**3GPP TSG RAN meeting #103 RP-240127**

**Maastricht, Netherlands, March 18-21, 2024**

## Status Report to TSG

**Agenda item:** 9.4.2.4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **WI / SI Name** | Rel-18 NR NTN (Non-Terrestrial Networks) enhancements | | | | |
| included in this status report | Study Item:  No | Study Item:  No | Study Item:  No | | Study Item:  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 -> 06/2024 | Performance part: 06/2024 | Testing part: | |
| **Overall Completion level** | Study Item: | Core part:  Overall: 99%  RAN1: 100%  RAN2: 100%  RAN3: 100%  RAN4: 99% | Performance Part:  Overall: 30%  RAN4: 30% | 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.*

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

Extension request by one quarter for RAN4 as per the exception sheet in RP-240142

## 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

**At RAN1#116 meeting**

##### 2.1.1.1 Maintenance on satellite switch with resync

Agreement

The draft LS reply in R1-2401610 is endorsed with the deletion of “CC RAN WG4” in the action.

Final LS in R1-2401748.

##### 2.1.1.2 Maintenance on Network verified UE location for NR NTN

Agreement

Confirm the following working assumption:

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.

Agreement

The TP below is endorsed

------------------------------------------------------- Start of TP for TS 38.215 ------------------------------------------------------------

5.1.30 UE Rx – Tx time difference

|  |  |
| --- | --- |
| **Definition** | The UE Rx – Tx time difference is defined as TUE-RX –TUE-TX  Where:  TUE-RX is the UE received timing of downlink subframe #*i* from a Transmission Point (TP) [18], defined by the first detected path in time.  TUE-TX is the UE transmit timing of uplink subframe #*j* that is closest in time to the subframe #i received from the TP.  Multiple DL PRS or CSI-RS for tracking resources, as instructed by higher layers, can be used to determine the start of one subframe of the first arrival path of the TP. 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.  For frequency range 1, the reference point for TUE-RX measurement shall be the Rx antenna connector of the UE and the reference point for TUE-TX measurement shall be the Tx antenna connector of the UE. For frequency range 2, the reference point for TUE‑RX measurement shall be the Rx antenna of the UE and the reference point for TUE‑TX measurement shall be the Tx antenna of the UE. |
| **Applicable for** | RRC\_CONNECTED,  RRC\_INACTIVE |

\*\*\* Unchanged parts are omitted \*\*\*

##### 2.1.1.3 Maintenance on RACH-less handover

**R1-2401535** Moderator summary #1 on remaining issues for RACH-less handover Moderator (Samsung)

Agreement

TP#1\_2 in section 2 of R1-2401535 is endorsed for TS38.213 clause 22.

Agreement

TP#3\_2 in section 2 of R1-2401535 is endorsed for TS38.213 clause 22.

#### 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)

Possible topics for discussion at RAN1#116bis:

* whether to reuse Table 6.3.3.2-4 of TS 38.211 without modification for NR over NTN for FR2-NTN in Rel-18, or to reuse the table with modifications.

## 2.2 RAN2

#### 2.2.1 Agreements

**At RAN2#125 meeting**

**Support of VSAT**

Agreements:

1. Introduce two per-UE capabilities for FR2-only band as below to indicate VSAT UE’s mobility and antenna types:

- A UE capability to indicate whether UE uses electronic or mechanical steering antenna

- A UE capability to indicate whether UE is a fixed or mobile VSAT

2. Introduce two separate indications in SIB1 to indicate whether current cell is barred for mobile VSAT, or barred for fixed VSAT

3. Introduce two separate indications in SIB1 to indicate whether current cell is barred for mobile VSAT, or barred for fixed VSAT

**Stage 2 corrections**

Agreed CR

* R2-2401599 Stage 2 corrections for NR NTN Thales, … CR Rel-18 38.300 18.0.0 XXXX - F NR\_NTN\_enh-Core

**RRC corrections**

Agreed CR

* R2-2400696 [H005][H004][H008] Event D2 for earth-moving cell Huawei, HiSilicon
* R2-2400535 [RILH005,H400] Consideration on location-based CHO remaining issues ZTE Corporation, Sanechips

Agreements:

1. For the EMC case, ephemeris and epochTime information for candidate CHO cell need to be provided in RRC Reconfiguration. Make The relevant fields conditionally mandatory in ASN.1 (i.e. for the EMC case)

2. CondEventD2 is only applicable to moving cell to moving cell scenario (No need to clarify this further in the specs)

3. Event D2 is supported for moving cell

4. Introduce a UE capability to indicate support of event D2. It is conditional mandatory for UE to support event D2 based measurement trigger if UE indicates supports locationBasedCondHandoverEMC in any NTN band.

5. For condEventD2 evaluation, the UE always relies on the ephemerisInfo, epochTime and associated movingReferenceLocation in SIB19 for serving cell. (the description of movingReferenceLocation needs to be updated accordingly and reference location1 removed from dedicated signalling). This also needs a clarification in the field description of movingReferenceLocation to indicate that if there is no associated threshold the feature is not supported for idle. Same behaviour is adopted for IoT-NTN

Agreements:

1. For soft satellite switch, UE shall apply the acquired DL timing and start accessing the target satellite with related operations (e.g. restart T430, reset N\_TA, resume UL operations) not before t-Service

2. For soft satellite switch, UE shall start acquiring the DL synchronization information for the target satellite from t-ServiceStart, while maintaining the connection with source satellite.

3. We don’t introduce the support for configuring and reporting measurements on the target cell (from target satellite) in the soft switch case

4. RAN2 understands that the NW is not expected to configure PDD reporting between serving and target satellites involved in the satellite switch

5. There is no need for the network to activate the use of the satellite switch with re-sync feature. If the UE supports satellite switch with re-sync it can perform it at any time during RRC Connected (up to UE implementation to use the information in broadcast signalling to switch to the new satellite in other states than RRC connected)

6. All UEs supporting satellite switch with resync shall be able to perform satellite switch with re-sync without RACH (this does not mean that a UE supporting satellite switch with resync needs to support RACH-less HO)

Endorsed TPs

* R2-2400309 [H009] NTN coverage enhancement implementation in RRC Huawei, HiSilicon
* R2-2400854 RIL Q638 on FR2 in NTN Qualcomm Incorporated

List of post meeting discussions

* [Post125][301][NR-NTN Enh] 38.331 CR (Ericsson) => in R2-2401589
* [Post125][302][NR-NTN Enh] 38.321 CR (Interdigital) => in R2-2401590
* [Post125][303][NR-NTN Enh] 38.304 CR (ZTE) => in R2-2401591
* [Post125][304][NR-NTN Enh] 37.355 CR (CATT) => in R2-2401592
* [Post125][305][NR-NTN Enh] UE Caps CRs (Intel) => in R2-2401593 and R2-2401594
* [Post125][307][NR-NTN Enh] 36.321 CR (Mediatek) => in R2-2401596

#### 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)

Possible topics for discussion:

* Handover delay in FR2 NTN with mechanically steered beams

## 2.3 RAN3

#### Agreements

**At RAN3#123 meeting**

#### 2.3.1.1 Agreements related to R18 NR NTN

Agreed CRs & TPs

* R3-241030 Correction for NR NTN early data forwarding and data discarding (NEC), CR1052r, TS 38.413 v18.0.0, Rel-18, Cat. F
* R3-241037 Correction on textual description of MME Early Status Transfer procedure (ZTE), CR1931r, TS 36.413 v18.0.0, Rel-18, Cat. F
* R3-241182 Correction to X2AP Conditional Handover Time Based Information IE (CATT, Nokia, Nokia Shanghai Bell) CR1773r, TS 36.423 v18.0.0, Rel-18, Cat. F
* R3-240437 Correction to the XnAP Conditional Handover Time Based Information IE (Nokia, Nokia Shanghai Bell, CATT) CR1172r, TS 38.423 v18.0.0, Rel-18, Cat. F
* R3-241049 Correction of timer-based conditional handover for NR NTN (Huawei) draftCR
* R3-241048 Correction of timer-based conditional handover for IoT NTN (Huawei) draftCR
* R3-240534 Correction of E-RABs Subject To DL Discarding for IoT NTN (Huawei), CR1930r, TS 36.413 v18.0.0, Rel-18, Cat. F
* R3-240220 ASN.1 and tabular alignment for NR NTN (CATT, ZTE, Nokia, Nokia Shanghai Bell, China Telecom), CR1066r, TS 38.413 v18.0.0, Rel-18, Cat. F

#### 2.3.1.2 Other agreements on previous releases

**For RAT restriction information, add 4 codepoints to S1AP and X2AP (NR-LEO, NR-MEO, NR-GEO, NR-OTHERSAT), and 4 codepoints to NGAP and XnAP (e-UTRA-LEO, e-UTRA-MEO, e-UTRA-GEO, e-UTRA-OTHERSAT); criticality ignore**

**Introduce enhancements to indicate GTP-U Error over E1, F1, Xn?**

Agreed CR or TPs

* R3-241054 Mobility Restrictions with NR NTN - S1AP Impacts (Ericsson, Vodafone, Thales Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell), CR1923r, TS 36.413 v17.5.0, Rel-17, Cat. F
* R3-241055 Mobility Restrictions with NR NTN - X2AP Impacts (Ericsson, Vodafone, Thales Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell), CR1765r, TS 36.423 v17.6.0, Rel-17, Cat. F
* R3-241056 Mobility Restrictions with NR NTN - S1AP Impacts (Ericsson, Vodafone, Thales Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell), CR1924r, TS 36.413 v18.0.0, Rel-18, Cat. A
* R3-241057 Mobility Restrictions with NR NTN - X2AP Impacts (Ericsson, Vodafone, Thales Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell)
* R3-241058 Correction on handover restriction from NR TN to LTE NTN (ZTE), CR1108r, TS 38.413 v17.7.0, Rel-17, Cat. F
* R3-241059 Correction on handover restriction from NR TN to LTE NTN (ZTE), CR1109r, TS 38.413 v18.0.0, Rel-18, Cat. A
* R3-241060 Correction on handover restriction from NR TN to LTE NTN (ZTE), CR1201r, TS 38.423 v17.7.0, Rel-17, Cat. F
* R3-241061 Correction on handover restriction from NR TN to LTE NTN (ZTE), CR1202r, TS 38.423 v18.0.0, Rel-18, Cat. A
* R3-241062 [DRAFT] Reply LS on the service requirement of restricting satellite access RAT type (Ericsson LM)
* R3-241122 Response LS on NG-RAN receiving a GTP-U Error Indication (Nokia, Nokia Shanghai Bell) LS out To: CT4 CC:
* R3-241117 NG-RAN indicates to SMF when a GTP-U Error Indication is received (Ericsson), CR1114r, TS 38.413 v18.0.0, Rel-18, Cat. F

#### 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

#### 2.4.1 Agreements

* **RAN4#110 meeting**

**Issue 2-1: The minimum peak EIRP and minimum output power for VSAT**

**Agreement:**

* Define two sets of minimum peak EIRP requirements
  + Set 1 requirements: based on type 1/2 UE with GSO, which can cover type 4/5 UE with GSO
  + Set 2 requirements: for type 3 UE with LEO [600]km
    - For (type 3 UE) fixed VSAT supporting LEO only with electronical steering antenna, specify the minimum EIRP as [60, 62, or 67.6] dBm.
      * Further down-selection of the values of minimum EIRP

**Agreement:**

* + - For (type 3 UE) fixed VSAT supporting LEO only with electronical steering antenna, specify the minimum EIRP as 61 dBm under the assumption of 600km orbit.
    - For (type 1,2,4,5 UE), specify the minimum EIRP as 70 dBm under the assumption of GSO.

