

* Agreement
  + Define SAN PUSCH demodulation performance requirements for DMRS bundling for FR1 only if RF confirm that phase continuous is feasible.

**Issue 4-1-5: Whether to define SAN PUCCH demodulation performance requirements for Msg4 HARQ-ACK?**

* Agreement
  + Do not define PUCCH requirements Msg4 HARQ-ACK for NLOS channel.

**Issue 4-1-6: Whether to define SAN demodulation performance requirements for network verified UE location?**

* Agreement
  + Do not define SAN demodulation performance requirements for network verified UE location.

**Issue 4-1-7: Whether to define SAN demodulation performance requirements for NTN-TN and NTN-NTN mobility and service continuity enhancement?**

* Agreement
  + Do not define SAN demodulation performance for NTN-TN and NTN-NTN mobility and service continuity enhancement.

**Issue 4-1-8: WID update**

* Agreement
  + Update the impacted specification TS 38.108 for the performance part in the WID.
  + Update the objective of performance part WI to include coverage enhancement if necessary.

**Issue 4-2-1: Frequency and timing drift**

* Agreement
  + Assumption: UE will do pre-compensation for frequency and timing drift.
  + No frequency and timing drift are modelled in Rel-18 NTN SAN requirements.

**Issue 4-2-2: SCS and channel bandwidth**

* Agreement
  + Start demod work with 120 kHz SCS for initial alignment. If RRM concludes that 120 kHz SCS is not feasible, then further discussion is needed at that time on how to proceed
  + FFS channel bandwidth

**Issue 4-2-3: Antenna configuration**

* Agreement
  + For the SAN Rx, we need both 1Rx and 2Rx. For UE Tx, more discussion is needed to cover 1 Tx only or also 2Tx.

**Issue 4-2-4: MCS & rank**

* Agreement
  + Postpone to discuss this issue after channel model is selected.
  + Companies can do some link budget analysis until the next meeting.

**Issue 4-2-5: SAN type**

* Agreement
  + Prioritize to define SAN demodulation requirement for Type 2-O. FFS to define BS demodulation requirement for Type 2-H, pending on conclusion of RF core requirement.

**Issue 4-2-6: Duplex**

* Agreement
  + FDD

**Issue 4-3-1: Test setup for SAN PUSCH demodulation performance requirements**

* Agreement
  + Option 1 as the starting point, other options are not precluded.
    - Option 1:

|  |  |  |
| --- | --- | --- |
| **Parameter** | | **Value** |
| Transform precoding | | Disabled, Enabled |
| HARQ | Maximum number of HARQ transmissions | 4 |
|  | RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
|  | DM-RS duration | single-symbol DM-RS |
|  | Additional DM-RS symbols | [Pos2] |
|  | Number of DM-RS CDM group(s) without data | 2 |
|  | Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
|  | DM-RS port(s) | {0} [, {0, 1}] |
|  | DM-RS sequence generation | NID=0, nSCID =0 |
| Time domain | PUSCH mapping type | B |
| resource | Start symbol index | 0 |
|  | Allocation length | 10 |
| Frequency domain | RB assignment | Full applicable test bandwidth |
| resource | Frequency hopping | Disabled |
| TPMI index for 2Tx two-layer spatial multiplexing transmission | | 0 |
| Code block group based PUSCH transmission | | Disabled |
| PT-RS | Frequency density (*KPT-RS*) | 2, |
| configuration | Time density (*LPT-RS*) | 1, |

**Issue 4-3-2: Test setup for SAN PUCCH demodulation performance requirements**

* Agreement
  + Option 1 as the starting point, other options are not precluded.
    - Option 1:

Table 3: Test parameters of PUCCH format 0

|  |  |
| --- | --- |
| Parameter | Test |
| Number of UCI information bits | 1 |
| Number of PRBs | 1 |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | N/A for 1 symbol Enabled for 2 symbols |
| First PRB after frequency hopping | The largest PRB index – (Number of PRBs - 1) |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Initial cyclic shift | 0 |
| First symbol | 13 for 1 symbol  12 for 2 symbols |
| Test metric | DTX to ACK probability  ACK missed detection probability |
| Channel Model | [NTN-TDLA10-3000] |

Table 4: Test parameters of PUCCH format 1

|  |  |
| --- | --- |
| Parameter | Test |
| Number of information bits | 2 |
| Number of PRBs | 1 |
| Number of symbols | 14 |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | enabled |
| First PRB after frequency hopping | The largest PRB index – (nrofPRBs – 1) |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Initial cyclic shift | 0 |
| First symbol | 0 |
| Index of orthogonal cover code (*timeDomainOCC*) | 0 |
| Test metric | NACK to ACK probability  ACK missed detection probability |

Table 5 Test parameters of PUCCH format 2

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Modulation order | QSPK |
| Starting RB location | 0 |
| Intra-slot frequency hopping | N/A |
| Number of PRBs | 4 |
| Number of symbols | 1 |
| The number of UCI information bits | 4 |
| First symbol | 13 |
| DM-RS sequence generation | *NID*0=0 |
| Test metric | DTX to ACK probability  ACK missed detection probability |

Table 6: Test parameters of PUCCH format 2

|  |  |
| --- | --- |
| Parameter | Value |
| Modulation order | QSPK |
| First PRB prior to frequency hopping | 0 |
| Intra-slot frequency hopping | enabled |
| Frist PRB after frequency hopping | The largest PRB index – (Number of PRBs – 1) |
| Number of PRBs | 9 |
| Number of symbols | 2 |
| The number of UCI information bits | 22 |
| First symbol | 12 |
| DM-RS sequence generation | *NID*0=0 |
| Test metric | BLER |

Table 7: Test parameters of PUCCH format 3

|  |  |  |
| --- | --- | --- |
| Parameter | Test 1 | Test 2 |
| Modulation order | QPSK | |
| First PRB prior to frequency hopping | 0 | |
| Intra-slot frequency hopping | enabled | |
| First PRB after frequency hopping | The largest PRB index – (Number of PRBs – 1) | |
| Group and sequence hopping | neither | |
| Hopping ID | 0 | |
| Number of PRBs | 1 | 3 |
| Number of symbols | 14 | 4 |
| The number of UCI information bits | 16 | 16 |
| First symbol | 0 | 0 |
| Test metric | BLER | |

Table 8: Test parameters of PUCCH format 4

|  |  |
| --- | --- |
| Parameter | Value |
| Modulation order | QPSK |
| First PRB prior to frequency hopping | 0 |
| Number of PRBs | 1 |
| Intra-slot frequency hopping | enabled |
| First PRB after frequency hopping | The largest PRB index – (Number of PRBs – 1) |
| Group and sequence hopping | neither |
| Hopping ID | 0 |
| Number of symbols | 14 |
| The number of UCI information bits | 22 |
| First symbol | 0 |
| Length of the orthogonal cover code | n2 |
| Index of the orthogonal cover code | n0 |
| Test metric | BLER |

**Issue 4-3-3: Test setup for SAN PRACH demodulation performance requirements**

* Agreement
  + Option 1 as the starting point, other options are not precluded.
    - Option 1:
      * PRACH format: C2 and B4
      * Test preamble configuration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Burst format | SCS (kHz) | Ncs | Logical sequence index | v |
|  | 60 | 69 | 0 | 0 |
| B4, C2 | 120 | 69 | 0 | 0 |

* + - * Frequency offset
        + [AWGN: 0Hz]
        + [Fading: 3000Hz]
      * Time error tolerance
        + **where is the largest delay of the propagation channel**
      * Channel Model: [NTN-TDLA10-3000]

Test setup for UL coverage enhancement

* Agreement
  + Postpone this topic discuss to the next meeting.

**RRM**

**Issue 1-1: Common vs. Different UE uplink timing requirements for different UE types**

**Agreement:**

* A common set of UE uplink timing requirements is defined for both UE types.

**Issue 1-2: Common vs. Different UE uplink timing accuracy requirements for different cases (Case-1/2/3)**

**Agreement:**

* Further discuss achievable UE performance under different cases, FFS whether separate requirements needed or not.

**Issue 1-3: Further relaxation of Te\_NTN for PRACH**

**Agreement:**

* Define Te\_NTN requirements for uplink signals/channels except for PRACH first, and come back to the issue to decide whether to introduce a different set of requirements for PRACH.

**Issue 1-5: Te\_NTN for 120kHz**

**Agreement:**

* FFS whether different set of Te\_NTN requirements needed for UL SCS 120kHz.

**Issue 1-6: Te\_NTN for 60kHz and 120kHz**

**Agreement:**

Companies should provide ‘the exact value of Te\_NTN and values assumed for X and Y’ and ‘the analysis result based on the following criterion.’ Otherwise, the values/proposals won’t be captured in the list of options.

* Tg = 0.5\*Tcp – (Td + Tp + Tr + Ta + Tf + Tm): an effective guard period in CP
  + Tcp: a length of CP for the given SCS of UL channel/signal
  + Td: UE downlink synchronization error for the given SCS of SSB (BW of PBCH DMRS, i.e. 20 PRBs)
  + Tp = Tp,ue + Tp,sat: a round trip propagation delay estimation error due to UE position and satellite position estimation errors
    - Tp,ue: a round trip propagation delay estimation error due to [X]m of UE position error
    - Tp,sat: a round trip propagation delay estimation error due to [Y]m of satellite position estimation error
  + Tr: TAC resolution error (from TS38.213)
  + Ta: TA adjustment accuracy error (from Table 7.3.2.2-1 of TS38.133)
  + Tf: an accumulated timing drift over 160ms due to a frequency offset of 0.1ppm
  + Tm: a margin needed at gNB receiver to accommodate any additional impairments if needed.
    - If a non-zero value is assumed in the proposal for Tm, the source of the impairments shall be provided too.
* Technical analysis is required if any number will be provided for each of the components in the next meeting.
* Whether the same or different values for different channels is contribution driven.

**Issue 2-1: RRC Idle and Inactive mobility**

**Agreement:**

* For Type 1 UE, UE requirements on RRC Idle and Inactive mobility in intra-satellite scenario reuse FR1 NTN requirements with Ksatellite = 1 without inter-satellite measurement configuration.
* For Type 2 UE, UE requirements on RRC Idle and Inactive mobility in intra-satellite scenario reuse FR1 NTN requirements with Ksatellite = 1 without inter-satellite measurement configuration. Note: RRC Idle and Inactive mobility in inter-satellite scenario is out of scope according to the endorsed RP-232694.

**Issue 2-2: L1 measurements**

**Agreement:**

* For Type 1 and Type 2 UE, L1-RSRP measurements are the same as the existing FR1 NTN requirements (9.5C).

**Issue 2-3: RLM**

**Agreement:**

* For Type 1 UE, RLM requirements specified based the assumption that the measurement delay without beam sweeping scaling factor.
  + RLM requirements are the same as the existing FR1 NTN requirements (8.1C).
* For Type 2 UE, RLM requirements are the same as the existing FR1 NTN requirements (8.1C).

**Issue 2-5: L3 measurements**

**Agreement:**

* For Type 1 UE and Type 2 UE, intra-satellite L3 measurements are the same as the existing FR1 NTN requirements defined in 9.2C and 9.3C without inter-satellite measurement configuration.
  + Existing UE capabilities need further clarification if these capabilities are expanded to NTN UE in Ka band, e.g.,
    - maxNumber-NGSO-SatellitesWithinOneSMTC-r17 and
    - parallelMeasurementWithoutRestriction-r17
  + Note: no inter-satellite L3 measurements based on the endorsed RP-232694.

**Issue 2-7: Measurement gap**

**Agreement:**

* FR2 MG patterns are used for NTN in bands above 10 GHz.

**Issue 2-8: Scheduling and Measurement Restrictions**

**Agreement:**

* Introduce scheduling and measurement restrictions only for mixed numerologies, as defined in FR 1 NTN, for the relevant FR2 NTN requirements, e.g.
  + radio link monitoring
  + L1-RSRP measurement
    - For Type 1 UE only
  + intra-frequency measurements
  + [inter-frequency measurements]

**Issue 2-9: Intra-satellite Handover**

**Agreement:**

* For Type 1 UE, intra-satellite HO/CHO requirements are the same as the existing FR1 NTN HO/CHO requirements.
* For Type 2 UE, intra-satellite HO/CHO requirements are the same as the existing FR1 NTN HO/CHO requirements.

**Issue 2-10: Inter-satellite Handover**

**Agreement:**

* For Type 1 UE, inter-satellite HO requirements are the existing FR1 NTN HO requirements with unknown cell condition plus an additional interruption component for UE beam refinement to address a concern about beam mis-alignment at the handover period due to the target satellite position error and/or UE beam steering error. TBD on the additional interruption length.
* For Type 2 UE, inter-satellite HO requirements are the existing FR1 NTN HO requirements with unknow cell condition plus an additional interruption component for the retuning of the mechanical beam direction. TBD on the additional interruption length.
* Postpone the discussion on inter-satellite CHO requirements on above 10GHz bands in future releases.

