**3GPP TSG RAN meeting #92-e RP-210986**

**Electronic Meeting, June 14 - 18th, 2021** *rev from**RP-210726*

## Status Report to TSG

**Agenda item:** 9.7.2.2 - Solutions for NR to support NTN [RAN2 WI: NR\_NTN\_solutions]

|  |  |
| --- | --- |
| **WI / SI Name** |  |
| included in this status report | Study Item: No | Core part: Yes | Performance part:Yes | Testing part:- |
| **Acronym** |  |
| **Unique ID** |  |
| **TSG Tdoc of latest approved WI/SI description (if any)** |  |
| **Target Completion Date****(indicate if changed)** | Study Item: - | Core part: 03/2022 | Performance part: 09/2022 | Testing part: - |
| **Overall Completion level** | Study Item: - | Core part: Overall: 35% RAN1: 50%%RAN2: 40%RAN3: 50% RAN4: 20% | Performance Part: Overall: 0% RAN1: 0%RAN2: 0%RAN3: 0% RAN4: 0% | Testing part: - |

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

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

**Source:**

|  |  |
| --- | --- |
| **Leading WG** | RAN2 |
| **Rapporteur** | **Name** | Nicolas Chuberre |
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## 1 Work plan related evaluation

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

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

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

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

## 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#104-bis-e, 12th April – 20th April 2021, e-meeting**

[General]

Agreements on “Timing relationship enhancements”:

Agreement:

For updating K\_offset after initial access, at least one of the following options is supported:

* Option 1: RRC reconfiguration
* Option 2: MAC CE

FFS: Other options

Agreement:

* For determination of cell-specific K\_offset in system information, down-select one option from below:
	+ Option 1: Signal one offset value for K\_offset
		- Note: For example, the value is expected to cover the RTT of service link plus the RTT between serving satellite and reference point
	+ Option 2: Signal a first offset value and a second offset value. K\_offset is equal to the sum of the two offset values
		- Note: For example, the first offset value is expected to cover the RTT between serving satellite and reference point or is determined by common TA, and the second offset value is expected to cover RTT of service link

Agreement:

Confirm the following working assumption:

Introduce K\_offset to enhance the adjustment of uplink transmission timing upon the reception of a corresponding timing advance command.

Agreement:

When UE is not provided with K\_offset value other than the one signaled in system information, the K\_offset value signaled in system information is used for all timing relationships that require K\_offset enhancement.

Agreement:

UE can be provided by network with a K\_mac value.

* When UE is not provided by network with a K\_mac value, UE assumes K\_mac = 0.

Agreements on “UL time and frequency synchronization”

Agreement:

The Timing Advance applied by an NR NTN UE in RRC\_IDLE/INACTIVE and RRC\_CONNECTED is given by:

$$T\_{TA}=\left(N\_{TA}+N\_{TA,UE-specific}+N\_{TA,common}+N\_{TA,offset}\right)×T\_{c}$$

Where:

* $N\_{TA}$ is defined as 0 for PRACH and updated based on TA Command field in msg2/msgB and MAC CE TA command.
	+ FFS: details of NTA update/accumulation.
* $N\_{TA,UE-specific}$  is UE self-estimated TA to pre-compensate for the service link delay.
* $N\_{TA,common}$ is network-controlled common TA, and may include any timing offset considered necessary by the network.
* $N\_{TA,common}$ with value of 0 is supported.
	+ FFS:  details of signaling including granularity.
* $N\_{TA,offset}$ is a fixed offset used to calculate the timing advance.

Note-1: Definition of $N\_{TA}$ is different from that in RAN1#103-e agreement.

Note-2: UE might not assume that the RTT between UE and gNB is equal to the calculated TA for Msg1/Msg A.

Note-3: $N\_{TA,common}$ is the common timing offset X as agreed in RAN1 #103-e.

Agreement:

Support serving-satellite ephemeris broadcast based on one or more of the following:

* Set 1: Satellite position and velocity state vectors:
	+ position X,Y,Z in ECEF (m)
	+ velocity VX,VY,VZ in ECEF (m/s)
* Set 2: At least the following parameters in orbital parameter ephemeris format:
	+ Semi-major axis α [m]
	+ Eccentricity e
	+ Argument of periapsis ω [rad]
	+ Longitude of ascending node Ω [rad]
	+ Inclination i [rad]
	+ Mean anomaly M [rad] at epoch time to
		- FFS: Whether pre-provisioned ephemeris based on orbital elements can be used as reference. Thereby, only delta corrections can be broadcast in order to reduce the overhead
* FFS: The field size for each parameter
* FFS: The impact on signaling due to the required accuracy of serving-satellite ephemeris
* FFS: Whether down-selection is needed or both sets are supported

Conclusion:

The orbital propagator model to be used at UE side can be left to implementation.