**Open issues:**

* Further discuss the minimum output power requirements

**Issue 2-3: Transmitter spurious emission**

**Agreement:**

* Further check if Prated,c,sys is based on TRP or EIRP.
  + If Prated,c,sys is based on TRP, go with proposal 3
  + If Prated,c,sys is based on EIRP, go with proposal 4

**Agreement:**

* + If Prated,c,sys is based on TRP and go with proposal 3:

|  |  |  |
| --- | --- | --- |
| Frequency Range | Maximum Level | Measurement bandwidth |
| 30 MHz ≤ f ≤ 2nd harmonic of the upper frequency edge of the UL operating band in GHz | -13 dBm | 4 kHz |

* + Further figure out the exact wording of Prated,c,sys for VSAT

**Issue 2-6: the applicability of antenna type for GSO and LEO scenario**

**Agreement:**

* Add the following definitions:
  + Co-polarized transmission: when the DUT transmission antenna polarization is aligned with test antenna polarization.
  + Cross-polarized transmission: when the DUT transmission antenna polarization is aligned with the tangent of the test antenna polarization.

**Issue 2-7: feature list**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 40.NR\_NTN\_enh | 40-1 | VSAT UE type in NTN | Support of fixed or mobile VSAT (Very Small Aperture Terminal) UE type  a) Type 1: a fixed VSAT, which can only be fixed.  b) Type 2: a mobile VSAT, which is capable to move.  A VSAT (Very Small Aperture Terminal) UE as defined in TS 38.101-5 shall indicate support of this capability with only one type. |  | Yes | N/A | The network doesn’t know the VSAT UE type. | Per UE | N/A | FR2 | N/A | Support receiving access control indication in system information  The feature group is applied to FR2-NTN | Optional with capability signalling |
| 40.NR\_NTN\_enh | 40-2 | Beam steering | Support of beam steering capability   1. Type 1: Fully electronically-steered beam UEs 2. Type 2: Fully mechanically-steered beam UEs   A VSAT (Very Small Aperture Terminal) UE as defined in TS 38.101-5 shall indicate support of this capability with only one type. |  | Yes | N/A | Beam steering is not supported. | Per UE | N/A | FR2 | N/A | The capability is not applicable for UE other than VSAT.  The feature group is applied to FR2-NTN | Optional with capability signaling |

**Issue 2-1: REFSENS requirements**

**Agreement:**

* For minimum EIS requirement,Lower aperture size/low antenna gain compared with 60cm/39.7dBi simulation assumption could be considered for minimum EIS requirement.
  + FFS on the concrete values of requirements

**Agreement:**

* For the VSAT REFSENS requirement, single polarization shall be assumed as baseline.
* [If VSAT is capable with 2Rx diversity, the further delta\_R [-2.5dB] with 2Rx could be added].

**Agreement:**

* For the type 3, to specify the minimum EIS requirement as [-115.6dBm]for 50MHz and for the other channel bandwidth, the corresponding EIS requirement could be scaled with PRB based compared with 50MHz under the assumption of 600km orbit.
* For the type 1,2,4,5, to specify the minimum EIS requirement as [-126.8dBm]for 50MHz and for the other channel bandwidth, the corresponding EIS requirement could be scaled with PRB based compared with 50MHz under the assumption of GSO orbit.

**Issue 2-2: Maximum input power for NTN VSAT**

**Agreement:**

* ~~Specify [-101]dBm as OTA maximum input level for (type 3 UE) fixed VSAT supporting LEO only with electronical steering antenna.~~
  + ~~Take the proposal 2 method into consideration for the further evaluation to confirm the value above~~
  + ~~Further study on the modulation order for maximum input level.~~

**Agreement:**

For type 3, for the maximum input power requirement, for Ka-band VSAT, only to define the requirement up to [16/64QAM].

* FFS on the coding rate when defining the FRC configuration for [16/64QAM] maximum input power.
* FFS on the value for maximum input power level.
* Note: for 64QAM modulation order, the lower orbits compared with 600KM might be considered .

For type 1/2 capable of connecting with both GSO and LEO, for the maximum input power requirement, for Ka-band VSAT, only to define the requirement up to [16/64QAM] under the LEO assumption as maximum input power

* FFS on the coding rate when defining the FRC configuration for [16/64QAM/] maximum input power.
* FFS on the value for maximum input power level.

For type 4/5 capable of connecting with GSO, for the maximum input power requirement, for Ka-band VSAT, only to define the requirement up to [16/64QAM/] under the GSO assumption as maximum input power

* FFS on the coding rate when defining the FRC configuration for [16/64QAM/] maximum input power.
* FFS on the value for maximum input power level.

**Issue 2-7: Others**

**Agreement:**

* Use ERC 74-01 as reference for band n512.

**BS RF/Demod**

SAN RF

SAN type 2-O out-of-band blocking requirement

**Agreement:**

Requirement:

| Frequency range of interfering signal  (MHz) | Wanted signal mean power  (dBm) | Interferer RMS field-strength  (V/m) | Type of interfering signal |
| --- | --- | --- | --- |
| 30 to 12750 | EISREFSENS + 6 dB | 0.0029 | CW |
| 12750 to FUL,low – [1500] | EISREFSENS + 6 dB | 0.0029 | CW |
| FUL,high + [1500] to 2nd harmonic of the upper frequency edge of the *operating band* | EISREFSENS + 6 dB | 0.0029 | CW |

SAN type 2-O in-channel selectivity requirement

**Agreement:**

Specify ICS requirement based on ICS value of 14 dBc and considering the IoT level is up to 5dBc

SAN Conformance

MU for 27.5-30 GHz for SAN type 2-O OTA receiver tests

**Agreement:**

Reused FR2 TN MUs (24.25-29.5 GHz) for SAN type 2-O receivers tests in 27.5-30.0 GHz.

MU for 17.3-20.2 GHz for SAN type 2-O OTA transmitter tests

**Agreement:**

Consider FR2 TN MUs (24.25-29.5 GHz) for SAN type 2-O transmitter tests in 17.3-20.2 GHz.

Values are kept in [], encouraging additional inputs from TE vendors.

Manufacturer declarations

**Agreement:**

Reused manufacturer declarations for SAN type 1-O except OSDD-related manufacturer declaration

Add EIS REFSENS for FR2 (EISREFSENS\_50M)

Test signal

**Agreement:**

Use the following test signal when testing SAN type 2-O

|  |  |  |
| --- | --- | --- |
| *Operating band* characteristics | | FDL\_high – FDL\_low ≤ 3250 MHz |
| TC signal | BWchannel | 100 MHz (Note 1, Note 2) |
| characteristics | Subcarrier spacing | Smallest supported subcarrier spacing declared per operating band (D.7) |
| NOTE 1: SAN vendor can decide to test with 50 MHz *SAN channel bandwidth* and smallest supported SCS declared per *operating band* (D.7) instead of 100 MHz *SAN channel bandwidth* in certain regions, where spectrum allocation and regulation require testing with 50 MHz.  NOTE 2: If this *SAN channel bandwidth* is not supported, the narrowest supported *SAN channel bandwidth* declared per *operating band* (D.7) shall be used. | | |

Test models

**Agreement:**

Specify following test models:

|  |  |  |
| --- | --- | --- |
| **Test models for FR2 in TS38.141-2** | **Applicability for NTN SAN** | **Test model for FR2-NTN** |
| NR-FR2-TM1.1 | Applicable but need to be updated for FDD NTN FR2 | NR-SAN-FR2-TM1.1 |
| NR-FR2-TM2 | Applicable, applicability for 64QAM pending on the further discussion. | NR-SAN-FR2-TM2 |
| NR-FR2-TM3.1 | Applicable | NR-SAN-FR2-TM3.1 |

Test configurations

**Agreement:**

Reuse test configuration NRTC1 (TS 38.181) for SAN type 2-O, no other TC is needed.

RF channels to be tested

**Agreement:**

RF channels for single carrier and multi-carrier operation for transmitter requirements for SAN type 1-O can be reused for SAN type 2-O.

|  |  |  |  |
| --- | --- | --- | --- |
| Requirements | | single carrier | Multi-carrier |
| 9.2 | Radiated transmit power | B,M,T | BRFBW, MRFBW, TRFBW |
| 9.3 | OTA SAN output power | B,M,T | BRFBW, MRFBW, TRFBW |
| 9.4 | OTA total power dynamic range | M | - |
| 9.6.2 | OTA Frequency Error | Same as EVM | Same as EVM |
| 9.6.3 | OTA Modulation quality | B, T | BRFBW, TRFBW |
| 9.7.2 | OTA Occupied BW | M | ~~-~~ |
| 9.7.3 | OTA ACLR | B, T | BRFBW,  TRFBW |
| 9.7.4 | OTA Out-of-band emissions | B,M,T | BRFBW, MRFBW, TRFBW |
| 9.7.5 | OTA Transmitter spurious emissions | B for spurious frequencies below the band, T for frequencies above the band | BRFBW for spurious frequencies below the band, TRFBW for frequencies above the band |

**Issue 3-2: SAN ACLR**

Agreement: SAN ACLR is **12 dBc** for GEO & LEO

**Issue 3-3: SAN ACS**

Agreement: SAN ACS is **18 dBc for GEO and 24 dBc for LEO**

**Issue 3-4: UE ACLR**

Agreement: NTN UE ACLR is **14 dBc for Fixed UE and Mobile UE**.