**Issue 2-11: Mechanical beam steering for Type 2 UE**

**Agreement:**

* For Type 2 UE, in RAN4#109, discuss and decide whether/how to resolve issues due to non-zero beam switching delay from one satellite to another.
  + The beam switching delay can be an implicit or explicit UE capability.
  + The capability can be static or semi-static one. RAN4 to aim to decide the details (including any procedure modification, which may be needed in RAN1/2/, to accommodate Type 2 UE beam switching latency).

**Issue 3-1: RRC state**

**Conclusion:**

* No discussion. Do not have to repeat discussions and make agreement on the issue already agreed by other working groups.

**Issue 3-2: Measurement period and accuracy requirements on RTD**

**Agreement:**

* Measurement period requirements for UE Rx-Tx measurement is defined to reuse the existing TN requirements with MG as baseline.
  + Option 1: a higher Es/Iot than the existing one is needed, targeting the same accuracy as the existing one.
  + Other options are not precluded.

**Issue 3-3: Measurement period and accuracy requirements on DL timing drift**

**Agreement:**

Discuss further on the interpretation on ‘UE Rx-Tx time difference measurement period’ as specified in RAN1 following conclusion.

*RAN1 agreement in RAN1#114 meeting*

* *DL timing drift measurement is defined as the DL timing estimated to be shifted due to Doppler over the service link associated with the UE Rx-Tx time difference measurement period.*

**Issue 3-4: Measurement accuracy requirements on UL timing drift**

**Agreement:**

Discuss and decide the following in RAN4#109.

* Whether the requirements apply when the total autonomous variation applied by the UE in the timing advance during a measurement period exceeds a threshold (e.g. 5\*Tp)

**Issue 4-1: TN to NTN cell reselection**

**Agreement:**

* FFS: whether/how to define TN to NTN cell reselection.

**Issue 4-2: NTN to TN cell reselection**

**Agreement:**

* UE is allowed to skip TN neighbour cells measurement in an area where there is no coverage of the frequency based on the provided TN cell coverage information and UE GNSS position information. FFS whether and how to implement it RAN4 CR.
* FFS on how to enhance NTN-to-TN cell reselection in case of mismatch between practical TN cell coverage and TN cell coverage information provided by serving cell.

**Issue 4-3: NTN to NTN time-based measurement initiation for cell reselection in earth-moving cell**

**Agreement:**

Further discuss the requirements on time-based measurement initiation for cell reselection in earth-moving cell based on following Options:

* Option 1: For NTN to NTN time-based measurement initiation for cell reselection in earth-moving cell, the existing RRC idle/inactive mode requirements referring to ‘t-service’ are reused.
* Option 2: Enhance the requirements on time-based measurement initiation for cell reselection in earth-moving cell
  + Introduce coverage information of serving cell for helping UE to assess the available time left for cell reselection measurement before UE leaves the coverage area of serving cell
* Option 3: For earth-moving cell, time-based measurement initiation may only apply to hard satellite switch in RAN2 design. (Nokia)

**Issue 4-4: NTN to NTN location-based measurement initiation for cell reselection in earth-moving cell**

**Agreement:**

* For NTN to NTN location-based measurement initiation for cell reselection in earth-moving cell, RAN4 to define the requirements based on the existing requirements on ‘4.2C Cell Re-selection for NR UE for Satellite Access,’ and introduce a new definition of reference location and an extra location margin.

**Issue 4-5: NTN to NTN higher priority frequency layer in earth-moving cell**

**Conclusion:**

* No discussion in RAN4#108bis

**Issue 4-6: Autonomous SMTC adjustment in RRC Idle/Inactive mode**

**Agreement:**

* For autonomous SMTC adjustment in RRC Idle/Inactive mode, no specific UE requirement is defined.

**Issue 5-1: NTN to NTN RACH-less (C)HO**

**Agreement:**

* RACH-less handover delay requirement consists of ‘RRC procedure delay + Interruption time,’ i.e. = TRRC + TInterrupt, where TInterrupt = Tprocessing + Tsearch + T∆ + Tmargin + TIU.
  + Tsearch: the definition and values are the same as that in 6.1C.1.2.2 in NTN HO.
  + Tprocessing: the definition and values are the same as that in 6.1C.1.2.2 in NTN HO.
  + T∆: the definition and values are the same as that in 6.1C.1.2.2 in NTN HO.
  + Tmargin: the definition and values are the same as that in 6.1C.1.2.2 in NTN HO.
  + TIU is the interruption uncertainty in acquiring the first UL transmission resource, which can be a configured grant based PUSCH, dynamic grant based PUSCH, SR on PUCCH, according to NW configuration and scheduling, or PRACH if no SSB mapping to pre-allocated grant has RSRP above the threshold while T304 is running.
* The RACH-less handover delay requirement applies to
  + both known and unknown cases
  + both intra-satellite and inter-satellite handover cases
  + both intra-frequency and inter-frequency target cell cases
* The RACH-less handover delay requirement is applicable only when the UE is provided with all essential information of the target satellite as the existing NTN handover requirement, i.e.
  + (from 6.1C.1.2 of TS38.133) The requirements apply provided that UE has the valid and applicable parameters of ephemeris information, common TA, DL and UL Polarization information, K offset , and K mac for target NR SAN cell during D handover, otherwise interruption time may be longer than the requirements in clause 6.1C.1.2.2.

**Issue 5-2: NTN to NTN Satellite switching without PCI change**

**Agreement:**

* For satellite switching without PCI change,
  + define requirements for both hard and soft switch scenarios.
    - TBD on how to define hard/soft satellite switch without PCI change (which will be determined mostly based on further clarification expected to be made by RAN2)
  + define requirements for PRACH-based and for without RACH performed solution.
  + The above does not necessarily mean that a common requirement formula cannot be defined. e.g. requirements for each case can be represented by a common formula with different definitions of respective components.
    - Starting point of the interruption time for the switch is t-Service, FFS other starting point needs to be considered for other cases depending on RAN2 progress
    - Ending point of the interruption time for the switch is PRACH transmission for PRACH-based case and [first UL transmission excepting PRACH for without RACH performed solution]
* Interruption time for the hard switch is defined as Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin 
  + Tsearch = [Trs] ms
  + Tprocessing = [5] ms
  + T∆, Tmargin and TIU are same as existing requirements
* FFS Interruption time for soft switch
* FFS on
  + whether/how to define requirements resulting from separate link switch time instances for UL and DL.
    - Note: the starting and ending may be revisited depending outcome of discussions
  + whether/how to define UE behavior (e.g. skipping/relaxation of L1/L3 measurement and evaluation) during the switch.

**Issue 5-3: NTN to NTN time and location-based trigger CHO enhancements**

**Agreement:**

* Define time and location-based NTN to NTN CHO requirements without L3 measurement criteria by modifying the current NTN to NTN CHO requirements.
* **RAN4#109 meeting, Chicago, USA, November 13 – 17, 2023:**

**UE RF**

**Issue 1-1 NTN UE power class/types definition**

**Agreement:**

* **Define the requirements based on the following UE types**

|  |  |  |
| --- | --- | --- |
| **UE class** | **UE type** | Type description |
| Fixed VSAT | 1 | Fixed VSAT supporting GSO and LEO with mechanical steering antenna. |
| 2 | Fixed VSAT supporting GSO and LEO with electronical steering antenna. |
| 3 | Fixed VSAT supporting LEO only with electronical steering antenna. |
| Mobile VSAT | 4 | Mobile VSAT supporting GSO with mechanical steering antenna. |
| 5 | Mobile VSAT supporting GSO with electronical steering antenna. |
| Note: Assuming that UE has single beam towards one single satellite at a given time. | | |

* UE capabilities for Rel-18 NTN UE
  + The following new UE capabilities will be specified
    - Capability signalling to distinguish electronic or mechanical steering antenna
    - Capability signalling to distinguish fixed or mobile VSAT
  + Reuse the capability of NTN\_ScenearioSuppot\_R17 to distinguish LEO, GSO or both

**Issue 1-2: Mapping between NF and NTN UE power class/types**

Agreement:

Fixed VSAT:

                             Electronic steering

                                             Class 1: 2.5 dB NF  (LEO and GSO)

                                             Class 2: 6 dB NF  (LEO only)

Mechanical steering

                                             Class 1: 2.5 dB NF  (LEO and GSO)

    Mobile VSAT:

                              electronic steering

                                             Class 1: 2.5 dB NF  (GSO)

                              mechanical steering

                                             Class 1: 2.5 dB NF  (GSO)

**Issue 1-3: the necessity of introduction of NTN UE capable of both electronic steering and mechanical steering and how reflect in the above UE types.**

**Agreement:**

* For the hybrid beam steering capable NTN UE, one clarification note is suggested to be added in 38.133 and 38.101-5 that the requirement could follow either electronic or mechanical beam steering requirements depending on the declared UE types.

**Issue 1-4: network signalling for barring certain VAST access**

Agreement: Specify a network IE to signal that network supports either a mobile VSAT UE, a fixed VSAT UE or both in Ka band.

**Issue 2-1: How to define the on-axis EIRP limit**

**Agreement:**

* maximum EIRP limit is 76.2dBm.
* The maximum TRP limit for NTN UE follows the regulatory requirements, including both ECC and FCC requirements.

**Issue 2-2: Transmit power assumption for each UE types**

**Agreement:**

* for each UE type, single value for minimum EIRP limit for certain elevation angle and FFS for the exact value;
* If UE is capable of communicating with both GSO and LEO, to follow the minimum EIRP for worse case.

**Issue 2-3: MPR and A-MPR requirement for VSAT**

**Agreement:**

* Not to introduce MPR and A-MPR requirement for NTN VSAT
* To use NS value approach to indicate the regional requirement if necessary

**Issue 2-4: freq error requirement for NTN VSAT**

Agreement: Reuse the existing FR1 NTN UE freq error requirement [+/-0.1ppm with 1ms]

**Issue 2-5: EVM requirement for NTN VSAT**

Agreement: postpone the support of Pi/2 BPSK for NTN VSAT in Rel-18 into future release

**Issue 2-6: Other transmitter signal quality requirement for NTN VSAT**

Agreement:

* Do not define the following requirements
  + carrier leakage requirement for NTN VSAT
  + legacy TN UE in-band emission for NTN VSAT
  + EVM equalizer spectrum flatness requirement for NTN VSAT

**Issue 2-7: Transmitter dynamic range requirement for NTN VSAT**

Agreement: The following requirements need be specified.

* The minimum output power
* The OFF output power
* The transition period requirement
* Power control requirement,

**Issue 2-8 OBW**

**Agreement:** follow the existing requirement of TS 38.101-2

**Issue 2-9 SEM requirement**

Agreement:

Option 1:

* Proposal 1:
* for the out-of-band emission requirement, propose to use the ITU-R SM.1541-6, Annex 5 OoB domain emission limits for space services (earth and space stations) as starting point and further discuss any modification if necessary (e.g. to keep consistency with other regional out-of-band emission requirement). [ZTE,R4-2320332]

Option 2:

**Table 9.5.2.2-1: General NR spectrum emission mask for FR2-NTN.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Spectrum emission limit (dBm) / Channel bandwidth** | | | | |
| **ΔfOOB**  **(MHz)** | **50**  **MHz** | **100**  **MHz** | **200**  **MHz** | **400**  **MHz** | **Measurement bandwidth** |
| ± 0-5 | -5 | -5 | -5 | -5 | 1 MHz |
| ± 5-10 | -13 | -5 | -5 | -5 | 1 MHz |
| ± 10-20 | -13 | -13 | -5 | -5 | 1 MHz |
| ± 20-40 | -13 | -13 | -13 | -5 | 1 MHz |
| ± 40-80 | -13 | -13 | -13 | -13 | 1 MHz |
| ± 80-100 | -13 | -13 | -13 | -13 | 1 MHz |
| ± 100-160 |  | -13 | -13 | -13 | 1 MHz |
| ± 160-200 |  | -13 | -13 | -13 | 1 MHz |
| ± 200-400 |  |  | -13 | -13 | 1 MHz |
| ± 400-800 |  |  |  | -13 | 1 MHz |
| ± 800-1600 |  |  |  |  | 1 MHz |
| ± 1600-3200 |  |  |  |  | 1 MHz |
| ± 3200-4000 |  |  |  |  | 1 MHz |
| NOTE 1: Void | | | | | |

Option 3: other options are not precluded.