Agreements on “Enhancements on HARQ”

not handled during this e-meeting

Agreements on “Others”

not handled during this e-meeting

[Essential corrections]

None

* **RAN1#105-e, 10th May – 27th May 2021, e-meeting**

[General]

Final LS endorsed in R1-2106331 Reply LS on PDB for new 5QI

Final LS endorsed in R1-2106341 Reply LS on TA pre-compensation

Agreements on “Timing relationship enhancements”:

Agreement:

If a UE is provided with a K\_mac value, when the UE would transmit a PUCCH with HARQ-ACK information in uplink slot *n* corresponding to a PDSCH carrying a MAC CE command on a downlink configuration, the UE action and assumption on the downlink configuration shall be applied starting from the first slot that is after slot $n+3N\_{slot}^{subframe,µ}+K\_{mac}$, where µ is the SCS configuration for the PUCCH.

Note: Here K\_mac is assumed to have the unit of the PUCCH slot. This can be revisited after the K\_mac signaling design is finalized.

Agreement:

The starts of ra-ResponseWindow and msgB-ResponseWindow are delayed by an estimate of UE-gNB RTT.

* The estimate of UE-gNB RTT is equal to the sum of UE’s TA and K\_mac.

Note 1: The UE’s TA is based on the RAN1#104bis-e agreement on Timing Advance applied by an NR NTN UE given by  $N\_{TA}=\left(N\_{TA}+N\_{TA, UE-specific}+N\_{TA,common}+N\_{TA,offset}\right)×T\_{c}$$T\_{TA}=\left(N\_{TA}+N\_{TA, UE-specific}+N\_{TA,common}+N\_{TA,offset}\right)×T\_{c}$. The estimate of gNB-satellite RTT is equal to the sum of $N\_{TA,common}×T\_{c}$ and K\_mac.  How to treat $N\_{TA}$ and $N\_{TA,offset}$ can be further discussed.

Note 2: According to the RAN1#104bis-e agreement: When UE is not provided by network with a K\_mac value, UE assumes K\_mac = 0.

Note 3: The accuracy of the estimated UE-gNB RTT with respect to the true UE-gNB RTT can be further discussed.

Note 4: Other options of determining the estimate of UE-gNB RTT can be further discussed.

Agreement:

The K\_offset value signaled in system information is always used for

* The transmission timing of RAR / fallbackRAR grant scheduled PUSCH
* The transmission timing of Msg3 retransmission scheduled by DCI format 0\_0 with CRC scrambled by TC-RNTI
* The transmission timing of HARQ-ACK on PUCCH to contention resolution PDSCH scheduled by DCI format 1\_0 with CRC scrambled by TC-RNTI
	+ FFS: The transmission timing of HARQ-ACK on PUCCH to contention resolution PDSCH scheduled by DCI format 1\_0 with CRC scrambled by C-RNTI
* The transmission timing of HARQ-ACK on PUCCH to MsgB scheduled by DCI format 1\_0 with CRC scrambled by MsgB-RNTI
	+ FFS: The transmission timing of HARQ-ACK on PUCCH to MsgB scheduled by DCI format 1\_0 with CRC scrambled by C-RNTI

FFS: how to treat additional transmission timings related to fallback DCI formats

FFS: how to update this formulation with beam-specific K\_offset if beam-specific K\_offset is agreed to be supported

Agreements on “UL time and frequency synchronization”

Final LS endorsed in [R1-2106332](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_105-e/Inbox/R1-2106332.zip) LS on broadcast of NTN GW or gNB position

Agreement:

Specifications should support delivery of ephemeris information using both ephemeris formats, i.e., state vectors and orbital elements.

Agreement:

RAN1 should send an LS to SA3, SA1 and possibly SA3-LI to get more inputs regarding the security/regulatory aspects if the NTN GW/gNB position is broadcast or possible to be derived by the UE with assistance information from the network, and on any aspects related to accuracy of the position.

Conclusion:

The Doppler shift over the feeder link and any transponder frequency error for both Downlink and Uplink is compensated by the GW and satellite-payload without any specification impacts in Release 17.