SAN UE demod

Topic #1 General

Sub-topic 1-1: channel model

**Issue 1-1-2: Doppler for UL**

* Agreements
  + 3000Hz as baseline

Topic #2: UE demodulation performance requirements

Sub-topic 2-1: Test scope

**Issue 2-1-1: Test for Disabled HARQ process for above 10 GHz bands**

* Agreements:
  + Define performance requirements for Disabled HARQ process
  + Set the number of HARQ Processes as: 4 with feedback disabled, 12 with feedback enabled in 16 HARQ processes with re-Tx disable for all HARQ processes and only transmit initial transmissions with NDI toggling. Throughput shall be measured on processes with HARQ enabled. Which 4 processes to disable are randomly select at test configuration.

|  |  |  |
| --- | --- | --- |
| **Prop. Channel** | **MCS** | **HARQ Config** |
| NTN-TDLC5-[600] | MCS4 | Disabled HARQ |
| MCS4 | 16 HARQ Proc |
| NTN-TDLC5-[600] | MCS4 | 32 HARQ Proc |
| MCS13 | 16 HARQ Proc |

**Issue 2-1-3: UE PDCCH demodulation requirements for above 10 GHz bands**

* Agreement
  + Define new PDCCH demodulation requirements for above 10GHz bands

Sub-topic 2-2: General issues for above 10 GHz bands

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

* Agreement
  + 200MHz

**Issue 2-2-3: Beamforming and beam steering**

* Agreements
  + Do not consider beamforming and beam steering for FR2 NTN demodulation requirements.

**Issue 2-2-4: Rx phase noise**

* Agreements
  + Do not consider PN impact in ideal simulation results alignment. The phase noise impact can be considered in impairment results.

Sub-topic 2-3: Test setup for above 10 GHz bands

**Issue 2-3-1: MCS for PDSCH**

* Agreement
  + MCS4 (QPSK, 0.30) and MCS13 (16QAM, 0.48)

**Issue 2-3-2: PDCCH aggregation level**

* Agreement
  + Option 1: 8 as baseline
  + Option 2: 2 and 4
  + Option 3: 4, 8 and 16

Topic #3: SAN demodulaton requirements

Sub-topic 3-1: General issues for above 10 GHz bands

**Issue 3-1-1: Antenna configuration**

* Agreement
  + Do not consider 2Tx

**Issue 3-1-2: Phase noise**

* Agreement
  + Do not model the phase noise for PUSCH SAN demodulation requirements in FR2-NTN in the ideal simulation assumption. The impact of phase noise can be considered in the impairment results.

Sub-topic 3-2: Test setup for normal PUSCH with CP-OFDM for above 10 GHz bands

**Issue 3-2-1: MCS**

* Agreement
  + MCS 2/16/20 in Table 1 with downselection based on SNR operating point:
    - MCS: MCS 2, FFS MCS16 and/or MCS20,
    - SNR operating point: should be lower than the link budget suggested SNR value, FFS SNR value

**Issue 3-2-2: Additional DM-RS position**

* Agreement
  + pos1

**Issue 3-2-3: RB assignment**

* Agreement
  + Full applicable test bandwidth

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

* Agreement
  + Not configure PT-RS for all test cases to be defined
  + FFS the configuration of PT-RS for test cases other than MCS2

**Issue 3-2-5: Other parameters**

* Agreements

|  |  |  |
| --- | --- | --- |
| **Parameter** | | **Value** |
| Transform precoding | | Disabled |
| 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 |
| 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} |
| DM-RS sequence generation | NID=0, nSCID =0 |
| Time domain resource | PUSCH mapping type | B |
| Start symbol index | 0 |
| Allocation length | 10 |
| Frequency domain resource | Frequency hopping | Disabled |
| Code block group based PUSCH transmission | | Disabled |

Sub-topic 3-3: Test setup for normal PUSCH with DFT-s-OFDM for above 10 GHz bands

**Issue 3-3-1: MCS**

* Agreement
  + MCS 2 in Table 1

**Issue 3-3-2: Additional DM-RS position**

* Agreement
  + pos1

**Issue 3-3-3: RB assignment**

* Agreement
  + 30 PRBs in the middle of the test bandwidth

**Issue 3-3-4: PTRS configuration**

* Agreement
  + Do not configure

**Issue 3-3-5: Other parameters**

* Agreement

|  |  |  |
| --- | --- | --- |
| **Parameter** | | **Value** |
| Transform precoding | | 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 |
| 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} |
| DM-RS sequence generation | NID=0, nSCID =0 |
| Time domain resource | PUSCH mapping type | B |
| Start symbol index | 0 |
| Allocation length | 10 |
| Frequency domain resource | Frequency hopping | Disabled |
| Code block group based PUSCH transmission | | Disabled |

Sub-topic 3-4: Test setup for PUSCH repetition Type A for above 10 GHz bands

**Issue 3-4-1: MCS**

* Agreement
  + MCS 5 in Table 3

**Issue 3-4-2: Other parameters**

* Agreement

|  |  |  |
| --- | --- | --- |
| **Parameter** | | **Value** |
| Transform precoding | | Disabled |
| HARQ | Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 3, 0, 3 [Note 1] |
| DM-RS | DM-RS configuration type | 1 |
| DM-RS duration | single-symbol DM-RS |
| Additional DM-RS symbols | Pos1 |
| 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 |
| DM-RS sequence generation | NID=0, nSCID =0 |
| Time domain resource | PUSCH mapping type | B |
| Start symbol index | 0 |
| Allocation length | 10 |
| PUSCH aggregation factor | n2 |
| Frequency domain resource | RB assignment | Full applicable test bandwidth |
| Frequency hopping | Disabled |
| Code block group based PUSCH transmission | | Disabled |
| PT-RS configuration | Frequency density (*KPT-RS*) | Disabled |
| Time density (*LPT-RS*) | Disabled |
| NOTE 1: The effective RV sequence is {0,2,3,1} with slot aggregation | | |

Sub-topic 3-5: Test setup for PUCCH for above 10 GHz bands

**Issue 3-5-2: Test parameters**

* Agreement
  + - 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 |
| Antenna configuration | 1x1, 1x2 |
| Propagation condition | NTN-TDLC5-3000 Low |
| Test metric | 1% of DTX to ACK probability  1% of ACK missed detection probability |

* + - 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 |
| Antenna configuration | 1x1, 1x2 |
| Propagation condition | NTN-TDLC5-3000 Low |
| Test metric | 1% of DTX to ACK probability  0.1% of NACK to ACK probability  1% of ACK missed detection probability |

* + - PUCCH format 2 (ACK missed detection)

|  |  |
| --- | --- |
| **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 |
| Antenna configuration | 1x1, 1x2 |
| Propagation condition | NTN-TDLC5-3000 Low |
| Test metric | 1% of DTX to ACK probability  1% of ACK missed detection probability |

* + - PUCCH format 2 (UCI BLER)

|  |  |
| --- | --- |
| **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 |
| Antenna configuration | 1x1, 1x2 |
| Propagation condition | NTN-TDLC5-3000 Low |
| Test metric | 1% of BLER |

* + - 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 |
| Antenna configuration | 1x1, 1x2 | |
| Propagation condition | NTN-TDLC5-3000 Low | |
| Test metric | 1% of BLER | |

* + - 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 |
| Antenna configuration | 1x1, 1x2 |
| Propagation condition | NTN-TDLC5-3000 Low |
| Test metric | 1% of BLER |

Sub-topic 3-6: Test setup for PRACH for above 10 GHz bands

**Issue 3-6-1: Time error tolerance**

* Agreement
  + where is the largest delay of the propagation channel = 0.06 us

**Issue 3-6-2: Requirements under AWGN channel**

* Agreement
  + Not define PRACH performance requirements under AWGN channel for above 10GHz bands

Sub-topic 3-7: Test setup for PUSCH with DM-RS bundling for FR1 UL coverage enhancement

**Issue 3-7-1: Timing drift**

* Agreement
  + Do not model timing drift/frequency drift in the ideal simulation. The impact of timing drift/frequency drift can be considered in the impairment results.

**Issue 3-7-2: Antenna configuration**

* Agreement
  + Consider both 1Tx1Rx and 1Tx2Rx for PUSCH with DMRS bundling demodulation requirements. Apply the same test applicability for 1T1Rx and 1Tx2Rx performance test defined in TS 38.181.

**Issue 3-7-3: Channel model**

* Agreement
  + NTN-TDLA100-200

**Issue 3-7-4: MCS**

* Agreement
  + MCS 4 in Table 1

**Issue 3-7-5: Additional DM-RS position**

* Agreement
  + pos1

**Issue 3-7-7: PUSCH mapping type**

* Agreement
  + A and B. Apply the same test applicability for 1T1Rx and 1Tx2Rx performance test defined in TS 38.181.

**Issue 3-7-8: Allocation length**

* Agreement
  + 14

**Issue 3-7-9: PTRS configuration**

* Agreement
  + Do not configure

**Issue 3-7-10: RV sequence**

* Agreement
  + 0,0,0,0

**Issue 3-7-13: Other parameters**

* Agreement

|  |  |  |
| --- | --- | --- |
| **Parameter** | | **Value** |
| Transform precoding | | Disabled |
| HARQ | Maximum number of HARQ transmissions | 4 |
| DM-RS | DM-RS configuration type | 1 |
| DM-RS duration | single-symbol DM-RS |
| Additional DM-RS position | pos1 |
| Number of DM-RS CDM group(s) without data | 2 |
| Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
| DM-RS port | 0 |
| DM-RS sequence generation | NID0=0, nSCID =0 |
| Time domain resource assignment | Start symbol | 0 |
| Frequency domain resource assignment | Frequency hopping | Disabled |
| Code block group based PUSCH transmission | | Disabled |
| Note 1: The effective RV sequence is {0, 2, 3, 1} with slot aggregation. | | |

**RRM**

Topic #1: UL timing requirements in bands above 10 GHz

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

**Online Agreement:**

* Define same Te\_NTN requirements for all UL channels, i.e. no separate Te\_NTN requirement for PRACH

**Issue 1-6A: Te\_NTN for 60kHz and 120kHz in Case2**

**Agreement: (ad-hoc agreement)**

* For 120kHz of UL SCS in case2, the requirements are applicable only if the ephemeris information be refreshed (i.e. update rate of ephemeris information in SIB19) at least every X seconds.
  + X= [7] s

**Issue 1-6B: Te\_NTN for 60kHz and 120kHz in Case3**

**Agreement:**

* For 120kHz of UL SCS in case3, Te\_NTN [Ts] is X.
  + - [10] Ts
    - Further discussion on the side condition is not precluded in maintenance part based on contribution driven.