**Issue 2-10 transmitter spurious emission requirement**

Agreement:

Option 1:

* The following regulatory requirement should be taken into account.
* for the general transmitter spurious emission requirement, propose to follow the ITU-R SM.39 recommendation.[ZTE,R4-2320332]

TABLE 2 [ITU-R SM.329]

|  |  |
| --- | --- |
| Space services (mobile earth stations)(3), (4) | 43  10 log *P*, or 60 dBc, whichever is less stringent |
| Space services (fixed earth stations)(3), (4) | 43  10 log *P*, or 60 dBc, whichever is less stringent |

* CEPT ERC 74.01
* FCC 25.202(f)(4)

**Issue 2-11 Phase continuity requirement for DMRS bundling.**

Agreement:

* NOT applicable for FR2-NTN VSAT

**Issue 3-1 REFSENS requirements**

Agreement for polarization assumption:

* For polarization assumption for VSAT receiver requirement, the default assumption is single polarization
* If VSAT is capable of both polarization reception at the same time, the delta\_R [TBD] for diversity gain could be added;

Agreement for REFSENS:

For UE type 3 supporting with LEO only:

* Link budget is based on the LEO600KM at [90] degree elevation angle and NF as 6dB;

For UE types supporting with both GEO and LEO:

* Link budget is based on GEO assumption with [25] degree elevation angle and NF as 2.5dB;

**Issue 3-2 FRC and FDD pattern in Annex.**

Agreement:

* Reuse the existing DL FRC defined in TS38.101-2 with update TDD pattern configuration for FDD. FFS for UL FRC/ PRB configuration.

**Issue 3-3: Maximum input power for NTN VSAT**

Agreement :

For UE type 3 supporting with LEO only:

* Link budget is based on the LEO400KM at [90] degree elevation;

For UE types supporting with both GEO and LEO:

* Link budget is based on LEO600KM at [90] degree elevation;

**Issue 3-4: In-band blocking requirement for**

Agreement :

for in-band blocking requirement for VSAT, propose to specify the power level of IBB to the same as power level of interfering signal of ACS requirement and reuse the freq offset of FR2 TN UE in-band blocking requirement

**Issue 3-5: Receiver spurious emission requirement for NTN VSAT.**

Agreement :

* Option 1: not needed since this is FDD band and OTA conformance testing.

**Issue 4-2: applicability of DMRS bundling for GSO and NGSO**

Agreement:

For GSO:

* *To reuse maxDurationDMRS-Bundling-r17 for Rel-18 NTN UE DMRS bundling*
* reuse the same requirement from Rel-17 TN coverage enhancement requirement (DMRS bundling )for Rel-18 NTN UE DMRS bundling requirement;
* . The requirement is verified under [0.17ppm] Doppler and constant delay test conditions. The delay condition is a constant and derived from the ephemeris information (SIB-19) and UE location associated with the Doppler value under test.

For NGSO:

* To define new capability for Rel-18 NTN UE DMRS bundling for Rel-18 NTN UE DMRS bundling;
* RAN4 will not introduce the requirement in Rel-18;
* There are no conformance testing with emulated varying channel model under NGSO up to Rel-18, whether to enable the DMRS bundling feature in NGSO, it’s up to the network decision;
* RAN4 recommend to specify side condition for NGSO under the varying Doppler and time delay in the future release.

**BS RF/Demod**

**Agreement:**

Separate GEO and LEO in 2 different classes

**Agreement:**

Specify ΔFR2\_REFSENS

**Agreement:**

As FRF=1 was not considered in Rel-18 coexistence study for this WI, there is no need to specify dynamic range.

**Issue 1-1: NTN UE antenna model**

* Proposals
  + Option 1: Change NTN UE antenna model parameter as below

|  |
| --- |
| 1    For UE,  where:  - J1(x) is the Bessel function of the first kind and first order with argument ‘x’;  - a is the radius of the antenna's circular aperture;  - k = 2f/c is the wave number;  - f is the frequency of operation;  - c is the speed of light in a vacuum and  is the angle measured from the bore sight of the antenna's main beam.  Note that *ka* equals to the number of wavelengths on the circumference of the aperture and is independent of the operating frequency. And the sin () function is in radian. |

* Agreement: Option 1 agreed

**Issue 2-2: Treatment of NaN value**

* Proposals
  + Option 1: In case that cell edge throughput is NaN due to the out of coverage, RAN4 can conclude based on average throughput loss.
* Agreement: option 1 agreed

**Issue 2-3: Conclusion on ACIR**

**Agreement:**

Based on collected results till RAN#109, RAN4 conclude below tentative ACIR from co-existence perspective:

* For case 6 &7 (SAN ACLR), required ACIR below 5 dB from RAN4 co-existence perspective
* For case 1 (VSAT UE ACLR), ACIR as [10.5] for GEO; ACIR for LEO: [13.15]
* For case 4 (SAN ACS), ACIR as [14.3] for GEO; ACIR for LEO:[16.2]
* For case 5 (VSAT UE ACS), ACIR as [39.2] for GEO; ACIR for LEO: [42.9]

Note: It’s not precluded to further discuss and make refinement if needed on above ACIR conclusion with associated ACLR/ACS requirements in future RAN4 meetings.

**Issue 2-5: ACLR & ACS**

**Agreement:**

For SAN ACLR: [12] dBc for both GEO and LEO

For VSAT UE ACLR: [14] dBc for both fixed VSAT and mobile VSAT

For SAN ACS: For GEO: [18] dBc, and LEO: [24] dBc.

For VSAT ACS:

* Considering below candidate values as starting point for VSAT ACS
  + Option 1: 23 dBc
  + Option 2: 30 dBc
  + Option 3: 35 dBc
* FFS for the additional means to address the co-existence issue, candidate options for further discussion
  + Option 1: Limit the elevation angles on DL side for VSAT UE
  + Option 2: Configure additional guard-band
  + Option 3: Consider different channel model (e.g. UMa instead of free space loss) between VSAT UE and TN BS.
  + Other options not precluded

**Issue 1-1-1: Scenario**

* Agreement:
  + For UE side
    - Define requirements for NGSO and GSO. FFS whether one or two sets of requirements are specified for NGSO and GSO.
  + For SAN side
    - Define one set of requirements for both NGSO and GSO.

**Issue 1-1-2: Channel model**

* Agreement:
  + Only NTN-TDLC will be considered.

**Issue 1-1-3: Doppler**

* Agreement: Consider the following Doppler value for initial evaluation
* UE: [600Hz, 1200HZ, 2000Hz]
* SAN: [600Hz, 3000Hz]
* Leave some margin with respect to 0.1ppm requirement if all of them found to be feasible. Margin to be discussed.

**Issue 1-1-4: Delay spread**

* Agreement:
  + 5ns for NTN-TDLC

**Issue 2-1-1: HARQ processes for above 10 GHz bands**

* Agreement
  + Consider both 16 and 32 HARQ processes; need further consideration on how to apply these to GSO and NGSO. Disabled HARQ requires further discussion.

**Issue 2-1-3: Whether to define UE PBCH demodulation requirements for above 10 GHz bands?**

* Agreement:
* Don’t define PBCH requirement for NR NTN enhancements.

**Issue 2-1-4: Whether to define UE CQI reporting requirements for above 10 GHz bands?**

* Agreement:
  + Do not define UE CQI reporting requirements for above 10 GHz bands

**Issue 2-2-1: SCS (except PBCH testing)**

* Agreement:
  + Confirm 120 kHz SCS for initial alignment as confirmed in RRM session.

**Issue 2-3-2: Rank for PDSCH**

* Agreement
  + Consider Rank 1 only.

**Issue 2-3-3: PDSCH mapping type**

* Agreement
  + PDSCH mapping type A

**Issue 2-3-5: Configuration for PBCH test (If agreed to be introduced)**

* Agreement
  + Not applicable (PBCH requirement will not be introduced)

**Issue 2-3-6: Configuration for CQI reporting test (If agreed to be introduced)**

* Agreement
  + Not applicable (CQI requirement will not be introduced)

**Issue 3-1-1: Whether to define PUSCH repetition Type A for SAN PUSCH demodulation requirements for above 10 GHz bands?**

* Agreement:
* Define PUSCH repetition Type A for SAN PUSCH demodulation requirements for above 10 GHz bands.

**Issue 3-1-2: Whether to define SAN PUSCH demodulation performance requirements for DMRS bundling?**

* Agreement:
* Define SAN PUSCH demodulation performance requirements for DMRS bundling
* FFS on whether actual model to be used for timing drift.

**Issue 3-1-3: Whether to define SAN multi-slot PUCCH format 1 demodulation requirements under LOS channel?**

* Agreement:
* Don’t define SAN PUCCH for msg4 HARQ-ACK demodulation requirements under LOS channel

**Issue 3-2-1: Channel bandwidth**

* Agreement:
* Consider 50MHz as the channel bandwidth.

**Issue 3-2-2: Antenna configuration**

* Agreement:
  + Keep the previous agreement to consider both 1Tx1Rx and 1Tx2Rx
  + FFS 2Tx2Rx pending on conclusion of the 2Tx UE RF requirement.

**Issue 3-2-3: Rank**

* Agreement
  + Rank 1 for 1Tx

**Issue 3-2-5: SAN type**

* Agreement
  + Do not define SAN demodulation requirement for SAN Type 2-H

**RRM**

**Issue 1-6: Te\_NTN for 60kHz and 120kHz**

**Agreement:**

* UL 60kHz SCS:
  + 13 Ts for all cases with 120kHz/240kHz SSB
* UL 120kHz SCS:
  + Case 1 and case 2: 7.5 Ts
    - FFS for the applicable side condition on case 2
  + Case 3: Higher than 7.5 Ts, FFS for the exact value

**Issue 1-7: NTA-offset**

**Agreement:**

* RAN4 to define the exact value of NTA,offset for NR NTN band above 10 GHz.
  + Option 1: the value of NTA-offset defined in Table 7.1.2-2 for FR2
  + Other options are not precluded.

**Issue 1-8: UE Timing Advance adjustment accuracy**

**Agreement:**

* RAN4 to define the timing advance adjustment accuracy requirement for NR NTN band above 10 GHz. The values for 60kHz and 120kHz UL SCSs are the same as those defined in Table 7.3A.2.2-1.

**Issue 1-9: UL timer accuracy requirements**

**Agreement:**

* RAN4 to define the UL timer accuracy requirements for NR NTN band above 10 GHz. The values are the same as those defined in Table 7.2C.2-1.

**Issue 1-10: Gradual timing adjustment requirements**

**Agreement:**

* RAN4 to define the gradual timing adjustment requirements for NR NTN band above 10 GHz. The values are the same as those defined in Table 7.1.2.1-1.

**Issue 2-1: RRC Idle and Inactive mobility**

**Agreement:**

* RAN4 not to define RRC Idle and Inactive mobility requirements for inter-sat scenario for Type 1 UE.

**Issue 2-3: RLM**

**Agreement:**

* Lmax = 64 and NRLM = 8; for both Type 1 and Type 2 UEs

**Issue 2-4: RRC Re-establishment**

**Agreement:**

* For type 1 UE
  + Inter-satellite RRC re-establishment: No RRC re-establishment requirements
* For type 1 UE:
  + Intra-satellite RRC re-establishment: Define RRC re-establishment requirement, and the requirement is the same as the existing FR1 NTN requirements (6.2C.1). And the requirement applies when the UE is not configured with inter-satellite measurement.
  + FFS whether exception case need to be considered
* For type 2 UE
  + Intra-satellite RRC re-establishment
    - Define RRC re-establishment requirement, and the requirement is the same as the existing FR1 NTN requirements (6.2C.1). And the requirement applies when the UE is not configured with inter-satellite measurement.
    - FFS whether exception case need to be considered
  + Inter-satellite RRC re-establishment
    - No RRC re-establishment requirements

**Issue 2-5: L3 measurements**

**Agreement:**

* For intra-frequency intra-satellite measurements, a UE shall be capable of performing SS-RSRP, SS-RSRQ, SS-SINR measurements for at least:
  + 8 identified cells, and 1 SSB per identified Cell
* For inter-frequency intra-satellite measurements, a UE shall be capable of performing SS-RSRP, SS-RSRQ, SS-SINR measurements for at least:
  + 4 identified cells, and 1 SSB per identified Cell

**Issue 2-7: Measurement gap**

**Agreement:**

* Companies are encouraged to discuss the per FR and per gap pattern capability aspects.

**Issue 2-10: Inter-satellite Handover**

**Agreement:**

* For type 1 UE, the additional interruption length X: 3\*Trs
* For type 2 UE: Introduce requirements based on the assumption as 22 degree/s for beam steering speed without UE capability
  + using formula as Angle offset / UE beam steering speed
  + UE beam steering speed as 22 degree/s

**Agreement:**

* Send an LS to RAN2 to notify that for type 2 UEs, the steering of the antenna beam is close to the maximum configurable value for T304.