Agreements on “Enhancements on HARQ”

Agreement:

For enhancement on the HARQ process indication, extend the HARQ process ID field up to 5 bits for DCI 0-2/1-2

Agreement:

For Type-2 HARQ codebook in NTN,

* For the DCI of PDSCH with feedback-enabled HARQ processes, the C-DAI and T-DAI are the count of only feedback-enabled processes
* FFS: Whether DCI for SPS release and any other DCIs are included in counting of C-DAI and T-DAI

Agreement:

Confirm the previous working assumption for X = T\_proc,1 where X is defined from the end of the reception of the last PDSCH or slot-aggregated PDSCH for a given HARQ process with disabled feedback to the start of the PDCCH carrying the DCI scheduling another PDSCH or set of slot-aggregated PDSCH for the given HARQ process.

Agreement:

For enhancement on the HARQ process indication at least for DCI 0-1/1-1, the Option-1 and Option-1a are lower priority for further discussion.

Agreement:

Discussion of enhancement(s) on the aggregated transmission (including repetition) is prioritized to improve the performance in NTN.

Agreements on “Others”

Agreement:

Same beam layout in BWP#0 and BWP#x (Option 1) and hierarchical beam for BWP#0 (Option 2) should be supported by the specifications for NR-NTN.

* FFS: Whether any specification changes are needed specifically to support this functionality

Agreement:

For explicit indication of polarization information for DL by the network, support indication in SIB

* FFS: Signaling details for indication in SIB

Agreement:

* Polarization information for UL may be indicated in SIB by the network
* UE assumes a same polarization for UL and DL, when the UL polarization information is absent.
* FFS: Signaling details for indication in SIB

[Essential corrections]

None

#### 2.1.2 Remaining Open issues

Down selection of Feeder link timing drift handling option among:

* Option 1: Feeder link timing drift is compensated by UE using Common TA parameters
* Option 2: Feeder link timing drift is compensated by the Network in a way transparent to UE

How to perform TA update/maintenance in RRC-Connected state

Determine NTN UL time synchronization requirements

What is the exact content of UE reporting/ how frequent is the UE reporting of information about the UE specific TA pre-compensation

Whether/ How to Support of DL frequency compensation for the service link Doppler.

How to update K\_offset after initial access

How to determine the K\_offset value

K\_mac signaling design

## 2.2 RAN2

#### 2.2.1 Agreements

[General]

The RAN2 work plan described in R2-2104963 should be considered as a basis for work.

* **RAN2#113-bis-e, 12th April – 20th April 2021, e-meeting**

Agreements on ”User plane”

* Legacy mechanism for RA type selection based on RSRP threshold is the baseline for NTN. Optimizations can still be suggested, showing the gain (in any case, any method needs to be combined with RSRP based approach)
* Reuse legacy RA type switching mechanism
* Extend the timer length of sr-ProhibitTimer (FFS on the details).
* RAN2 wait for RAN1’s feedback on UE obtaining UE-gNB RTT
* RAN2 wait for RAN1’s progress and postpone the discussion on how to broadcast parameters, if any, for TA pre-compensation.
* RAN2 send an LS to RAN1, focusing on below aspects:
* - Ask RAN1 to prioritize the TA pre-compensation work on whether and/or what parameters to broadcast for TA pre-compensation, and when broadcasted, how often the broadcasted parameters are expected to change over time;
* - RAN2 has agreed to use UE-gNB RTT as the offset to start some UP timers (e.g. drx-HARQ-RTT-TimerDL). Ask RAN1 to provide inputs on (i) how UE acquires UE-gNB RTT and (ii) what additional information needs to be broadcasted other than that for TA pre-compensation, if any.
* At least for uplink scheduling adaptations, the UE may report information about the UE specific TA pre-compensation. The exact information and frequency of reports depend on RAN1 outcome. FFS on when/how to report.
* The UE reports the UE specific TA pre-compensation during RACH procedure using MAC CE (FFS if this needs to be configured). Actual content is FFS and also depends on further RAN1 input.
* It is NW scheduling strategy to avoid NTN UE in HARQ stalling state. From RAN2 perspective, the NW can continuously schedule the UE using one or a combination of scheduling strategies, such as without HARQ retransmissions, or with blind retransmissions, or with HARQ retransmissions based on DL HARQ feedback (or UL decoding result).
* RAN2 confirms that in NTN if the UE is in DRX Active Time for any reason, the UE should monitor the PDCCH regardless of whether drx-HARQ-RTT-TimerUL or drx-HARQ-RTT-TimerDL is running or not. No specification change is needed.
* RAN2 confirms that in NTN using the value= “zero” for drx-HARQ-RTT-TimerUL and drx-RetransmissionTimerUL is possible. No specification change is needed.
* In NTN, The drx-HARQ-RTT-TimerUL is configured per UE DRX group and the behaviour can be configured per HARQ process. FFS the different behaviours and how to indicate the behaviour to the UE and the number of behaviours (e.g., two or more behaviours).
* LCP restrictions should be further considered for an UL HARQ process in NTN. FFS if no further LCP restrictions are needed, or if (R16) existing LCP restrictions can be re-used or if new LCP restriction shall be defined for this purpose.
* The UE utilizes the t-Reassembly timer value that does not depend on the time-varying UE-gNB delay.
* The value range of t-Reassembly shall be extended. The following set of values are possibly added for t-Reassembly timer: {ms210, ms220, ms340, ms350, ms550, ms1100, ms1650, ms2200}. Any other values are FFS.
* The network can configure the values of PDCP discardTimer and PDCP t-Reordering timer greater than the RLC t-Reassembly timer.
* Extend the range of the PDCP discardTimer and the PDCP t-reordering timer. One option is to enlarge the set of allowed values for the PDCP discardTimer and the PDCP t-reordering timer. The exact values FFS