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

**Online Agreement:**

* NTA,offset for FR2-NTN is 0.

**Issue 1-12: Applicability of UL timing requirements for PUSCH DMRS bundling**

**Online Agreement:**

* The existing UL timing accuracy requirements apply to UL transmissions in TDW for PUSCH DMRS bundling.

Topic #2: RRM requirements in bands above 10 GHz

Issue 2-7: Measurement gap

**Online Agreement:**

* For FR2-NTN support, UE is not required to support per-FR gap (e.g. independentGapConfig). FR2-NTN capable UE is not expected to perform measurements on FR1-NTN.

**Issue 2-13: UE capability**

**Online Agreement:**

* The following UE capabilities introduced in Rel-17 NR NTN are not applicable for each UE type (Type 1 and Type 2) in FR2-NTN:
  + maxNumber-NGSO-SatellitesWithinOneSMTC-r17
  + parallelMeasurementWithoutRestriction-r17
  + parallelSMTC-r17
  + maxNumber-LEO-SatellitesPerCarrier-r17
  + parallelMeasurementGap-r17

**Issue 2-14: Draft reply LS to RAN2 (R4-2400007 /R1-2312553, Response on LS on the system parameters for NTN above 10 GHz)**

**Online Agreement: (Nokia will draft a reply LS)**

* RAN4 to send a reply LS to RAN2 (R4-2400007/R1-2312553, Response on LS on the system parameters for NTN above 10 GHz).

Topic #3: Network verified UE location

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

**Agreement: (online agreement)**

* Nsample = 1 for UE Rx-Tx measurement period requirements
* Define additionally the single satellite based RTT requirement without MG based on the existing RTT requirements, given that the RTT requirement with MG was already agreed as baseline.

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

**Online Agreement:**

* No UE requirement on DL timing drift measurement/calculation.

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

**Online Agreement:**

* Further discussion in maintenance phase is not precluded based on contribution driven.
  + No new applicability condition for UE Rx-Tx measurement requirements related to amount of variation in the applied TA during measurement period.

**Issue 3-5: Other impact on RRM**

**Online Agreement:**

* When UE switches to a new satellite switch with same PCI, and no UE requirement applies. RAN4 can further discuss whether to stop or re-start the measurement in maintenance phase based on contribution driven.

Topic #4: Idle/Inactive mode mobility enhancements

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

**Agreement: (ad-hoc agreement)**

* Requirement applicability
  + Only inter-frequency cell reselection from TN to NTN only in FR1-NTN
  + Timer-based measurement triggering parts not applicable for cell reselection from TN to NTN
  + The requirements apply provided that UE has valid SIB19
  + UE is not required to ensure having a valid version of SIB19 and the exact time of reacquiring SIB19 is up to UE implementation.

**Online Agreement:**

* Measurement requirements on inter-frequency cell reselection from NR TN to NTN
  + - * Kcarrier\_TN \* Tdetect/measure/evaluate,NR\_Inter\_TN + + T\_GNSS if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the enhancedMeasurementLEO-r17 is not enabled, or within Kcarrier\_TN \* Tdetect/measure/evaluate,NR\_Inter\_TN + if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [14] and the enhancedMeasurementLEO-r17 is enabled.
        + The parameter Kcarrier\_TN is the number of NR TN inter-frequency carriers indicated by the serving cell.
        + The parameter Kcarrier\_NTN is the number of NR NTN inter-frequency carriers indicated by the serving cell.
        + Tdetect/measure/evaluate,NR\_Inter\_TN is the NR TN inter-frequency cell re-selection requirement defined in Table 4.2.2.4-1 in TS38.133
        + Tdetect/measure/evaluate,NR\_Inter\_NTN is the NR NTN inter-frequency cell re-selection requirement defined in Table 4.2C.2.4-1 in TS38.133
  + T\_GNSS is TTFF (Time To First Fix) of which value is left undefined in RRM spec. If UE GNSS has been switched ON, T\_GNSS can be assumed zero.
    - The note below is to be implemented in RRM requirement spec:
      * the above requirement does not assume UE always performs NTN cell detection/measurement as well as TN cells.
* Implement the requirements for TN-to-NTN cell reselection in IDLE mode in a new subclause under clause 4.2.
* FFS how to implement in CR the impact to the TN-to-TN requirement under this scenario in the maintenance phase.

**Updated agreement on top of adhoc agreement:**

* + The requirements apply provided that network provides SIB19. UE is not required to ensure having a valid version of SIB19 and the exact time of reacquiring SIB19 is up to UE implementation.

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

**Agreement: (ad-hoc agreement)**

* Requirement applicability
  + Only inter-frequency cell reselection from NTN in FR1-NTN to TN
  + FFS inter-RAT cell resection
* Measurement requirements on cell reselection from NTN to NR TN (inter-frequency)
  + Remove HST components.
  + Remove HST components if inter-RAT considered in Rel-18

**Online Agreement:**

* Measurement requirements on cell reselection from NTN to NR TN (inter-frequency intra-RAT)
  + - Kcarrier\_TN \* Tdetect/measure/evaluate,NR\_Inter\_TN + if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the enhancedMeasurementLEO-r17 is not enabled, or within Kcarrier\_TN \* Tdetect/measure/evaluate,NR\_Inter\_TN ~~+ K~~~~carrier\_HST~~ ~~\* T~~~~detect/measure/evaluate,NR\_Inter\_HST~~ + if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [14] and the enhancedMeasurementLEO-r17 is enabled.
      * The parameter Kcarrier\_TN is the number of NR TN inter-frequency carriers indicated by the serving cell, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.
      * The parameter Kcarrier\_HST is the number of NR TN inter-frequency carriers which are configured with highSpeedMeasInterFreq-r17 indicated by the serving cell, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.
      * The parameter Kcarrier\_NTN is the number of NR NTN inter-frequency carriers indicated by the serving cell.
      * Tdetect/measure/evaluate,NR\_Inter\_TN is the NR TN inter-frequency cell re-selection requirement defined in Table 4.2.2.4-1 in TS38.133
      * Tdetect/measure/evaluate,NR\_Inter\_NTN is the NR NTN inter-frequency cell re-selection requirement defined in Table 4.2C.2.4-1 in TS38.133
    - When the distance between the UE and tn-ReferenceLocation is larger than tn-DistanceRadius +50m, the UE is allowed to not perform measurements on the TN frequency in the corresponding area.
* Measurement requirements on cell reselection from NTN to LTE TN (inter-RAT)
  + - NEUTRA\_carrier \* Tdetect/measure/evaluate,EUTRAN
      * The parameter NEUTRA\_carrier\_HST is the total number of configured E-UTRA carriers indicated to meet high speed requirements in the neighbour frequency list, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.
      * The parameter NEUTRA\_carrier is the number of EUTRA TN carriers indicated by the serving cell, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.
    - When the distance between the UE and tn-ReferenceLocation is larger than tn-DistanceRadius +50m, the UE is allowed to not perform measurements on the TN frequency in the corresponding area.

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

**Agreement (online on Tuesday):**

* For companies not supporting the moderator’s WF, to have offline discussion with other companies. If consensus on any other compromised alternative can be achieved, we can go with that alternative. If not, the moderator’s WF will be agreed on Thursday.

**Online agreement:**

* For time-based NTN to NTN cell reselection in earth-moving cell, reuse the existing RRC idle/inactive mode requirements (4.2C and 5.1C) referring to ‘t-service’.
  + Note: “UE shall start measurement of the neigbhor cells indicated by the serving cell before t-Service is reached according to the requirements” is already stated in the existing requirements.

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

**Agreement: (online agreement)**

* For location triggered cell reselection measurement for earth moving cell, a margin of X meters for determining the distance between UE and reference location is added. X = [80]m

Topic #5: Connected mode mobility enhancements

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

**Online Agreement: (f/u can be through CRs in the future meetings)**

* For RACH-less HO,
  + on PRACH in TIU
    - Leave TIU as is. RAN4 to add back PRACH to TIU if supported by RAN2 spec in maintenance phase, e.g.
      * PRACH if TA timer is not running and there is no PUCCH SR
      * PRACH if no valid configured grant based PUSCH is found
  + Remove SR on PUCCH from TIU
    - RAN4 to add back it to TUE if supported by RAN2 spec in maintenance phase.
* For RACH-less CHO,
  + The requirement for time-based CHO can be the baseline, with the following modification on TIU
    - For combination of RACH-less handover with time-based conditional handover, TIU can be a configured grant based PUSCH, dynamic grant based PUSCH, SR on PUCCH, according to NW configuration and scheduling.

**Issue 5-2-C: Common aspects for ‘Hard’ and ‘Soft’ Satellite switch**

**Agreement: (ad-hoc agreement)**

* Decide a specific value for Tprocessing time
  + 10ms
* Side condition for the requirement applicability
  + the target cell Es/Iot ≥ -2 dB

**Issue 5-2-H1: (‘Hard’ Satellite switch) Separate link switch time instances for UL and DL**

**Online Agreement:**

* Do not define separate starting points for UL and DL for hard switch

**Issue 5-2-H2: (‘Hard’ Satellite switch) Interruption time**

**Online Agreement:**

* Starting point of the interruption time
  + t-Service
* Tsearch
  + Tfirst\_SSB [ms], where Tfirst\_SSB is the time to the end of the first complete SSB burst indicated by
    - SMTC of serving cell + ssb-TimeOffset + PDD propagation difference
* TIU
  + 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 TA timer is not running and there is no PUCCH SR
  + Note: Anything not compliant with RAN2 spec, if identified, will be removed.
* From T-service until the satellite switch completion, the UE is allowed to skip measurements other cells and satellites than the target satellite

**Issue 5-2-S1: (‘Soft’ Satellite switch) RAN2 LS on soft satellite switch**

**Agreement: (ad-hoc agreement – details for LS reply is separately discussed/approved, ledy by Apple)**

* It is feasible that a soft satellite switch capable UE can perform downlink synchronization with the target NGSO satellite and keep the connection (DL and UL) with the source NGSO satellite simultaneously under the following conditions.
  + Only if SSBs from the two satellites are spaced apart from each other at least by [1 OFDM symbol] in the time domain at UE Rx side.
* [If the UE not capable of parallelMeasurementWithoutRestriction-r17 then scheduling restriction shall be expected within the duration from Tstart to T service.]