**Issue 3-2:** **Measurement period and accuracy requirements on RTD**

**Agreement:**

* For UE Rx-Tx measurement period requirement, as baseline, the scope does not include measurements across different frequency layers.
* For the core part CR, Nsample = [1].

**Issue 4-1: TN to NTN cell reselection**

**Agreement:**

* Define requirements on TN to NTN cell reselection.
  + Define core requirements for GNSS ON and GNSS switch OFF to ON, no test case.
  + No specific value for the GNSS time to first fix to be define for the case of GNSS switch OFF to ON.

**Issue 4-2: NTN to TN cell reselection**

**Agreement:**

* Define requirements on NTN to TN cell reselection.

#### 2.4.2 Remaining Open issues

Specify remaining core requirements for NR-NTN deployment in above 10 GHz

* Rx/Tx for the selected VSAT UE class/types for the Ka band (i.e. Off axis, spurious, EIS, EIRP, ACS)
* Rx/Tx for SAN node for the Ka band (i.e. ICS)
* RRM for electronically-steered beam UEs (Type 1) and mechanically-steered beam UEs (Type 2) (e.g. additional interruption time during inter satellite HO, non zero beam switching delay)

Specify performance requirements for NR-NTN deployment in above 10 GHz

* Specify RRM performance requirements and test cases
* Specify UE demodulation and CSI reporting requirements
* Specify satellite access node demodulation requirements
* Specify satellite access node conformance tests

## 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.

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## 4. References

## 4.1 RAN1

**RAN1#114bis Xiamen/China, October 9th - 13th, 2023:**

* R1-2310221 R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R1-2308863 Considerations on the system parameters for FR2-NTN THALES
* R1-2310650 Rel-18 Higher Layer Parameters for NR NTN Moderator (Thales)
* R1-2309988 Discussion on RAN4 LS on the system parameters for NTN above 10 GHz MediaTek Inc.
* R1-2309149 Discussion on the RAN1 related aspects for NTN above 10 GHz ZTE
* R1-2309333 Discussion on RAN4 LS on FR2-NTN PRACH aspects LG Electronics
* R1-2309492 Discussion on FR2 issues for NR NTN CATT
* R1-2309543 Discussion on the RAN1 impact for NTN above 10GHz Beijing Xiaomi Mobile Software
* R1-2309849 Discussion on NTN above 10 GHz Apple
* R1-2310049 Discussion on FR2-NTN for NR NTN NTT DOCOMO, INC.
* R1-2310108 Discussions on RAN4 LS on FR2-NTN aspects Sharp
* R1-2309041 Discusion of the LS on the system parameters for NTN above 10 GHz vivo
* R1-2309342 Discussion on RAN4 LS on system parameters for NTN above 10 GHz Samsung
* R1-2309735 Open issues related to NTN operation in frequency bands above 10 GHz Nokia, Nokia Shanghai Bell
* R1-2310239 Discussion on RAN4 LS on the system parameters for NTN above 10 GHz Ericsson
* R1-2310262 Discussion on RAN1 impact to support RAN4 work on NTN above 10GHz Huawei, HiSilicon
* Discussion to be handled in agenda item 8.13. Determine whether/how RAN1 specifications need to be changed.
* R1-2310158 Power control for RACH-less handover in NR NTN Qualcomm Incorporated
* R1-2308910 Further discussion on LS for RACH-less handover Huawei, HiSilicon
* R1-2309040 Discussions on RAN2 LS on RACH-less Handover vivo
* R1-2309341 Discussion on RAN2 LS on RACH-less handover Samsung
* R1-2309610 Discussion on remaining issue for RACH less handover for NR NTN OPPO
* R1-2309808 Draft Reply LS on RACH-less Handover Apple
* R1-2310219 Discussion on RAN2 LS on RACH-less handover Ericsson
* Discussion to be handled in agenda item 8.13.
* R1-2308908 Maintenance of coverage enhancement for NR NTN Huawei, HiSilicon
* R1-2309091 Discussions on remaining issues of coverage enhancements in NR NTN vivo
* R1-2309150 Remaining issue on coverage enhancement ZTE
* R1-2309230 Remaining issues on coverage enhancement for NR NTN Spreadtrum Communications
* R1-2309250 Maintenance of coverage enhancement for NR NTN Baicells
* R1-2309313 On coverage enhancements for NR NTN Ericsson
* R1-2309334 Remaining issues on coverage enhancement for NR NTN LG Electronics
* R1-2309392 Remaining issues on coverage enhancement for NR NTN Samsung
* R1-2309434 Discussion on remaining issues on coverage enhancement for NR-NTN xiaomi
* R1-2309504 Discussion on remaining issues of UL coverage enhancement for NR NTN CATT
* R1-2309598 Discussion on remaining issue for coverage enhancement for NR NTN OPPO
* R1-2309687 Remaining issues on coverage enhancement for NR NTN CMCC
* R1-2309710 Maintenance of coverage enhancements for NR NTN ETRI
* R1-2309712 Remaining issues on coverage enhancement for NR-NTN Panasonic
* R1-2309736 Open issues related to coverage enhancements for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2309793 Discussion on remaining issues of coverage enhancement for NR NTN Lenovo
* R1-2309850 On Remaining Issues of Coverage Enhancement for NR NTN Apple
* R1-2309986 Coverage enhancement for NR NTN MediaTek Inc.
* R1-2310050 Maintenance of coverage enhancement for NR NTN NTT DOCOMO, INC.
* R1-2310109 Remaining issues on coverage enhancement for NR NTN Sharp
* R1-2310159 Maintenance on coverage enhancements for NR NTN Qualcomm Incorporated
* R1-2308862 Maintenance on network verified UE location in NR NTN THALES
* R1-2308909 Maintenance of network-verified UE location for NR NTN Huawei, HiSilicon
* R1-2309092 Discussions on remaining issues of UE location verification in NR NTN vivo
* R1-2309151 Remaining issue on network verified UE location ZTE
* R1-2309393 Remaining issues on network verified UE location for NR NTN Samsung
* R1-2309505 Discussion on remaining issues on Network verified UE location for NR NTN CATT
* R1-2309599 Discussion on remaining issue for network verified UE location for NR NTN OPPO
* R1-2309737 Open issues related to network verified UE location for NR over NTN Nokia, Nokia
* R1-2309851 On Remaining Issues of Network Verified UE Location Apple
* R1-2309987 Network verified UE location for NR NTN MediaTek Inc.
* R1-2310051 Remaining issue on Network verified UE location for NR NTN NTT DOCOMO, INC.
* R1-2310160 Maintenance on network verified UE location for NR NTN Qualcomm Incorporated
* R1-2310236 On maintenance of network verified UE location for NR NTN Ericsson Limited
* R1-2308864 Feature Lead Summary #1 on Network verified UE location for NR NTN THALES
* R1-2308865 Feature Lead Summary #2 on Network verified UE location for NR NTN THALES
* R1-2308911 Maintenance of disabling of HARQ feedback for IoT NTN Huawei, HiSilicon
* R1-2309000 Remaining issues on disabling of HARQ feedback for IoT NTN Spreadtrum Communications
* R1-2309172 Remaining issue on disabling of HARQ feedback ZTE
* R1-2309280 Disabling of HARQ-ACK feedback for IoT NTN NEC

**RAN1#115 Chicago/USA, November 13th - 17th, 2023:**

* R1-2312496 LS out LS on NR-NTN TP for TS 38.300 RAN1, THALES
* R1-2312518 discussion FLS#1 on NR-NTN TP for TS 38.300 Moderator (THALES)
* R1-2312510 other Session notes for 8.13 (Maintenance on NTN (Non-Terrestrial Networks) enhancements) Ad-Hoc Chair (Huawei)
* R1-2312625 discussion FLS#2 on NR-NTN TP for TS 38.300 Moderator (THALES)
* R1-2312553 LS out Response on LS on the system parameters for NTN above 10 GHz RAN1, Nokia
* R1-2312655 discussion RAN1 agreements for Rel-18 WI on IoT NTN enhancements up to RAN1#115 Moderator (MediaTek Inc.)
* R1-2312495 draftCR TP for TS 38.300 Moderator (THALES)
* R1-2312681 LS out LS on NR-NTN TP for TS 38.300 RAN1, THALES
* R1-2312669 draftCR TP for TS 38.300 Moderator (THALES)
* R1-2312670 LS out LS on NR-NTN TP for TS 38.300 RAN1, THALES
* R1-2312301 discussion Rel-18 Higher Layer Parameters for IoT NTN Moderator (MediaTek)
* R1-2312377 discussion Summary of discussion on remaining issues for RACH-less handover Moderator (Samsung)
* R1-2312424 discussion Rel-18 Higher Layer Parameters for NR NTN Moderator (THALES)
* R1-2312246 discussion TP for TS 38.300 THALES
* R1-2312247 discussion On RAN1 related aspects for NTN above 10 GHz Mitsubishi Electric RCE
* R1-2312136 discussion Further discussion of open issues related to NTN operation in frequency bands above 10 GHz Nokia, Nokia Shanghai Bell
* R1-2312141 discussion Summary #1 for FR2-NTN Moderator (Nokia)
* R1-2312142 discussion Summary #2 for FR2-NTN Moderator (Nokia)
* R1-2311312 discussion Remaining issue on NTN above 10 GHz CATT
* R1-2310936 discussion Considerations on the system parameters for FR2-NTN THALES
* R1-2310877 discussion Discussion on RAN1 impact to support the RAN4 work on NTN above 10GHz Huawei, HiSilicon
* R1-2310917 discussion On RAN1 impact of NTN above 10 GHz Ericsson
* R1-2311429 discussion Power control for RACH-less handover in NR NTN NEC
* R1-2311199 discussion Discussion on the RAN1 related aspects for NTN above 10 GHz ZTE
* R1-2311700 discussion Discussion on NTN above 10 GHz Apple
* R1-2311636 discussion Discussion on FR2-NTN for NR NTN NTT DOCOMO, INC.
* R1-2311585 discussion Discussion on the RAN1 impact for NTN above 10GHz Beijing Xiaomi Mobile Software
* R1-2311772 discussion Discussions on RAN4 LS on FR2-NTN aspects Sharp
* R1-2312051 discussion On RACH-less handover in NR NTN Qualcomm Incorporated
* R1-2311996 discussion Discussion on RAN4 LS on the system parameters for NTN above 10 GHz MediaTek Inc.
* R1-2312004 discussion Remaining issues on coverage enhancements for NR NTN Hyundai Motor Company
* R1-2311994 discussion Coverage enhancement for NR NTN MediaTek Inc.
* R1-2312052 discussion Maintenance on coverage enhancements for NR NTN Qualcomm Incorporated
* R1-2311918 discussion Remaining issues of coverage enhancement for NR NTN LG Electronics
* R1-2311861 discussion Remaining issues on coverage enhancement for NR NTN Samsung
* R1-2311773 discussion Maintenance on coverage enhancement for NR NTN Sharp
* R1-2311637 discussion Maintenance on coverage enhancement for NR NTN NTT DOCOMO, INC.
* R1-2311200 discussion Remaining issue on coverage enhancement ZTE
* R1-2311245 discussion Discussion on remaining issue for coverage enhancement for NR NTN OPPO
* R1-2311389 discussion Discussion on remaining issues on coverage enhancement for NR-NTN xiaomi
* R1-2311498 discussion Remaining issues on coverage enhancement for NR NTN CMCC
* R1-2311179 discussion Remaining issues on coverage enhancements for NTN Spreadtrum Communications
* R1-2311513 discussion Remaining issues on NR NTN Coverage Enhancement NEC
* R1-2311112 discussion Discussions on remaining issues of coverage enhancements in NR NTN vivo
* R1-2310916 discussion On maintenance of coverage enhancements for NR NTN Ericsson
* R1-2310874 discussion Maintenance of coverage enhancement for NR NTN Huawei, HiSilicon
* R1-2312137 discussion Open issues related to coverage enhancements for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2312091 discussion Maintenance of coverage enhancement for NR NTN Baicells
* R1-2312319 discussion Summary #1 on 8.13.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2312320 discussion Summary #2 on 8.13.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2312321 discussion Summary #3 on 8.13.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2312672 discussion Summary #EOM on 8.13.1 Coverage enhancement for NR NTN Moderator (NTT DOCOMO, INC.)
* R1-2312258 discussion Network verified UE location for NR NTN MediaTek Inc.
* R1-2312138 discussion Remaining open issues related to network verified UE location for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2310875 discussion Maintenance of network-verified UE location for NR NTN Huawei, HiSilicon
* R1-2310935 discussion Maintenance on network verified UE location in NR NTN THALES
* R1-2310937 discussion Feature Lead Summary #1 on Network verified UE location for NR NTN Moderator (THALES)
* R1-2310938 discussion Feature Lead Summary #2 on Network verified UE location for NR NTN Moderator (THALES)
* R1-2310939 discussion Feature Lead Summary #3 on Network verified UE location for NR NTN Moderator (THALES)
* R1-2311325 discussion Remaining issue on network verified UE location CATT
* R1-2311113 discussion Discussions on remaining issues of UE location verification in NR NTN vivo
* R1-2311521 discussion Maintenance on Network-verified UE location for NR-NTN PANASONIC
* R1-2311246 discussion Discussion on remaining issue for network verified UE location for NR NTN OPPO
* R1-2311201 discussion Remaining issue on network verified UE location ZTE
* R1-2311638 discussion Remaining issue on Network verified UE location for NR NTN NTT DOCOMO, INC.
* R1-2311701 discussion On Remaining Issues of Network Verified UE Location Apple
* R1-2311759 discussion Remaining Issues on Network Verified UE Location for NR NTN ETRI
* R1-2311862 discussion Remaining issues on network verified UE location for NR NTN Samsung
* R1-2311942 discussion On maintenance of network verified UE location for NR NTN Ericsson Inc.
* R1-2312053 discussion Maintenance on network verified UE location for NR NTN Qualcomm Incorporated
* R1-2311995 discussion Network verified UE location for NR NTN MediaTek Inc.