**Agreement:**

Further discuss on the solutions of alleviating the scheduling restriction problem can be further discussed in maintenance phase.

**Issue 5-2-S2: (‘Soft’ Satellite switch) Interruption time**

**Agreement: (Needs online discussion)**

* The starting point of the downlink synchronization time~~/interruption time~~.
  + Between t-serviceStart and t-Service, the exact starting time is up to UE implementation
* The starting point of the interruption time.
  + t-Service
* **Online Agreement**: Satellite switch latency Requirement
  + If t-Service – t-serviceStart >= Tsearch + T∆ + Tmargin and UE is able to perform downlink synchronization with the target NGSO satellite and keep the connection (DL and UL) with the source NGSO satellite simultaneously
    - Satellite switch **ending pint** is **no later than** is Tprocessing + TIU from t-Service
  + Otherwise
    - Satellite switch ~~latency~~ **ending pint** is **no later than** Tsearch + T∆ + Tmargin + Tprocessing + TIU from t-serviceStart
  + Interruption is allowed only after t-Service

**Agreement:**

* Satellite switch delay (Tsoft-switch), from t-serviceStart to the time instance for the first UL transmission to the target satellite, is defined as below:
  + Tsoft-switch = max(t-Service - t-serviceStart, Tsearch + T∆ + Tmargin) + Tprocessing + TIU
* ‘The time instance for the first UL transmission to the target satellite’ is no earlier than t-Service.

**Online Agreement:**

* Tsearch
  + Tfirst\_SSB [ms], where Tfirst\_SSB is the time to the end of the first complete SSB burst indicated by
    - SMTC of serving cell + ssb-TimeOffset + PDD propagation difference
* TIU (ending point of interruption is at TIU)
  + 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 TA timer is not running and there is no PUCCH SR
  + Note: Anything not compliant with RAN2 spec, if identified, will be removed.
* T∆: Same as the existing requirements
* Tmargin: Same as the existing requirements
* Further discuss whether UE is allowed to skip or deprioritize measurements on the serving cell and neighbor cells from T-Start in maintenance phase

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

**Online Agreement:**

* For NTN to NTN time or location only-based trigger CHO enhancements, the existing conditional CHO requirement defined in 6.1C.2.2 (DCHO = TRRC + TEvent\_DU + Tmeasure + Tinterrupt + TCHO\_execution, Tinterrupt = Tprocessing + TIU + T∆ + Tmargin) is reused with the following updates:
  + TEvent\_DU is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until the time (condition T1-1) or location condition (both condition D1-1 and condition D1-2) is fulfilled.
  + Remove Tmeasure
  + Add Tsearch to Tinterrupt, i.e. Tinterrupt = Tprocessing + TIU + T∆ + Tmargin+ Tsearch, and the definition of Tsearch is the same as the existing one defined in [6.1C.1.2]

Topic #6: Performance requirements

**Issue 6-1: Configuration of test cases**

**Agreement:**

* Strive to reuse Rel-17 NR NTN test setup for satellite specific parameters. Any changes, if needed/identified for FR2-NTN, can be considered.

**Issue 6-2: NTN bands above 10 GHz**

**Agreement:**

* For FR2-NTN Type 1 and Type 2 UEs, the below are baseline. Type 1 and Type 2 UEs can have different sets of test cases.
  + RRC Idle and Inactive mobility in intra-satellite scenario
  + UL timing accuracy
  + L1-RSRP
  + RLM
  + L3 measurements in intra-satellite scenario
  + Intra-satellite Handover
  + Blind inter-satellite Handover
  + For relative accuracy for intra-frequency measurement, FFS whether to define requirements for intra-sat only based on the assumption of same Rx beam.

**Issue 6-3: NTN bands below 10 GHz**

**Agreement:**

* For FR1-NTN test cases, the below are baseline.
* Network verified UE location
* NTN-TN cell reselection
* NTN to NTN time-based measurement initiation for cell reselection in earth-moving cell, only for satellite switch
* NTN to NTN location-based measurement initiation for cell reselection in earth-moving cell, for cell switch
* NTN to NTN RACH-less (C)HO
* NTN to NTN Satellite switching without PCI change
  + Hard switch
    - RACH based
    - RACH-less
  + soft switch
    - RACH based
    - RACH-less
* NTN to NTN time-based trigger CHO enhancements
* NTN to NTN location- based trigger CHO enhancements

**Agreement:**

* For network verified UE location,
* For accuracy requirement, re-use the TN accuracy requirements, including both baseband estimation accuracy and RF calibration margin, and side conditions with Nsample = 1
* Existing report mapping for UE and gNB Rx-Tx are re-used for NW verified location

#### 2.4.2 Remaining Open issues

**UE RF**

**Issue 2-1: The minimum peak EIRP and minimum output power for VSAT**

**Open issues:**

* Further discuss the minimum output power requirements

**Issue 2-2: Maximum input power for NTN VSAT**

For type 3, for the maximum input power requirement, for Ka-band VSAT, only to define the requirement up to [16/64QAM].

* FFS on the coding rate when defining the FRC configuration for [16/64QAM] maximum input power.
* FFS on the value for maximum input power level.
* Note: for 64QAM modulation order, the lower orbits compared with 600KM might be considered .

For type 1/2 capable of connecting with both GSO and LEO, for the maximum input power requirement, for Ka-band VSAT, only to define the requirement up to [16/64QAM] under the LEO assumption as maximum input power

* FFS on the coding rate when defining the FRC configuration for [16/64QAM/] maximum input power.
* FFS on the value for maximum input power level.

For type 4/5 capable of connecting with GSO, for the maximum input power requirement, for Ka-band VSAT, only to define the requirement up to [16/64QAM/] under the GSO assumption as maximum input power

* FFS on the coding rate when defining the FRC configuration for [16/64QAM/] maximum input power.
* FFS on the value for maximum input power level.

**BS RF/Demod**

**Issue 3-5: UE ACS**

Further investigate and check the current TN FR2 ACS test methodology/configuration and conclude a single ACS value from Option 1 and Option 2 in the next meeting

* Option 1: [27.5]dBc
* Option 2: [23-28]dBc

NOTE 1:              At the time of this 3GPP co-existence study, there is no TN band defined or planned near 17 GHz. The parameters are derived based on 3GPP coexistence scenarios in which a TN system is simulated to be operating in the band directly adjacent to the proposed NTN system as well as technical assumptions that may or may not be applicable in practice. The results of the study are not intended to address coexistence issues from a regulatory standpoint.

NOTE 2:             There are existing non-3GPP VSAT UE operating in Ka band at present and will likely continue operating in the future, with ACS performance lower than the values proposed.

NOTE 3:              Additional solutions could be further considered to address coexistence issues if and when TN is deployed in 17 GHz.

*[Editor’s Note]*

*For a better reading, latest agreement/WF of Issue 3-2 to Issue 3-5 are summarized in the table below for reference.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | SAN | | UE | |
| GEO | LEO | Fixed | Mobile |
| ACLR (dBc) | 12 | 12 | 14 | 14 |
| ACS  (dBc) | 18 | 24 | [See Issue 3-5]1, 2, 3 | [See Issue 3-5]1, 2, 3 |
| NOTE 1: At the time of this 3GPP co-existence study, there is no TN band defined or planned near 17 GHz. The parameters are derived based on 3GPP coexistence scenarios in which a TN system is simulated to be operating in the band directly adjacent to the proposed NTN system as well as technical assumptions that may or may not be applicable in practice. The results of the study are not intended to address coexistence issues from a regulatory standpoint.  NOTE 2:   There are existing non-3GPP VSAT UE operating in Ka band at present and will likely continue operating in the future, with ACS performance lower than the values proposed.  NOTE 3:    Additional solutions could be further considered to address coexistence issues if and when TN is deployed in 17 GHz. | | | | |

For performance part:

* 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 SAx/CTs

#### 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.

## 4. References

NOTE: This can be e.g. a list of all related Tdocs in the affected WGs since last TSG, references to LSs, produced TRs/TSs, the work/study item description or status reports of previous TSGs.