## 4.2 RAN2

**RAN2#123bis Xiamen/China, October 9th - 13th, 2023:**

* R2-2310084 discussion Remaining Issues on NR Non-Terrestrial Networks (NTN) THALES
* R2-2310085 Work Plan R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R2-2310157 draftCR UE Capabilities for Rel-18 NR NTN Enh. WI Intel Corporation
* R2-2310158 draftCR UE Capabilities for Rel-18 NR NTN Enh. WI Intel Corporation
* R2-2310552 draftCR Stage 3 running 38.304 CR for NTN ZTE Corporation, Sanechips
* R2-2310840 draftCR Stage 3 NTN running CR for 38.321 - RAN2#123 InterDigital
* R2-2310841 discussion MAC open issues in NTN InterDigital
* R2-2311230 CR Stage 3 Running RRC CR for NR NTN Rel-18 Ericsson
* R2-2311231 discussion Rapporteur s input to 38.331 regarding TN area information Ericsson
* R2-2311255 draftCR Stage-2 running CR for TS 38.300 for Rel-18 NTN enhancements THALES (Rapporteur)
* R2-2309407 LS in LS on the service requirement of restricting satellite access RAT type (C1-236567; contact: Google) CT1
* R2-2309421 LS in Reply LS to RAN2 on unchanged PCI (R1-2308566; contact: CATT) RAN1
* R2-2309422 LS in Reply LS on RACH-less Handover (R1-2308568; contact: Samsung) RAN1
* R2-2309438 LS in Reply LS on Common Signaling in (C)HO (R3-234664; contact: Qualcomm) RAN3
* R2-2309476 LS in Reply LS on time-based trigger condition in NG HO for NR NTN (S2-2310013; contact: Samsung) SA2
* R2-2310000 discussion Higher layer signalling for PUCCH repetition for Msg4 HARQ-ACK Huawei, HiSilicon
* R2-2310559 discussion Consideration on coverage enhancements ZTE Corporation, Sanechips
* R2-2309529 discussion Discussion on PUCCH enhancement for Msg4 HARQ-ACK in NR NTN OPPO
* R2-2310037 discussion Discussion on network verified UE location in NR NTN THALES
* R2-2310133 discussion Discussion on network verified UE location Ericsson
* R2-2310147 discussion Open issues on Network verified location Nokia, Nokia Shanghai Bell
* R2-2310176 discussion Single satellite Multi-RTT based positioning Qualcomm Incorporated
* R2-2310245 discussion Discussion on the remaining issues for network verified UE location CMCC
* R2-2310418 discussion Discussion on network verified UE location Xiaomi
* R2-2310560 discussion Consideration on NW verified UE location ZTE Corporation, Sanechips
* R2-2310985 discussion UE location verification by Network NEC Telecom MODUS Ltd.
* R2-2311009 discussion Network Verified UE Location in NTN Samsung Electronics Iberia SA
* R2-2309503 discussion Remaining issues on NW verification of UE location in R18 NR NTN CATT
* R2-2309700 discussion Handling of UE location verification during handover Huawei, Turkcell, HiSilicon
* R2-2309989 discussion Views on some remaining issues for network verified UE location Lenovo Information Technology
* R2-2309990 discussion Discussion on Network Verified UE Location TCL
* R2-2309995 discussion Multiple-RTT positioning in NTN Quectel
* R2-2311323 LS out Draft LS on NW verified UE location failure during cell change Qualcomm Incorporated
* R2-2311316 discussion Report of [304][NR-NTN Enh] NW verified UE location failure during cell change Qualcomm Incorporated
* R2-2311324 LS out LS on NW verified UE location failure during cell change RAN2
* R2-2310046 discussion Discussion on mobility enhancements for VSAT THALES
* R2-2310246 discussion Discussion on left issues for cell reselection CMCC
* R2-2310065 discussion Open issues of cell reselection enhancement Samsung Research America
* R2-2310177 discussion TN cell coverage info and measurement relaxation Qualcomm Incorporated
* R2-2310306 discussion NTN-TN cell reselection enhancement Apple
* R2-2310419 discussion Cell reselection enhancements for NTN-TN mobility Xiaomi
* R2-2310626 discussion Discussion on TN Measurement Relaxation Issues FGI
* R2-2310842 discussion NTN-TN mobility and service continuity InterDigital
* R2-2310986 discussion On the use of TN coverage signalling to indicate non-TN areas NEC Telecom MODUS Ltd.
* R2-2311229 discussion NTN neighbour cell information in TN cells Ericsson, Thales
* R2-2309653 discussion Remaining Issues on Cell Reselection for Power Saving vivo
* R2-2309862 discussion Remaining issues on NTN-TN cell reselection enhancement LG Electronics France
* R2-2309909 discussion Discussion on TN Coverage Area Information Update Issues FGI
* R2-2309960 discussion Views on some remaining issues for NTN-TN mobility Lenovo
* R2-2311317 discussion Report of [AT123bis][305][NR-NTN Enh] Support of NTN neighbor cell info Ericsson
* R2-2310413 discussion Discussion on location-based measurement initiation in moving cells Huawei, HiSilicon, Turkcell
* R2-2310843 discussion Cell reselection enhancements for Earth moving cell InterDigital
* R2-2311228 discussion Cell reselection enhancements Ericsson
* R2-2310022 discussion Discussion on remaining issues of PCI unchanged handover Transsion Holdings
* R2-2310034 discussion Discussion on satellite switch with longer gap in conjunction with unchanged PCI PANASONIC R&D Center Germany
* R2-2310066 discussion CHO Enhancements for NTN Samsung Research America
* R2-2310067 discussion Open issues on NTN RACH-less HO and PCI unchanged switch Samsung Research America
* R2-2310178 discussion RACH-less handover for NTN Qualcomm Incorporated
* R2-2310179 discussion Details on satellite switch with PCI unchange Qualcomm Incorporated
* R2-2310225 discussion Aquisition of target satellite information with PCI unchanged China Telecom
* R2-2310247 discussion Further discussion on PCI unchanged CMCC
* R2-2310307 discussion Satellite switching with unchanged PCI Apple
* R2-2310308 discussion NR NTN specific HO enhancement Apple
* R2-2310412 discussion Discussion on handover enhancements Huawei, HiSilicon, Turkcell
* R2-2310420 discussion Discussion on handover enhancements for NTN-NTN mobility Xiaomi
* R2-2310435 discussion Remaining issue on RACH-less HO for NTN ITL
* R2-2310561 discussion Consideration on remaining issues on NTN HO enhancements ZTE Corporation, Sanechips
* R2-2310636 discussion On Common HO Signalling for Rel-18 NTN Nokia, Nokia Shanghai Bell
* R2-2310637 discussion Final View on RACH-less HO in Rel-18 NTN Nokia, Nokia Shanghai Bell
* R2-2310638 discussion On How To Resolve Remaining Issues for Unchanged PCI (Satellite Switching without L3 Mobility) Nokia, Nokia Shanghai Bell
* R2-2310662 discussion Remaining Issues of RACH-less (C)HO NEC
* R2-2310663 discussion Remaining Details of Unchanged PCI Switch NEC
* R2-2310696 discussion Remaining issues on the unchanged PCI satellite switch Google Inc.
* R2-2310697 discussion Discussion on the unchanged PCI scenario with optional random access ETRI
* R2-2310768 discussion Common handover signalling for NTN Sony
* R2-2310769 discussion Signaling overhead reduction during NTN-NTN HOs Sony
* R2-2310844 discussion NTN mobility enhancements for RRC\_CONNECTED InterDigital
* R2-2310845 discussion Satellite switching without PCI change InterDigital
* R2-2311019 discussion Remaining issues on RACH-less HO for NR NTN ETRI
* R2-2311144 discussion Discussion on NTN HO enhancements Sharp
* R2-2311212 discussion Common signalling of HO common information Sequans Communications
* R2-2311223 discussion “Unchanged PCI” solution vs “PCI change only” solution Sequans Communications
* R2-2311227 discussion Handover enhancements Ericsson
* R2-2309500 discussion Discussion on common (C)HO configuration CATT
* R2-2309501 discussion Discussion on RACH-less HO in NR NTN CATT
* R2-2309502 discussion Discussion on unchanged PCI mechanism CATT
* R2-2309537 discussion Discussion on handover enhancement for NR NTN OPPO
* R2-2309654 discussion Further Discussion on CHO Enhancements for NR NTN vivo
* R2-2309655 discussion Remaining Issue on RACH-less for R18 NR NTN vivo
* R2-2309656 discussion Further Discussion on Service Link Switching with Unchanged PCI vivo
* R2-2309784 discussion Handover Enhancement in LEO NTN: Unchanged PCI MediaTek Inc.
* R2-2309863 discussion Remaining issues on handover enhancements LG Electronics France
* R2-2309864 discussion Discussion on unchanged PCI TCL
* R2-2309865 discussion Discussion on RACH-less HO TCL
* R2-2309883 discussion Discussion on moving cell reference location for CHO ASUSTeK
* R2-2309884 discussion Discussion on remaining issue for unchanged PCI switch ASUSTeK
* R2-2309961 discussion Views on some remaining issues for PCI-unchanged scenario Lenovo
* R2-2309962 discussion Views on some remaining issues for RACH-less HO in NTN Lenovo
* R2-2311318 discussion [AT123bis][306][NR-NTN Enh] RACH-less HO InterDigital
* R2-2311319 discussion [AT123bis][307][NR-NTN Enh] Unchanged PCI (Apple) Apple