## 4.1 RAN1

**RAN1#116 meeting, Athens, Greece, Feb 26 – Mar 1, 2024**

* R1-2400353 discussion Remaining issue on NR-NTN ZTE
* R1-2400587 discussion Discussion on maintenance on NR NTN enhancements OPPO
* R1-2400532 discussion Discussion on remaining issues in NR NTN enhancements xiaomi
* R1-2400224 discussion Maintenance on Rel-18 NR NTN vivo
* R1-2400713 discussion Maintenance on NR NTN enhancements Samsung
* R1-2400995 discussion On Remaining Issue of Uplink Coverage Enhancement Apple
* R1-2400976 discussion On maintenance of NR NTN enhancements Ericsson
* R1-2400970 discussion Open aspects related to Rel-18 maintenance for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2401096 discussion Maintenance of NR NTN enhancements NTT DOCOMO, INC.
* R1-2401764 other Session notes for 8.10 (Maintenance on NR NTN enhancements) Ad-Hoc Chair (Huawei)
* R1-2401669 discussion Discussion on FR2-NTN aspects at RAN1#116, second round Moderator (Nokia)
* R1-2401748 LS out Reply LS on Satellite Switch with Resync Moderator (Apple)
* R1-2401846 discussion Discussion on FR2-NTN aspects at RAN1#116, third round Moderator (Nokia)
* R1-2401813 LS out DRAFT Reply LS on UE capability to support DMRS bundling for GSO and NGSO Ericsson
* R1-2401814 LS out Reply LS on UE capability to support DMRS bundling for GSO and NGSO RAN1, Ericsson
* R1-2401377 discussion Maintenance of coverage enhancement for NR NTN Huawei, HiSilicon
* R1-2401422 discussion Maintenance on NR NTN enhancements Qualcomm Incorporated
* R1-2401167 discussion Maintenance on coverage enhancement for NR NTN Sharp
* R1-2401498 discussion Summary #1 on 8.10 Coverage enhancement for NR NTN Moderator (NTT DOCOMO)
* R1-2401499 discussion Summary #2 on 8.10 Coverage enhancement for NR NTN Moderator (NTT DOCOMO)
* R1-2401535 discussion Moderator summary #1 on remaining issues for RACH-less handover Moderator (Samsung)
* R1-2401537 discussion FL Summary #1: Maintenance on Network verified UE location for NR NTN Moderator (Thales)
* R1-2401538 discussion FL Summary #2: Maintenance on Network verified UE location for NR NTN Moderator (Thales)
* R1-2401539 discussion FL Summary #3: Maintenance on Network verified UE location for NR NTN Moderator (Thales)
* R1-2401540 discussion Discussion on FR2-NTN aspects at RAN1#116, first round Moderator (Nokia)
* R1-2401609 discussion Moderator summary of Reply LS to R1-2400009 (LS on RAN2 agreements for satellite switch with resync) Moderator (Apple)
* R1-2401610 LS out Draft Reply LS on Satellite Switch with Resync Moderator (Apple)

## 4.2 RAN2

**RAN2#125 meeting, Athens, Greece, Feb 26 – Mar 1, 2024**

* R2-2400085 LS in Response to “Reply LS on the service requirement of restricting satellite access RAT type” (S2-2401650; contact: Vodafone) SA2
* R2-2400036 LS in LS on OAM requirements for UE location verification (R3-238056; contact: CATT) RAN1
* R2-2400068 LS in Reply LS on the service requirement of restricting satellite access RAT type (S1-233296; contact: Apple) SA1
* R2-2400061 LS in LS on NTN VSAT capability (R4-2321975; contact: ZTE) RAN4
* R2-2400062 LS in LS on UE capability to support DMRS bundling for GSO and NGSO (R4-2321976; contact: Ericsson) RAN4
* R2-2400054 LS in LS on Handover Times for NTN UEs with mechanically steered beams in FR2-NTN (R4-2321576; contact: Nokia) RAN4
* R2-2400033 LS in LS on NR-NTN TP for TS 38.300 (R1-2312681; contact: Thales RAN1
* R2-2400045 LS in Reply LS on NW verified UE location failure during cell change (R3-238024; contact: Qualcomm) RAN3
* R2-2400711 discussion RIL List on 37.355 for NR NTN CATT
* R2-2400712 CR Correction on NR NTN in TS 37.355 CATT
* R2-2400609 CR Miscellaneous Corrections in 38.304 ZTE Corporation, Sanechips
* R2-2400534 discussion Consideration on VSAT support requested in R4-2321975 ZTE Corporation, Sanechips
* R2-2401410 CR Rapporteur input R18 NR NTN RRC Ericsson
* R2-2401411 discussion Rapporteur input R18 NR NTN RRC RIL Ericsson
* R2-2401449 LS out Draft LS response on Handover delay in FR2 NTN with mechanically steered beams Nokia
* R2-2401403 draftCR Corrections to stage 2 for NR NTN R18 Ericsson
* R2-2401282 CR Correction to Stage 2 on NTN mobility Huawei, HiSilicon
* R2-2401513 CR Correction to Stage 2 on NTN mobility Huawei, HiSilicon
* R2-2401462 discussion Miscellaneous Stage 2 corrections for NR NTN Samsung
* R2-2400771 draftCR 38.300 corrections for network verified UE location Nokia, Nokia Shanghai Bell
* R2-2400772 discussion On combining CHO and RACH-less Nokia, Nokia Shanghai Bell
* R2-2400535 discussion [RILH005,H400] Consideration on location-based CHO remaining issues ZTE Corporation, Sanechips
* R2-2400536 discussion Inclusion of NTN-Config for PCI unchanged ZTE Corporation, Sanechips
* R2-2400537 discussion Inclusion of Msg4 ACK repetition parameters ZTE Corporation, Sanechips
* R2-2400538 discussion [RILH001]Discussion on the switch timing for soft-switch case ZTE Corporation, Sanechips
* R2-2400808 discussion Issues on condEventD2 and RACH-less HO Samsung
* R2-2400809 discussion Issues on satellite switch with PCI unchanged and RIL S481 Samsung
* R2-2400802 discussion RRC corrections for NTN InterDigital
* R2-2400500 discussion Open Issues on the Satellite Switch with Resynchronization Google Inc.
* R2-2400501 discussion Provision of the TN PLMN ID in an NTN Cell Google Inc.
* R2-2400497 discussion Discussion on open issue for NTN CHO LG Electronics France
* R2-2400498 discussion Discussion on open issue for satellite swithcing with re-sync LG Electronics France
* R2-2400481 discussion The remaining issues of satellite switch of re-sync TCL
* R2-2400992 discussion [H015] Start and stop condition of T430 Huawei, HiSilicon
* R2-2401005 discussion [O600] Discusssion on TN cell broadcasting NTN info OPPO
* R2-2401006 discussion [O601] Discussion on location-based CHO for earth moving cells OPPO
* R2-2401007 discussion [O602] Discussion on unchanged PCI OPPO
* R2-2400937 discussion Open issues on satellite switch with unchanged PCI Apple
* R2-2400938 discussion Open issues on NR NTN Enhancements Apple
* R2-2400852 discussion RIL Q571 and H792 on issue of serving satellite change Qualcomm Incorporated
* R2-2400853 discussion DL sync and switch time in Satellite switch with re-sync Qualcomm Incorporated
* R2-2400855 discussion RACH-less satellite switch with resync Qualcomm Incorporated
* R2-2400892 discussion [K003] Discussion on satellite switch triggering ASUSTeK
* R2-2400869 discussion Discussion on configuration of ntn-cg-RACH-less-RetransmissionTimer LG Electronics Inc.
* R2-2401084 discussion [C606] Further discussion on CHO in EMC CATT, Thales, vivo, Samsung, Ericsson, Nokia, Nokia Shanghai Bell, Huawei, HiSilicon, ITL, OPPO
* R2-2401183 discussion On first UL transmission for unchanged PCI RIL H001 Nokia, Nokia Shanghai Bell
* R2-2401134 discussion Considerations on left issues on EMC CHO CMCC
* R2-2401135 discussion Considerations on left issues on PCI unchanged CMCC
* R2-2400182 discussion Consideration of remaining open issues of NTN China Telecom
* R2-2400695 discussion [H001] Discussion on unchanged PCI Huawei, HiSilicon
* R2-2400696 discussion [H005][H004][H008] Event D2 for earth-moving cell Huawei, HiSilicon
* R2-2400697 discussion [H792] Measurement results reporting for unchanged PCI cell Huawei, HiSilicon
* R2-2400698 discussion [H010][O602][C603] Discussion on ssb-TimeOffset Huawei, HiSilicon
* R2-2400699 discussion [H791] SMTC for measuring unchanged PCI cell Huawei, HiSilicon
* R2-2400700 discussion [H790] Applicable events for unchanged PCI cell Huawei, HiSilicon
* R2-2400701 discussion [H062] SIB19 acquisition after satellite switching Huawei, HiSilicon
* R2-2400702 discussion [H400] Correction to CondEvent D2 Huawei, HiSilicon
* R2-2400703 discussion CHO configuration in satellite switching Huawei, HiSilicon
* R2-2400670 discussion Further Thoughts on CHO in EMC [C606] Nokia, Nokia Shanghai Bell
* R2-2400122 discussion [V503] Remaining Issues on Location Based CHO for Moving Cell vivo
* R2-2400123 discussion Remaining Issues on Satellite Switch with Re-sync vivo
* R2-2400124 discussion [V507] Clarification on RACH-less CG Periodicity vivo
* R2-2400309 discussion [H009] NTN coverage enhancement implementation in RRC Huawei, HiSilicon
* R2-2400248 discussion Discussion on leftover open issues of TS 38.331 CATT
* R2-2400249 discussion [C604] [C622] On parameter applicability to CG RACH-less HO in NR NTN CATT
* R2-2400250 discussion [C619] On serving cell configuration for EMC CHO CATT
* R2-2400251 discussion Discussion on Remaining Open Issue for Unchanged PCI Mechanism (H001) CATT, Huawei, HiSilicon, CMCC
* R2-2400195 discussion [H063] RACH-based satellite switching with re-sync Huawei, HiSilicon, CATT, CMCC
* R2-2401256 discussion Open issues on location based CHO ITL
* R2-2401258 discussion Open issues on satellite switching with re-sync ITL
* R2-2401393 discussion Remaining issues on NR NTN Enhancements Sequans Communications
* R2-2401400 discussion Remaining issue on soft satellite switch with re-sync Ericsson
* R2-2401281 discussion Discussion on MAC behaviours related to RACH-less HO and unchanged PCI Huawei, HiSilicon
* R2-2400125 discussion Remaining Issues on PUCCH Repetition vivo
* R2-2400871 discussion Indication for HARQ feedback for RACH-less handover LG Electronics Inc.
* R2-2400881 discussion Discussion on corrections for RACH-less handover without retransmission timer NEC
* R2-2400882 discussion Discussion on remaining issues of RACH-less handover for NTN NEC
* R2-2400939 discussion Clarification on UE operation upon TATimer expiry during RACH-less HO Apple
* R2-2400803 discussion MAC corrections for NTN InterDigital
* R2-2400810 discussion Corrections on NTN MAC issues Samsung
* R2-2401000 discussion Discussion on PUCCH enhancement for Msg4 HARQ-ACK in NR NTN OPPO
* R2-2400854 discussion RIL Q638 on FR2 in NTN Qualcomm Incorporated
* R2-2400587 discussion Discussion on the measurement rules for cell re-selection ETRI
* R2-2401277 discussion Open issues on GNSS enhancements Huawei, HiSilicon
* R2-2401278 discussion Remaining issues on discontinous coverage Huawei, HiSilicon
* R2-2401401 discussion R18 IoT NTN GNSS extension Ericsson
* R2-2401409 discussion Remaining issue on switch procedure for satellite switch with re-sync Ericsson
* R2-2401404 discussion Remaining issue on VSAT UEs Ericsson

## 4.3 RAN3

**RAN3#125 meeting, Athens, Greece, Feb 26 – Mar 1, 2024**

* R3-240125 CR Correction for NR NTN early data forwarding and data discarding NEC
* R3-241030 CR Corrections on NR NTN NEC, Samsung
* R3-240634 CR Correction on textual description of Downlink RAN Early Status Transfer procedure ZTE
* R3-241036 CR Correction on textual description of Downlink RAN Early Status Transfer procedure ZTE
* R3-240635 CR Correction on textual description of MME Early Status Transfer procedure ZTE
* R3-241037 CR Correction on Time-based HO over S1 ZTE, CATT, Nokia, Nokia Shanghai Bell
* R3-240501 CR Correction to S1AP Time Based Handover Information IE CATT, Nokia, Nokia Shanghai Bell
* R3-240520 CR Correction to X2AP Conditional Handover Time Based Information IE CATT, Nokia, Nokia Shanghai Bell
* R3-241038 CR Correction to X2AP Conditional Handover Time Based Information IE CATT, Nokia, Nokia Shanghai Bell
* R3-241182 CR Correction to X2AP Conditional Handover Time Based Information IE CATT, Nokia, Nokia Shanghai Bell, ZTE, Qualcomm Incorporated
* R3-240436 CR Correction to the NGAP Time Based Handover Information IE Nokia, Nokia Shanghai Bell, CATT
* R3-240437 CR Correction to the XnAP Conditional Handover Time Based Information IE Nokia, Nokia Shanghai Bell, CATT
* R3-240636 CR Correction on Handover Window Start of Time-based HO ZTE
* R3-240637 CR Correction on Handover Window Start of Time-based CHO ZTE
* R3-240532 draftCR Correction of timer-based conditional handover for NR NTN Huawei
* R3-241049 draftCR Correction of timer-based conditional handover for NR NTN Huawei
* R3-240434 discussion Discussion on the support for HO with location-based trigger condition Nokia, Nokia Shanghai Bell
* R3-240435 draftCR Clarification on the support for NG-HO with Location-based Trigger Condition Nokia, Nokia Shanghai Bell
* R3-240083 draftCR Clarification for NTN on MBS and Disaggregated gNB Qualcomm Incorporated
* R3-240084 draftCR Clarification for NTN on MBS and Disaggregated gNB Qualcomm Incorporated
* R3-240245 CR ASN.1 review to 38.413 for NTN Samsung
* R3-240534 CR Correction of E-RABs Subject To DL Discarding for IoT NTN Huawei
* R3-240535 CR Correction of presence of DL Discarding Huawei
* R3-240220 CR ASN.1 and tabular alignment for NR NTN CATT, ZTE, Nokia, Nokia Shanghai Bell, China Telecom