**RAN2#124 Chicago/USA, November 13th - 17th, 2023:**

* R2-2312857 discussion Remaining Issues on NR Non-Terrestrial Networks (NTN) THALES
* R2-2312858 CR Introduction of NTN enhancements THALES
* R2-2312162 discussion Open topics on UE capabilities for Rel-18 NR NTN Enh. WI including summary report of email discussion [Post123bis][310] Intel Corporation
* R2-2312163 draftCR UE capabilities for Rel-18 NR NTN Enh. WI Intel Corporation
* R2-2312164 draftCR UE capabilities for Rel-18 NR NTN Enh. WI Intel Corporation
* R2-2312276 draftCR Multi-RTT positioning in NTN Qualcomm Incorporated
* R2-2312210 CR Introduction of NR NTN enhancements in 38.304 ZTE Corporation, Sanechips
* R2-2313014 CR Introduction of RACH-less handover to TS 38.321 InterDigital, Samsung
* R2-2313531 CR Introduction of Rel-18 NR NTN enhancements Ericsson
* R2-2313533 discussion TS 38.331 Open Issue List for NR NTN Rel-18 Ericsson
* R2-2313002 discussion MAC open issues in NTN InterDigital
* R2-2313225 CR Introduction of network verification of UE location in TS 37.355 CATT
* R2-2313226 Work Plan LPP stage-3 issue and open issue status for Rel-18 NR NTN CATT (Rapporteur)
* R2-2313003 discussion Coverage enhancement in Non-Terrestrial Networks InterDigital
* R2-2313294 discussion Indication for Msg3 based request for PUCCH repetition LG Electronics Inc.
* R2-2312280 discussion UE capability indication for Msg4 ACK repetition Qualcomm Incorporated
* R2-2312052 discussion Discussion on remaining issue for NR NTN coverage enhancement CATT
* R2-2311960 discussion Discussion on PUCCH enhancement for Msg4 HARQ-ACK in NR NTN OPPO
* R2-2312908 discussion Further consideration on PUCCH repetition for Msg4 HARQ-ACK Huawei, HiSilicon
* R2-2312702 discussion Msg3 indication for PUCCH repetition for Msg4 HARQ-ACK Nokia, Nokia Shanghai Bell
* R2-2312789 discussion Consideration on remaining coverage enhancements issues ZTE Corporation, Sanechips
* R2-2312649 discussion Considerations on the coverage enhancements CMCC
* R2-2312650 discussion Discussion on network verified UE location CMCC
* R2-2312461 discussion Views on cell change during UE location verification Lenovo
* R2-2312517 discussion Discussion on network verified UE location Ericsson
* R2-2312713 discussion Remaining issues on UE location verification Huawei, Turkcell, HiSilicon
* R2-2312121 discussion Remaining Issues in Network verified UE Location MediaTek Inc.
* R2-2312948 discussion UE location verification by Network NEC Telecom MODUS Ltd.
* R2-2313007 discussion Network Verified UE Location in NTN Samsung Electronics Iberia SA
* R2-2313050 discussion Remaining Aspects on Network Verified UE Location Nokia, Nokia Shanghai Bell
* R2-2313346 discussion Discussion on network verified UE location in NR NTN IPLOOK
* R2-2313530 discussion NTN neighbour cell information in TN cells Ericsson, Thales, Apple, Samsung, Deutsche Telekom, Qualcomm
* R2-2313532 discussion Cell reselection enhancements for hard switch Ericsson
* R2-2312950 discussion On the use of TN coverage signalling to indicate non-TN areas NEC Telecom MODUS Ltd.
* R2-2313401 discussion Remaining issues on NTN-TN cell reselection enhancement LG Electronics France
* R2-2313506 discussion Discussion on mobility enhancements for VSAT THALES
* R2-2313552 discussion Remaining issues on NTN-TN cell reselection enhancement LG Electronics France, Google Inc., Thales
* R2-2313411 discussion Discussion on NTN-TN cell reselection enhancements ETRI
* R2-2313481 discussion Support of NTN neighbor cell info in TN cell Sequans Communications
* R2-2313079 discussion Discussion on TN broadcasting NTN assistance information Huawei, HiSilicon, Turkcell
* R2-2312949 discussion TN-NTN Mobility NEC Telecom MODUS Ltd.
* R2-2312291 discussion NTN-TN cell reselection enhancement Apple
* R2-2312104 discussion Remaining issues of cell reselection enhancement Samsung
* R2-2312277 discussion Cell coverage info and measurements Qualcomm Incorporated
* R2-2311967 discussion Discussion on the change of TN coverage information OPPO
* R2-2311968 discussion Discussion on support of NTN neighbor cell info in TN cell OPPO
* R2-2311888 discussion Cell (re)selection – discussion on broadcasting SIB19 in terrestrial networks PANASONIC
* R2-2311834 discussion Remaining Issues on Cell Reselection for NR NTN vivo
* R2-2312547 discussion Discussions on providing NTN neighbor cell information in TN cell ITRI
* R2-2312841 discussion Support of NTN neighbour cell info in TN cells Sony
* R2-2312462 discussion Views on providing NTN information in TN cell Lenovo
* R2-2312651 discussion Discussion on NTN-TN cell reselection CMCC
* R2-2312644 discussion Remaining issues on cell reselection enhancements ZTE Corporation, Sanechips
* R2-2312609 discussion FFS issues of unchanged PCI solution NEC
* R2-2313080 discussion Discussion on HO enhancements Huawei, HiSilicon, Turkcell
* R2-2313051 discussion Remaining issues for IDLE and CONNECTED mode mobility in Rel-18 NTN Nokia, Nokia Shanghai Bell
* R2-2313052 discussion Remaining Issues for Satellite Switching without L3 Mobility Nokia, Nokia Shanghai Bell
* R2-2313529 discussion Remaining issues with connected mode enhancements Ericsson
* R2-2313399 discussion Remaining issues on handover enhancements LG Electronics France
* R2-2313297 discussion Remaining open issues on RACH-less HO for NTN ETRI
* R2-2313004 discussion Remaining open issues: RACH-less handover InterDigital
* R2-2313005 discussion Remaining open issues: CHO for Earth-moving cells InterDigital
* R2-2313190 discussion Discussion on CHO configuration for moving cell location ASUSTeK
* R2-2312463 discussion Some remaining issues for CHO and RACH-less HO in NTN Lenovo
* R2-2312356 discussion Open issues on RACH-less in NR NTN Apple
* R2-2312500 discussion Remaining issue for RACH-less Sharp
* R2-2312840 discussion Signaling overhead reduction during NTN-NTN HOs Sony
* R2-2312790 discussion Consideration on RACH-less HO remaining issues ZTE Corporation, Sanechips
* R2-2312763 discussion Discussion on the remaining issues for the handover enhancements Xiaomi
* R2-2311835 discussion Remaining Issues on CHO Enhancements for NR NTN vivo
* R2-2311836 discussion Remaining Issues on RACH-less for R18 NR NTN vivo
* R2-2311859 Work Plan Remaining Issues on RACH-less for R18 NR NTN Quectel
* R2-2311966 discussion Discussion on handover enhancement for NR NTN OPPO
* R2-2312278 discussion Open issues for handover enhancements Qualcomm Incorporated
* R2-2312105 discussion Remaining issues on Handover enhancements Samsung
* R2-2312292 discussion CHO enhancement to earth moving target cell Apple
* R2-2312053 discussion Configuration for location-based CHO for earth-moving cell CATT
* R2-2312057 discussion Discussion on RACH-less HO in NR NTN CATT
* R2-2312058 discussion Discussion on unchanged PCI mechanism CATT
* R2-2312047 discussion Leftover issues on the unchanged PCI satellite switch Google Inc.
* R2-2312120 discussion On Outstanding Issues in Unchanged PCI in LEO NTN MediaTek Inc.
* R2-2312293 discussion Satellite switching with unchanged PCI Apple
* R2-2312106 discussion Remaining issues on PCI unchanged satellite switch Samsung
* R2-2312279 discussion Major issues for satellite switch with PCI unchanged Qualcomm Incorporated
* R2-2311989 discussion Signalling design of satellite switching with PCI unchanged China Telecom
* R2-2311837 discussion Remaining Issues on Service Link Switching with Unchanged PCI vivo
* R2-2311849 discussion Discussion on unchanged PCI mechanism Quectel
* R2-2312546 discussion Discussions on SMTC configuration for satellite switch without PCI change ITRI
* R2-2312632 discussion Discussion on remaining issues of soft and hard satellite switch with PCI unchanged Transsion Holdings
* R2-2312464 discussion On some remaining issues for PCI-unchanged scenario Lenovo
* R2-2312645 discussion Usage and signaling of t-start ZTE Corporation, Sanechips
* R2-2312646 discussion Discussion on remaining issues of soft and hard satellite switch with PCI unchanged Transsion Holdings
* R2-2313191 discussion Discussion on remaining issue for unchanged PCI switch ASUSTeK
* R2-2313206 discussion Report of [Post123bis][312][NR-NTN Enh] Unchanged PCI CMCC, Apple
* R2-2313006 discussion Remaining open issues: Satellite switching without PCI change InterDigital
* R2-2313279 discussion Remaining issues on Unchanged PCI ITL
* R2-2313400 discussion Remaining issues on unchanged PCI LG Electronics France
* R2-2313475 discussion Unchanged PCI satellite switch considerations Sequans Communications

## 4.3 RAN3

**RAN3#121bis Xiamen/China, October 9th - 13th, 2023:**

* R3-235981 CR (BLCR to 38.413) BL CR for NR NTN Nokia, Nokia Shanghai Bell, Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated
* R3-235982 CR (BLCR to 38.423) BL CR for NR NTN Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC
* R3-235057 draftCR (BL CR to 38.300) Stage 2 BL CR for NR NTN Ericsson, CATT, Thales, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated
* R3-235063 CR (BL CR to 38.413) BL CR for NR NTN Nokia, Nokia Shanghai Bell, Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated
* R3-235839 CR (BL CR to 38.413) BL CR for NR NTN Nokia, Nokia Shanghai Bell, Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated
* R3-235072 CR (BL CR to 38.423) BL CR for NR NTN Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC
* R3-235840 CR (BLCR to 38.423) BL CR for NR NTN Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC
* R3-235221 Work Plan R18 WI NR-NTN-enh work plan at RAN1, 2 and 3 THALES
* R3-235023 LS in Reply LS on time-based trigger condition in NG HO for NR NTN SA2(Samsung)
* R3-235516 other (TP for TS38.413 BL CR and TS38.423 BL CR) miscellaneous Correction on the BL CRs Nokia, Nokia Shanghai Bell
* R3-235944 other (TP to BL CR for TS 38.413) miscellaneous Correction on the BL CRs Nokia, Nokia Shanghai Bell
* R3-235945 other (TP to BL CR for TS 38.423) miscellaneous Correction on the BL CRs Nokia, Nokia Shanghai Bell
* R3-235498 other (TP to BL CR for TS 38.423) Time Margin for CHO in NR NTN - XnAP Impact Ericsson, ESA, Thales
* R3-235499 other (TP to BL CR for TS 38.423) Location-Triggered CHO for NR NTN Ericsson, ESA, ZTE, Thales, Inmarsat
* R3-235696 other (TP to BL CR for TS 38.423) Location-Triggered CHO for NR NTN Ericsson, ESA, ZTE, Thales, Inmarsat, Hughes
* R3-235497 discussion Time Margin for CHO in NR NTN Ericsson, Thales, ESA
* R3-235215 discussion Consideration on OAM requirements for UE location verification CATT,Ericsson, Huawei
* R3-235216 other (TP to BL CR for TS 38.455, 38.300, 38.305)Positioning support for NR NTN UE location verification CATT
* R3-235146 discussion Discussion on E-CID method for NTN THALES, Huawei, Ericsson
* R3-235254 discussion On NTN NW verified UE location Lenovo
* R3-235325 other (draftCR to 38.305, TP to BL CR for TS 38.300) Discussion on OAM configuration for network verified UE location ZTE
* R3-235326 discussion Discussion on mirror positions ambiguity for network verified UE location ZTE
* R3-235392 discussion Discussion on UE location verification for NTN China Telecommunication
* R3-235460 other (TP to BL CR for TS 38.455, 38.473) Discussion on TRP Information for NR NTN Qualcomm Incorporated
* R3-235463 other (TP to BL CR for TS 38.455) Discussion on Mirror Point Resolution and ECID Measurement Qualcomm Incorporated
* R3-235474 discussion Leftover issue on UE location verification Samsung
* R3-235505 discussion Discussion on Altitude for the NTN TRP Huawei, Thales, Ericsson
* R3-235517 discussion Discussion on UE location verification Nokia, Nokia Shanghai Bell
* R3-235496 draftCR OAM Requirements for UE Location Verification Ericsson, CATT, Huawei
* R3-235504 other (TP BL 38.300) OAM Requirements for UE Location Verification Huawei, Ericsson, CATT
* R3-235506 other (TP BL 38.455) NTN Access Point Position Huawei, Thales, Ericsson
* R3-235507 LS out Draft LS on Altitude for the Access Point (to: SA2; cc: CT1, CT4, SA5, RAN2, RAN1; contact: Huawei) Huawei, Thales, Ericsson
* R3-235508 CR Mapped Cell Id Introduction for E-CID and NR NTN Huawei, Thales, Ericsson

**RAN3#122 Chicago/USA, November 13th - 17th, 2023:**

* R3-237058 draftCR (BL CR to 38.300) Stage 2 BL CR for NR NTN Ericsson, CATT, Thales, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated
* R3-237059 CR (BLCR to 38.413) BL CR for NR NTN Nokia, Nokia Shanghai Bell, Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated
* R3-237060 CR (BLCR to 38.423) BL CR for NR NTN Huawei, Ericsson, Thales, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC
* R3-237697 CR (BLCR to 38.413) BL CR for NR NTN Nokia, Nokia Shanghai Bell, Ericsson, Thales, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated
* R3-237428 draftCR OAM Requirements for UE Location Verification Ericsson, CATT, Huawei
* R3-237454 discussion Discussion on E-CID method for NTN THALES, Huawei, Ericsson
* R3-237244 discussion The discussion on location verification of NTN NEC
* R3-237260 discussion Discussion on remaining issues in Network Verified UE Location Qualcomm Incorporated
* R3-237138 LS in LS on NW verified UE location failure during cell change RAN2(Qualcomm)
* R3-237436 other (TP for TS 38.455) Support UE location verification in NR NTN Nokia, Nokia Shanghai Bell
* R3-237443 discussion Remaining Issues on UE Location Verification Ericsson, Thales, Huawei
* R3-237445 discussion UE Location Verification Failure During Cell Change Ericsson, Huawei
* R3-237420 discussion On NTN NW verified UE location Lenovo
* R3-237636 discussion Leftovers for UE location verification Samsung
* R3-237375 discussion Discussion on NW verified UE location failure during cell change and reply LS Huawei, Ericsson, Thales
* R3-237368 other (TP BL 38.300) OAM Requirements for UE Location Verification Huawei, Ericsson, CATT
* R3-237369 other (TP to 38.305) Mapped cell Id usage for UE disambiguation in multi-RTT Huawei, Thales, Ericsson
* R3-237370 CR Mapped Cell Id Introduction for E-CID and NR NTN Huawei, Thales, Ericsson
* R3-237371 discussion Discussion on Altitude for the NTN TRP Huawei, Thales, Ericsson
* R3-237372 other (TP BL 38.455) NTN Access Point Position Huawei, Thales, Ericsson
* R3-237373 LS out LS on Altitude for the Access Point Huawei, Thales, Ericsson
* R3-237300 discussion Further discussion on OAM requirements for UE location verification CATT, Huawei, Ericsson, Nokia, Nokia Shanghai Bell, Samsung
* R3-237301 other (TP to BL CR for TS 38.455) Positioning support for NR NTN UE location CATT
* R3-237338 other Discussion on remaining issues for network verified UE location ZTE
* R3-237571 discussion On NTN network verified UE location China Telecommunication