## 4.4 RAN4

**RAN4#110 meeting, Athens, Greece, Feb. 26 – Mar. 1, 2024:**

* R4-2400039 Updated co-existence simulation result for above 10GHz bands CATT
* R4-2400040 Further discussion on Co-existence simulation result for above 10GHz bands CATT
* R4-2400041 Further discussion on SAN RF requirements for above 10GHz bands CATT
* R4-2400042 Discussion on SAN RF conformance testing requirements for above 10GHz bands CATT
* R4-2400043 Further discussion on SAN demodulation requirements for above 10 GHz bands CATT
* R4-2400123 Discussion on NTN RRM requirements in above 10GHz bands CATT
* R4-2400124 Reply LS on the system parameters for NTN above 10 GHz CATT
* R4-2400125 Reply LS on satellite switch with resync CATT
* R4-2400219 On NTN mobility and service continuity enhancements China Telecom
* R4-2400223 Further discussion on coexistence study between TN and NTN above 10GHz bands Qualcomm Incorporated
* R4-2400253 NR NTN SAN demodulation disussion Nokia, Nokia Shanghai Bell
* R4-2400254 NR NTN UE demodulation disussion Nokia, Nokia Shanghai Bell
* R4-2400285 Discussions on NTN UE Tx RF requirements Samsung
* R4-2400286 draftCR to TS 38.101-5 sub-clause 9.2.1 Samsung
* R4-2400461 On UE demod requirements for NR NTN enhancement Apple
* R4-2400484 On NR-NTN RRM requirements in above 10 GHz bands Apple
* R4-2400485 On mobility and service continuity for eNTN Apple
* R4-2400486 Reply LS on RAN2 agreements for satellite switch with resync Apple
* R4-2400509 Regulatory Analysis of the Ku Band Intelsat
* R4-2400510 Ku Band Standardization: Topics on Coexistence Studies Intelsat
* R4-2400511 Motivation to support mobile VSAT in NGSO deployment scenarios Eutelsat Group
* R4-2400516 Regulatory status of NTN in bands above 10 GHz post WRC-23 Eutelsat Group
* R4-2400712 VSAT device type reference architecture and requirements Qualcomm Incorporated
* R4-2400713 (NR\_NTN\_enh-Core) draft CR clarifications for the FCC requirements Qualcomm Incorporated
* R4-2400735 [NR\_NTN\_enh-Perf]Discussion on the performance requirements for NR NTN enhancements Qualcomm India Pvt Ltd
* R4-2400736 [NR\_NTN\_enh-Perf]Simulation results for NR NTN enhancements Qualcomm India Pvt Ltd
* R4-2400760 Topic summary for [110][224] NR\_NTN\_enh Moderator (Qualcomm)
* R4-2400846 (NR\_NTN\_enh-Core) Discussion on the LS from RAN2 and RRM core requirement for NR NTN mobility enhancements CMCC
* R4-2400943 Discussion on RRM requirements for NR NTN UE in above 10GHz bands LG Electronics Inc.
* R4-2400944 Discussion on NTN service continuity enhancement LG Electronics Inc.
* R4-2401016 Discussion on RRM requirements for NTN above 10 GHz bands and other enhancement MediaTek inc.
* R4-2401017 Discussion on RRM requirements for NR NTN mobility enhancement MediaTek inc.
* R4-2401089 Topic summary for [110][130] NR\_NTN\_enh\_UERF Moderator(ZTE)
* R4-2401116 Big CR on TS38.101-5 for UE RF Requirements Samsung Electronics France SA
* R4-2401118 CR on TR38.863 Addition of simulation assumptions in above 10GHz Samsung Electronics, Thales
* R4-2401192 Discussion on RRM requirements for NTN bands above 10GHz xiaomi
* R4-2401193 Discussion on Network verified UE location xiaomi
* R4-2401194 Discussion on NTN-TN and NTN-NTN mobility and service continuity enhancements xiaomi
* R4-2401402 Discussion on NR NTN enhancement SAN demodulation requirements Ericsson
* R4-2401403 Simulation results for NR NTN enhancement SAN demodulation requirements Ericsson
* R4-2401497 Discussion on remain issues for NR-NTN RRM requirements in above 10 GHz bands vivo
* R4-2401498 Discussion on remain issues for NTN-NTN mobility enhancements vivo
* R4-2401499 Discussion on RRM impact on Network verified UE location in NTN vivo
* R4-2401500 Draft CR on RRC\_CONNECTED state mobility for NTN vivo
* R4-2401501 Draft CR on cell reselection requirements for NTN-NTN mobility vivo
* R4-2401556 On UE demodulation requirement for NR NTN enhancement Ericsson
* R4-2401557 Simulation results for NR NTN enhancement UE demodulation requirement Ericsson
* R4-2401565 Draft CR on title header for enhanced NR\_ARFCN LG Electronics Finland
* R4-2401579 View on BS demodulation requirements for NTN enhancement Samsung
* R4-2401596 RRM requirements in above 10 GHz bands Ericsson
* R4-2401597 Network verified UE location Ericsson
* R4-2401598 NTN-TN and NTN-NTN mobility and service continuity enhancements Ericsson
* R4-2401599 RRM performance requirements for NTN Ericsson
* R4-2401716 Discussion on general issues for demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2401717 Discussion on SAN demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2401718 Discussion on UE demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2401719 Simulation assumption on demodulation requirements for NR NTN enhancements Huawei,HiSilicon
* R4-2401821 Discussion on NR-NTN deployment in above 10GHz bands ZTE Corporation
* R4-2401822 Discussion on NTN-TN and TN-NTN mobility ZTE Corporation
* R4-2401830 Reply LS to RAN1 on the system parameters for NTN above 10GHz ZTE Corporation
* R4-2401963 (NR\_NTN\_enh–Core) Modify the section number for Tmeasure in handover delay. ZTE
* R4-2401976 Revised NR NTN enhancement workplan NTT DOCOMO, INC.
* R4-2402060 Discussion on simulation conclusion for Ka band NTN UE ACS Huawei, HiSilicon
* R4-2402061 Draft CR for 38.101-5 to introduce clause 10.1~10.3 Huawei, HiSilicon
* R4-2402062 Discussion on Tx requirement for Ka band NTN UE Huawei, HiSilicon
* R4-2402063 Discussion on Rx requirement for Ka band NTN UE Huawei, HiSilicon
* R4-2402064 CR for 38.101-5 to introduce Phase continuity requirements for NTN UE DMRS bundling Huawei, HiSilicon
* R4-2402192 Discussion on RRM requirements for NTN in Ka band Huawei, HiSilicon
* R4-2402193 draftCR on measurement requirements for NTN in Ka band Huawei, HiSilicon
* R4-2402194 draftCR for RRM impacts of DMRS bundling Huawei, HiSilicon
* R4-2402195 Discussion on RRM requirements for NW verified location Huawei, HiSilicon
* R4-2402196 Discussion on mobility enhancements in NTN Huawei, HiSilicon
* R4-2402197 draftCR on requirements for satellite switch with re-sync Huawei, HiSilicon
* R4-2402198 Discussion on performance requirements for Rel-18 NTN Huawei, HiSilicon
* R4-2402314 Response LS on the systems parameters for NTN above 10 GHz Ericsson
* R4-2402327 NTN enhancement - further investigation on coexistence Ericsson
* R4-2402328 NTN enhancement: Running CR to TS 38.108 NTN Ka-band Ericsson
* R4-2402329 NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - clauses 9.2.3 Ericsson
* R4-2402330 NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - clauses 10.7 Ericsson
* R4-2402331 NTN enhancement: VSAT spurious emission Ericsson
* R4-2402332 NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - Tx spurious Ericsson, Thales
* R4-2402382 Timing considerations and LS reply to RAN1 on FR2-NTN. Nokia, Nokia Shanghai Bell
* R4-2402383 Discussion on the required modifications on Rx-Tx time difference for NTN Nokia, Nokia Shanghai Bell
* R4-2402384 Considerations on Satellite Switching with re-sync Nokia, Nokia Shanghai Bell
* R4-2402385 Test cases scope and configuration for NTN enhancements Nokia, Nokia Shanghai Bell
* R4-2402485 Discussion on RRM requirements for NR-NTN UEs in above 10GHz bands Samsung
* R4-2402486 Discussion on RRM requirements for NTN-NTN and NTN-TN mobility Samsung
* R4-2402487 Discussion on RRM performance part for Rel-18 NTN Samsung
* R4-2402488 Draft CR on VSAT UE timing requirements for NTN in above 10GHz Samsung
* R4-2402496 Draft CR to 38.101-5 on DMRS bundling for FR1 Ericsson
* R4-2402497 Draft CR to 38.101-5 on DMRS bundling for FR2 Ericsson
* R4-2402520 Further discussion on SAN RF requirements for NTN in Ka-band ZTE Corporation
* R4-2402521 Further discussion on UE Tx RF requirements for NTN in Ka-band ZTE Corporation
* R4-2402522 Further discussion on UE Rx RF requirements for NTN in Ka-band ZTE Corporation
* R4-2402523 Joint contribution for NTN VSAT RF requirements in Ka-band ZTE Corporation , Thales
* R4-2402524 Draft CR to TS 38.108 Clause 10.6 OTA out-of-band blocking ZTE Corporation
* R4-2402525 Draft CR to TS 38.108 Clause 10.7 OTA in-channel selectivity ZTE Corporation
* R4-2402526 Draft CR to TS 38.101-5 Clause 9.3 Output power dynamics ZTE Corporation
* R4-2402527 Draft CR to TS 38.101-5 Clause 10.4 Maximum input power requirement ZTE Corporation
* R4-2402528 Draft CR to TS 38.101-5 Clause 10.6 Blocking requirement ZTE Corporation
* R4-2402529 Draft CR to TS 38.101-5 Annex: NTN VSAT related FRC ZTE Corporation
* R4-2402645 Topic summary for [110][305] NR\_NTN\_enh\_Part1 Moderator (Thales)
* R4-2402646 Topic summary for [110][306] NR\_NTN\_enh\_Part2 Moderator (Ericsson)
* R4-2402647 Topic summary for [110][307] NR\_NTN\_enh\_Part3 Moderator (Samsung)
* R4-2402660 Topic summary for [110][320] NR\_NTN\_enh\_SAN\_UE\_demod Moderator (Huawei)
* R4-2402708 DraftCR to 38.133 on measurement requirements for UE verified Location in NTN Nokia, Nokia Shanghai Bell
* R4-2402709 DraftCR to 38.133 on performance requirements for UE verified Location in NTN Nokia, Nokia Shanghai Bell
* R4-2402762 NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - Tx spurious Ericsson, Thales
* R4-2402788 (NR\_NTN\_enh-Core) 1 NTN support for frequency band above 10GHz Qualcomm Incorporated
* R4-2402789 (NR\_NTN\_enh-Core) Network verified UE location Qualcomm Incorporated
* R4-2402790 (NR\_NTN\_enh-Core) Mobility requirements for NTN below 10GHz Qualcomm Incorporated
* R4-2402797 NTN Enhancement: Discussion on SAN RF Conformance Testing in FR2-NTN Ericsson
* R4-2402854 Way forward on [110][306] NR\_NTN\_enh\_Part2 Ericsson
* R4-2402855 Way forward on [110][307] NR\_NTN\_enh\_Part3 Samsung
* R4-2402865 Way forward on [110][320] NR\_NTN\_enh\_SAN\_UE\_demod Huawei
* R4-2402924 Draft CR for 38101-5 THALES
* R4-2402927 CR proposal to add Doppler and Delay variation examples as a function of time for NGSO and GSO in a new Annex THALES
* R4-2402928 Reply LS on the system parameters for NTN above 10 GHz THALES
* R4-2402930 Remaining issues on NTN UL Timing Accuracy for above 10 GHz THALES
* R4-2402933 Remaining issues on VSAT UE requirements for above 10 GHz THALES, Magister Solutions Ltd
* R4-2402963 Ad-hoc meeting minutes for [110][307] NR\_NTN\_enh\_Part3 Samsung
* R4-2402964 Draft CR on title header for enhanced NR\_ARFCN LG Electronics Finland
* R4-2402965 NTN enhancement: Running CR to TS 38.108 NTN Ka-band Ericsson
* R4-2402966 Draft CR to TS 38.108 Clause 10.7 OTA in-channel selectivity ZTE Corporation
* R4-2403012 Offline minutes for topic [110][320] NR\_NTN\_enh\_SAN\_UE\_demod Huawei, HiSilicon
* R4-2403091 Collection table of co-existence simulation result for above 10GHz bands Samsung
* R4-2403092 WF on [110][307] NR\_NTN\_enh\_Part3 Samsung
* R4-2403256 Ad-hoc minutes on RRM requirements for NR\_NTN\_enh Samsung
* R4-2403492 WF on RRM requirements for NR\_NTN\_enh Qualcomm
* R4-2403493 Reply LS on RAN2 agreements for satellite switch with resync Apple
* R4-2403494 Further LS reply on the system parameters for NTN above 10 GHz Nokia
* R4-2403495 draftCR on measurement requirements for NTN in Ka band Huawei, HiSilicon
* R4-2403496 Draft CR on VSAT UE timing requirements for NTN in above 10GHz Samsung
* R4-2403497 DraftCR to 38.133 on measurement requirements for UE verified Location in NTN Nokia, Nokia Shanghai Bell
* R4-2403498 DraftCR to 38.133 on performance requirements for UE verified Location in NTN Nokia, Nokia Shanghai Bell
* R4-2403499 Draft CR on RRC\_CONNECTED state mobility for NTN vivo
* R4-2403500 Draft CR on cell reselection requirements for NTN-NTN mobility vivo
* R4-2403572 Big CR to TS 38.133 on RRM requirements for NR NTN enhancement Qualcomm
* R4-2403641 draftCR to TS 38.101-5 sub-clause 9.2.1 Samsung
* R4-2403642 NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - clauses 9.2.3 Ericsson
* R4-2403643 Draft CR to TS 38.101-5 Clause 9.3 Output power dynamics ZTE Corporation
* R4-2403644 Draft CR for 38101-5 THALES
* R4-2403645 Draft CR for 38.101-5 to introduce clause 10.1~10.3 Huawei, HiSilicon
* R4-2403646 Draft CR to TS 38.101-5 Clause 10.4 Maximum input power requirement ZTE Corporation
* R4-2403647 Draft CR to TS 38.101-5 Clause 10.6 Blocking requirement ZTE Corporation
* R4-2403648 Draft CR to TS 38.101-5 Annex: NTN VSAT related FRC ZTE Corporation
* R4-2403649 WF on NR-NTN UE RF Requirements ZTE
* R4-2403866 CR for 38.101-5 to introduce Phase continuity requirements for NTN UE DMRS bundling Huawei, HiSilicon
* R4-2403867 Draft CR to 38.101-5 on DMRS bundling for FR2 Ericsson

16.02.2024 minor adaptations for RAN #103

10.11.2023 minor adaptations for RAN #102

02.08.2023 minor adaptations for RAN #101

26.04.2023 minor adaptations for RAN #100

01.02.2023 minor adaptations for RAN #99

27.10.2022 minor adaptations for RAN #98e

01.08.2022 minor adaptations for RAN #97e

21.05.2022 minor adaptations for RAN #96

10.01.2022 minor adaptations for RAN #95e

04.10.2021 minor adaptations for RAN #94e

08.08.2021 minor adaptations for RAN #93e

17.05.2021 minor adaptations for RAN #92e

28.01.2021 minor adaptations for RAN #91e

09.11.2020 minor adaptations for RAN #90e

31.08.2020 minor adaptations for RAN #89e

20.04.2020 minor adaptations for RAN #88e

18.02.2020 minor adaptations for RAN #87e

14.11.2019 minor adaptations for RAN #86

18.08.2019 minor adaptations for RAN #85

12.05.2019 minor adaptations for RAN #84

27.02.2019 minor adaptations for RAN #83

21.11.2018 completion levels with colours added (for RAN #82)

v04.81 31.07.2018 simplification of template and addition of cross-TSG aspects (for RAN #81)

v04.80 21.05.2018 minor adaptations for RAN #80

v04.79 26.02.2018 minor adaptations for RAN #79

v04.78 18.11.2017 minor adaptations for RAN #78

v04.77 06.08.2017 minor adaptations for RAN #77

v04.76 15.05.2017 minor adaptations for RAN #76

v04.75 31.01.2017 minor adaptations for RAN #75

v04.74 28.10.2016 minor adaptations for RAN #74

v04.73 01.09.2016 adaptations for RAN #73 (time units in extra Excel table, RAN6 reporting included)

v04.72 26.05.2016 adaptations for RAN #72 (introduction of NR & GERAN TUs)

v04.71 10.02.2016 minor adaptations for RAN #71

v04.70 30.10.2015 minor adaptations for RAN #70

v04.69 12.08.2015 minor adaptations for RAN #69

v04.68 21.05.2015 minor adaptations for RAN #68

v04.67 01.02.2015 minor adaptations for RAN #67

v04.66 16.11.2014 minor adaptations for RAN #66

v04.65 16.08.2014 minor adaptations for RAN #65

v04.64 22.05.2014 minor adaptations for RAN #64

v04.63 24.01.2014 restructuring for RAN #63 to cover Core & Perf. in one doc file

v03.62 11.11.2013 section 1.2.3 adapted for RAN #62

v03 11.08.2013 section 1.2.3 added on time budget

v02 07.05.2010 history added, some spelling corrections

v01 13.11.2009 First version of the template