## 4.4 RAN4

**RAN4#108bis Xiamen/China, October 9th - 13th, 2023:**

* R4-2316495 other Discussions on NTN regulatory information Samsung
* R4-2315767 draftCR NTN enhancement: draft CR to TR 38.863 NTN Ka-band Regulatory aspects Ericsson
* R4-2316904 draftCR NTN enhancement: draft CR to TR 38.863 NTN Ka-band Regulatory aspects Ericsson
* R4-2316215 other Discussion on DMRS bundling Huawei, HiSilicon
* R4-2316216 draftCR Draft CR for 38.101-5 to update the clause of Transmit modulation quality Huawei, HiSilicon
* R4-2315246 discussion Discussion on RRM requirements impact for LS on PUSCH DMRS bundling MediaTek inc.
* R4-2317653 draftCR draft CR to TS 38.101-5: spec skeleton for NTN UE in Ka-band ZTE Corporation, Samsung
* R4-2316870 discussion Calibration updates for above 10 GHz and related information THALES, Magister Solutions Ltd
* R4-2316868 discussion Initial coexistence simulation results for above 10 GHz and related requirements THALES, Magister Solutions Ltd
* R4-2316514 other Coexistence simulation results between TN and NTN above 10GHz bands Qualcomm Incorporated
* R4-2316535 other Initial simulation results for Ka-band NTN coexistence study ZTE Corporation
* R4-2315119 other Further discussion on co-existence study for above 10GHz bands CATT
* R4-2315120 other Co-existence study result for above 10GHz bands CATT
* R4-2316213 discussion Some simulation results for Rel-18 NTN coexistence study Huawei, HiSilicon
* R4-2316265 discussion Discussion on simulation assumptions and results of NTN co-existence study in above 10GHz Samsung Electronics Iberia SA
* R4-2316250 other Assumption and results of calibration for NTN co-existence in above 10GHz bands Samsung Electronics Iberia SA
* R4-2315764 other NTN enhancement: coexistence simulations assumptions Ericsson
* R4-2315765 other NTN enhancement: calibration outcomes and coexistence simulations results Ericsson
* R4-2315769 draftCR draft CR to TS 38.108 - NTN enhancement SAN RF requirements Ericsson
* R4-2315121 other Further discussion on SAN RF requirements for above 10GHz bands CATT
* R4-2315122 draftCR Draft CR for TS 38.108, On introduction of above 10GHz bands to clause 10.1-10.4 CATT
* R4-2315124 other Simulation results for Ka-band NTN SAN dynamic range CATT
* R4-2316536 other Further discussion on SAN RF requirements for NTN in Ka-band ZTE Corporation
* R4-2316891 draftCR Draft CR on TS 38.108 for Clause 9.6 - OTA transmitted signal quality THALES
* R4-2316888 draftCR Draft CR on TS 38.108 for Clause 5 - Operating bands and channel arrangement THALES
* R4-2316889 draftCR Draft CR on TS 38.108 for Clause 9.2 - Radiated transmit power and Clause 9.3 - OTA Satellite Access Node output power THALES
* R4-2316848 draftCR Draft CR to TS 38.108: FRC annex for FR2-NTN, Rel-18 Huawei, HiSilicon
* R4-2316853 draftCR Draft CR to TS 38.108: EVM measurement annex for FR2-NTN, Rel-18 Huawei, HiSilicon
* R4-2315123 other Discussion on SAN RF conformance testing requirements for above 10GHz bands CATT
* R4-2315766 other NTN enhancement: UE RF requirements Ericsson
* R4-2316214 other Discussion on Ka band NTN UE Huawei, HiSilicon
* R4-2316790 discussion On DMRS bundling with Doppler pre-compensation for NTN Apple
* R4-2316871 discussion Mapping NTN UE terminal requirements on NTN types THALES
* R4-2316537 other Further discussion on UE RF requirements for NTN in Ka-band ZTE Corporation
* R4-2316496 other Discussions on NTN UE RF Samsung
* R4-2316282 other On PUSCH DMRS bundling for NR NTN coverage enhancement Ericsson
* R4-2315768 draftCR NTN enhancement: draft CR to TS 38.307 release independant aspects for NTN UE Ericsson
* R4-2316054 discussion Discussion on general issues for NTN RRM requirements in Ka band Huawei, HiSilicon
* R4-2316254 discussion General Timing aspects for operation at 10 GHz in NTN Nokia, Nokia Shanghai Bell
* R4-2315406 discussion Discussion on RRM requirements for NTN deployment in above 10 GHz bands Xiaomi
* R4-2315734 discussion General discussion on NTN RRM requirements in above 10 GHz bands vivo
* R4-2315756 other Discussion on NR-NTN deployment in above 10GHz bands ZTE Corporation
* R4-2316705 discussion NTN UE types above 10 GHz beam steering time Inmarsat, Viasat
* R4-2316872 discussion Clarification on the NTN RRM testing procedure configuration THALES
* R4-2316882 other NTN support for frequency band above 10GHz Qualcomm Incorporated
* R4-2316585 discussion On RRM requirements for electronically-steered beam UEs (Type 1) Apple
* R4-2315355 discussion Discussion on RRM requirements for electronically-steered beam UEs in NTN above 10GHz bands Samsung
* R4-2315514 discussion Discussion on RRM requirements for Type 1 NR NTN UE in above 10GHz bands LG Electronics Inc.
* R4-2315136 discussion Discussion on RRM requirements for electronically-steered beam UEs (Type 1) in above 10 GHz bands CATT
* R4-2315242 discussion Discussion on RRM requirements for electronically-steered beam UEs (Type 1) for NTN above 10 GHz bands MediaTek inc.
* R4-2316255 discussion General requirements for Electronically steered beams in NTN Nokia, Nokia Shanghai Bell
* R4-2316055 discussion Discussion on mobility requirements for Type 1 NTN UE Huawei, HiSilicon
* R4-2315740 discussion Discussion on RRM requirements for electronically-steered beam UEs (Type 1) vivo
* R4-2315876 discussion RRM requirements for electronically-steered beam UEs (Type 1) Ericsson
* R4-2315877 discussion RRM requirements for mechanically-steered beam UEs (Type 2) Ericsson
* R4-2315741 discussion Discussion on RRM requirements for mechanically-steered beam UEs (Type 2) vivo
* R4-2316056 discussion Discussion on mobility requirements for Type 2 NTN UE Huawei, HiSilicon
* R4-2316256 discussion General requirements for Mechanically steered beams in NTN Nokia, Nokia Shanghai Bell
* R4-2315243 discussion Discussion on RRM requirements for mechanically-steered beam UEs (Type 2) for NTN above 10 GHz bands MediaTek inc.
* R4-2315137 discussion Discussion on RRM requirements for mechanically-steered beam UEs (Type 2) in above 10 GHz bands CATT
* R4-2315515 discussion Discussion on RRM requirements for Type 2 NR NTN UE in above 10GHz bands LG Electronics Inc.
* R4-2315356 discussion Discussion on RRM requirements for mechanically-steered beam UEs in NTN above 10GHz bands Samsung
* R4-2316586 discussion On RRM requirements for mechanically-steered beam UEs (Type 2) Apple
* R4-2316875 discussion RRM Requirements for Type 2 UE Terminal in above 10 GHz THALES
* R4-2316883 other Network verified UE location Qualcomm Incorporated
* R4-2315735 discussion Discussion on RRM impacts on Network verified UE location for NTN enhancement vivo
* R4-2315244 discussion Discussion on RRM requirements for Network verified UE location MediaTek inc.
* R4-2316257 discussion Discussion on updating the RX-TX measurements for NTN Nokia, Nokia Shanghai Bell
* R4-2316057 discussion Discussion on RRM requirements for NW verified location Huawei, HiSilicon
* R4-2315874 discussion Network verified UE location Ericsson
* R4-2315875 discussion NTN-TN and NTN-NTN mobility and service continuity enhancements Ericsson
* R4-2316058 discussion Discussion on mobility enhancements in NTN Huawei, HiSilicon
* R4-2316258 discussion Service continuity and mobility enhancements between TN and NTN Nokia, Nokia Shanghai Bell
* R4-2315407 discussion Discussion on RRM requirements for NTN-TN and NTN-NTN mobility and service continuity enhancements Xiaomi
* R4-2315245 discussion Discussion on RRM requirements for NR NTN mobility enhancement MediaTek inc.
* R4-2315138 discussion Discussion on RRM requirements for NTN-TN and NTN-NTN mobility and service continuity enhancements CATT
* R4-2315173 discussion Discussion on RRM core requirement for NR NTN mobility enhancements CMCC
* R4-2315733 discussion Discussion on RRM requirements for mobility on NTN enhancement vivo
* R4-2315757 other Discussion on RRM requirements for NTN enhancement ZTE Corporation
* R4-2315357 discussion Discussion on RRM requirements for NTN-NTN and NTN-TN mobility Samsung
* R4-2315524 discussion Discussion on NTN service continuity enhancement LG Electronics Inc.
* R4-2316587 discussion On mobility and service continuity for eNTN Apple
* R4-2316259 discussion Test cases scope and configuration for NTN enhancements Nokia, Nokia Shanghai Bell
* R4-2316015 Work Plan Workplan on demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2315999 discussion Discussion on SAN demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2316153 discussion View on BS demodulation requirements for NTN enhancement Samsung
* R4-2315591 discussion Discussion on NR NTN enhancement SAN demodulation Ericsson
* R4-2315050 discussion Discussion on NR NTN SAN Demodulation Nokia, Nokia Shanghai Bell
* R4-2315051 discussion NR NTN UE demodulation disussion Nokia, Nokia Shanghai Bell
* R4-2315592 discussion Discussion on NR NTN enhancement general issue and UE demodulation Ericsson
* R4-2315348 discussion Discussion on the UE demodulation and CSI requirements for NR NTN enhancements Qualcomm Inc
* R4-2315483 discussion On UE demod and CSI requirements for NR NTN enhancement Apple
* R4-2315998 discussion Discussion on UE demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2317275 other Ad-hoc minutes for NR\_NTN\_enh Samsung
* R4-2317261 other Topic summary for [108-bis][138] NR\_NTN\_enh\_UERF Moderator (ZTE)
* R4-2316919 other Offline meeting minutes on NR NTN UE and SAN demod Huawei
* R4-2316921 other WF on NR\_NTN\_enh\_SAN\_UE\_demod Huawei
* R4-2316905 other WF on NR NTN SAN RF requirements Ericsson
* R4-2316906 other WF on NR NTN coexistence Samsung
* R4-2316997 other Ad-hoc meeting minutes for NR NTN coexistence Samsung
* R4-2316998 other Collection of NR NTN coexistence study results Samsung
* R4-2316999 other Simulation assumptions NR NTN coexistence in >10 GHz bands Samsung
* R4-2317214 other Topic summary for [108-bis][222] NR\_NTN\_enh Moderator (Qualcomm)
* R4-2317648 other WF on NR\_NTN\_enh\_UERF Main Session
* R4-2317649 other WF on DMRS bundling for NTN Thales
* R4-2317327 other RRM WF and CR work split for NR\_NTN\_enh Qualcomm
* R4-2317374 other RRM WF and CR work split for NR\_NTN\_enh Qualcomm
* R4-2317008 other Simulation assumptions NR NTN coexistence in >10 GHz bands Samsung
* R4-2317767 other WF on DMRS bundling for NTN Thales
* R4-2317939 other Topic summary for [108bis][307] NR\_NTN\_enh\_Part1 Moderator(Thales)
* R4-2317940 other Topic summary for [108bis][308] NR\_NTN\_enh\_Part2 Moderator(Ericsson)
* R4-2317941 other Topic summary for [108bis][309] NR\_NTN\_enh\_Part3 Moderator(Samsung)
* R4-2317953 other Topic summary for [108bis][322] NR\_NTN\_enh\_SAN\_UE\_demod Moderator(Huawei)

**RAN4#109 Chicago/USA, November 13th - 17th, 2023:**

* R4-2320152 draftCR Draft CR on TS 38.108: Corrections on channel raster and synchronization raster NEC
* R4-2319569 other NTN enhancement: system parameters update Ericsson
* R4-2319571 CR NTN enhancement: CR to TR 38.863 NTN Ka-band Regulatory aspects Ericsson
* R4-2319182 other Discussion on regulatory information on NTN UE Samsung
* R4-2320952 pCR Draft TP for TR 37.911 - Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology THALES
* R4-2320949 CR Draft CR proposal to add Doppler and Delay variation examples as a function of time for NGSO and GSO in a new Annex THALES
* R4-2320970 discussion NTN-TN co-existence simulation results in above 10 GHz bands THALES, Magister Solutions Ltd
* R4-2318298 other Co-existence study result for above 10GHz bands CATT
* R4-2318493 other Discussion on Co-existence study result for above 10GHz bands CATT
* R4-2319566 other NTN enhancement: coexistence simulations results Ericsson
* R4-2319567 other NTN enhancement: initial conclusion from simulations results Ericsson
* R4-2319260 discussion Joint proposals on NTN co-existence study Samsung R&D Institute UK
* R4-2319777 discussion Results of NTN coexistence study in above 10GHz Samsung Electronics Nordic AB
* R4-2319890 other Some simulation results for Rel-18 NTN coexistence study Huawei, HiSilicon
* R4-2320330 other Coexistence simulation results for NTN in Ka-band ZTE Corporation
* R4-2320392 other Coexistence simulation results between TN and NTN above 10GHz bands for VSAT and L-ESIM Qualcomm Incorporated
* R4-2320331 other Further discussion on SAN RF requirements for NTN in Ka-band ZTE Corporation
* R4-2320334 draftCR Draft CR to TS 38.108 Clause 10.5 OTA in-band selectivity and blocking ZTE Corporation
* R4-2320335 draftCR Draft CR to TS 38.108 Clause 10.6 OTA out-of-band blocking ZTE Corporation
* R4-2320336 draftCR Draft CR to TS 38.108 Clause 10.7 OTA in-channel selectivity ZTE Corporation
* R4-2320153 draftCR Draft CR on TS 38.108: Radiated transmit power requirements in extreme conditions NEC
* R4-2320154 draftCR Draft CR on TS 38.108: OTA modulation quality NEC
* R4-2320155 draftCR Draft CR on TS 38.108: EVM annex for FR2-NTN NEC
* R4-2319711 draftCR Draft CR to TS 38.108: correction on EVM measurement annex for FR2-NTN, Rel-18 Keysight Technologies UK Ltd
* R4-2319570 draftCR NTN enhancement: draft CR to TS 38.108 NTN Ka-band - system parameters udpate Ericsson
* R4-2319577 draftCR NTN enhancement: draft CR to TS 38.108 NTN Ka-band - clause 4.3 Ericsson
* R4-2319578 draftCR NTN enhancement: draft CR to TS 38.108 NTN Ka-band - clause 4.6 Ericsson
* R4-2319579 draftCR NTN enhancement: draft CR to TS 38.108 NTN Ka-band - clause 9.4 Ericsson
* R4-2319580 CR NTN enhancement: Running CR to TS 38.108 NTN Ka-band Ericsson, Huawei, Thales
* R4-2318299 other Further discussion on SAN RF requirements for above 10GHz bands CATT
* R4-2318300 draftCR Draft CR for TS 38.108, On introduction of above 10GHz bands to clause 10.1-10.4 CATT
* R4-2318302 other Simulation results for Ka-band NTN SAN dynamic range CATT
* R4-2320972 discussion Remaining issues for SAN RF requirements in above 10 GHz THALES
* R4-2320917 CR Draft CR on TS 38.108 for Clause 9.7 - OTA unwanted emissions THALES
* R4-2318301 other Discussion on SAN RF conformance testing requirements for above 10GHz bands CATT
* R4-2320551 other LS on UE capability of PUSCH DMRS bundling for NR NTN Ericsson
* R4-2320900 discussion Details on NTN UE terminal requirements based on different NTN UE types THALES
* R4-2320903 CR Draft CR to TS 38.101-5: NTN UE in Ka-band THALES
* R4-2320552 draftCR CR on DMRS bundling Ericsson
* R4-2320337 draftCR Draft CR to TS 38.101-5 Clause 9.3 Output power dynamics ZTE Corporation
* R4-2320338 draftCR Draft CR to TS 38.101-5 Clause 10.4 Maximum input power requirement ZTE Corporation
* R4-2320339 draftCR Draft CR to TS 38.101-5 Clause 10.6 Blocking requirement ZTE Corporation
* R4-2320340 draftCR Draft CR to TS 38.101-5 Annex: NTN VSAT related FRC ZTE Corporation
* R4-2320332 other Further discussion on UE RF requirements for NTN in Ka-band ZTE Corporation
* R4-2320333 other Joint contribution for NTN VSAT RF requirements in Ka-band ZTE Corporation , Thales, Samsung, Ericsson, Huawei
* R4-2319572 draftCR NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - clause 5 Ericsson
* R4-2319573 draftCR NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - clauses 9.1 Ericsson
* R4-2319574 draftCR NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - clauses 9.2.2 Ericsson, Verizon
* R4-2319575 draftCR NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - clauses 9.2.3 Ericsson
* R4-2319576 draftCR NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - clauses 10.7 Ericsson
* R4-2319568 other NTN enhancement: UE RF requirements Ericsson
* R4-2319891 draftCR Draft CR for 38.101-5 to introduce clause 10.1~10.3 Huawei, HiSilicon
* R4-2319892 other Discussion on Ka band NTN UE Huawei, HiSilicon
* R4-2319893 other Discussion on DMRS bundling Huawei, HiSilicon
* R4-2319894 CR CR for 38.101-5 to introduce Phase continuity requirements for NTN UE DMRS bundling Huawei, HiSilicon
* R4-2318425 CR CR to 38.101-5 on the introduction of NTN DMRS bundling feature Apple
* R4-2318426 discussion On DMRS bundling with Doppler pre-compensation for NTN Apple
* R4-2319179 other Discussions on NTN UE RF Samsung
* R4-2319180 draftCR Draft CR to TS 38.101-5: sub-clause 9.2.1 Samsung
* R4-2319181 draftCR Draft CR to TS 38.101-5: regulatory related RF requirements Samsung
* R4-2320574 draftCR Draft CR: Cell Re-selection for NR UE satellite access in RRC\_IDLE state ZTE Corporation
* R4-2320575 draftCR Draft CR: Cell Re-selection for NR UE satellite access in RRC\_INACTIVE state ZTE Corporation
* R4-2320003 discussion Discussion on RRM impacts of DMRS bundling Huawei, HiSilicon
* R4-2320004 discussion Discussion on RRM requirements for NTN in Ka band Huawei, HiSilicon
* R4-2320005 draftCR draftCR on HO requirements for NTN in Ka band Huawei, HiSilicon
* R4-2320557 other Discussion on NR-NTN deployment in above 10GHz bands ZTE Corporation
* R4-2319212 discussion Discussion on RRM requirements for NR-NTN UEs in above 10GHz bands Samsung
* R4-2319214 draftCR Draft CR on VSAT UE timing requirements for NTN in above 10GHz Samsung
* R4-2319062 discussion General discussion on NTN RRM requirements in above 10 GHz bands vivo
* R4-2318845 discussion Discussion on RRM requirements for NTN bands above 10GHz Xiaomi
* R4-2318846 draftCR DraftCR on measurement delay requirements for NTN bands above 10GHz Xiaomi
* R4-2318819 draftCR draft CR on handover for VSAT UE Ericsson
* R4-2318821 discussion RRM requirements in above 10 GHz bands Ericsson
* R4-2318841 discussion Discussion on RRM requirements for NR NTN UE in above 10GHz bands LG Electronics Inc.
* R4-2318460 discussion Discussion on RRM requirements for NTN above 10 GHz bands and other enhancement MediaTek inc.
* R4-2318340 discussion Discussion on NTN RRM requirements in above 10 GHz bands CATT
* R4-2318341 draftCR Draft CR on RRC\_IDLE and RRC\_INACTIVE state mobility for NTN in above 10 GHz bands CATT
* R4-2318654 discussion On NR-NTN RRM requirements in above 10 GHz bands Apple
* R4-2320736 discussion On solutions for NTN requirements for operations above 10 GHz Nokia, Nokia Shanghai Bell
* R4-2320965 draftCR draft Cat-B CR RLM in NTN band above 10GHz Qualcomm Incorporated
* R4-2320966 other NTN support for frequency band above 10GHz Qualcomm Incorporated
* R4-2320971 discussion On the NTN UL Timing Accuracy for above 10 GHz THALES
* R4-2320967 other Network verified UE location Qualcomm Incorporated
* R4-2320737 discussion Impact of NTN specificities on RX-TX Difference measurements Nokia, Nokia Shanghai Bell
* R4-2320738 draftCR DraftCR on requirements for UE verified Location Nokia, Nokia Shanghai Bell
* R4-2319063 discussion Discussion on RRM impacts on Network verified UE location for NTN enhancement vivo
* R4-2320006 discussion Discussion on RRM requirements for NW verified location Huawei, HiSilicon
* R4-2320007 discussion Discussion on mobility enhancements in NTN Huawei, HiSilicon
* R4-2320558 other Discussion on RRM requirements for NTN enhancement ZTE Corporation
* R4-2319064 draftCR draft CR on RRC\_CONNECTED state mobility for NTN vivo
* R4-2319061 discussion Discussion on RRM requirements for mobility on NTN enhancement vivo
* R4-2319213 discussion Discussion on RRM requirements for NTN-NTN and NTN-TN mobility Samsung
* R4-2318897 discussion Discussion on NTN service continuity enhancement LG Electronics Inc.
* R4-2318908 discussion Discussion on RRM core requirement for NR NTN mobility enhancements CMCC
* R4-2318820 discussion NTN-TN and NTN-NTN mobility and service continuity enhancements Ericsson
* R4-2318655 discussion On mobility and service continuity for eNTN Apple
* R4-2318342 discussion Discussion on RRM requirements for NTN-TN and NTN-NTN mobility and service continuity enhancements CATT
* R4-2318461 discussion Discussion on RRM requirements for NR NTN mobility enhancement MediaTek inc.
* R4-2320739 discussion Service continuity and mobility enhancements between TN and NTN Nokia, Nokia Shanghai Bell
* R4-2320740 discussion Test cases scope and configuration for NTN enhancements Nokia, Nokia Shanghai Bell
* R4-2318822 discussion RRM performance requirement for NTN Ericsson
* R4-2320008 discussion Discussion on performance requirements for Rel-18 NTN Huawei, HiSilicon
* R4-2320238 discussion Discussion on general issues for demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2320239 discussion Discussion on SAN demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2319846 discussion View on BS demodulation requirements for NTN enhancement Samsung
* R4-2318058 discussion Discussion on NR NTN SAN Demodulation Nokia, Nokia Shanghai Bell
* R4-2318059 discussion NR NTN UE demodulation disussion Nokia, Nokia Shanghai Bell
* R4-2318582 discussion On UE demod and CSI requirements for NR NTN enhancement Apple
* R4-2318735 discussion Discussion on the UE demodulation and CSI requirements for NR NTN enhancements Qualcomm India Pvt Ltd
* R4-2318736 discussion Simulation results summary for NR NTN enhancements Qualcomm India Pvt Ltd
* R4-2319223 discussion On general issues and UE demodulation requirements for NR NTN enh. Ericsson
* R4-2319224 other Simulation results for NR NTN enhancement UE demodulation Ericsson
* R4-2319313 discussion Discussion on NR NTN enhancement SAN demodulation requirements Ericsson
* R4-2319314 other Simulation results for NR NTN enhancement SAN demodulation requirements Ericsson
* R4-2320240 discussion Discussion on UE demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2318182 other Topic summary for [109][226] NR\_NTN\_enh Moderator (Qualcomm)
* R4-2318145 other Topic summary for [109][139] NR\_NTN\_enh\_UERF Moderator (ZTE)
* R4-2318200 other Topic summary for [109][308] NR\_NTN\_enh\_Part1 Moderator (Thales)
* R4-2318201 other Topic summary for [109][309] NR\_NTN\_enh\_Part2 Moderator (Ericsson)
* R4-2318202 other Topic summary for [109][310] NR\_NTN\_enh\_Part3 Moderator (Samsung)
* R4-2318216 other Topic summary for [109][324] NR\_NTN\_enh\_SAN\_UE\_demod Moderator (Huawei)

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