Agreements on “Control plane”

* When the network stops broadcasting a TAC, the UE needs to know it (FFS on further details)
* RAN2 assume UE does not do TAU if one of the currently broadcasted TAC belongs to UE’s registration area.
* RAN2 confirm that in NTN when TAC change in SI happens is up to network implementation, i.e. it may not exactly sync up with real-time illumination on ground.
* Send a LS to CT1 and SA2, with Cc RAN3. The content is: currently RAN2 has two options on table, and the preference is “AS indicates all received TACs to NAS layer when more than one TAC per PLMN is broadcasted in NTN cell”, compared to “AS still reports only one TAC to NAS layer”, and ask for CT1’s feedback. Also include justification for RAN2 preference
* For Rel-17 NTN, Rel-17 NR operation is enhanced (e.g. the SMTC configuration and UE measurement gap configuration) aiming to address the issues associated with the different/larger propagation delays, and the satellites (considering e.g. their deployment, mobility, height, minimum elevation and prioritizing typical NTN scenarios).
* Rel-17 NTN will not rely only on network implementation to address the issue explained in agreement 1.
* Enhancements of the SMTC configuration is supported for Rel-17 NTN.
* Optional new UE assistance is defined in Rel-17 NTN for network to properly (re)configure the SMTC and/or measurement gap
* For Rel-17 NTN, one or more SMTC configuration(s) associated to one frequency can be configured. FFS solution details.
* - The SMTC configuration can be associated with a set of cells (e.g., per satellite or any other suitable set per gNB determination).
* - The multiple SMTC configurations are enabled by introducing different new offsets in addition to the legacy SMTC configuration. FFS how the offsets will be managed/signalled.
* FFS the following open questions:
* (a) can the UE be configured with multiple SMTCs per carrier and use them all in parallel?
* (b) How the NW knows which SMTC (incl. offsets/periodicity, etc.) is relevant for a particular UE?
* (c) Is there any validity: in time or for certain location only, foreseen in such multiple SMTC configuration?
* (d) What is the potential impact on the signalling, assuming this delay is a dynamic value?
* (e) What about the feeder link delay? Is it considered anywhere?
* The configuration of one or multiple offsets is left up to the network implementation.
* It is up to network to update the SMTC configuration of the UE to accommodate the different propagation delays.
* Measurement gaps enhancements should be supported. FFS on the details
* Timing information in CHO execution triggering for NTN describes the time after which the UE is allowed to execute CHO to the candidate target cell.
* Working assumption: the timing information for CHO execution triggering in NTN is defined in the form of a timer/timers. This can be revised and a solution based on UTC/system frame number can be considered if problems are found (e.g. if the timer lacks accuracy due to RTT in NTN).
* The location in location-based CHO execution triggering for NTN describes the distance between the UE and the reference location of the cell (serving cell or the target cell). FFS what the reference location of the cell is (e.g. cell center or other) and how this is provided to the UE.

[Essential corrections]

None

* **RAN2#114-e, 19th May – 27th May 2021, e-meeting**

Agreements on ”User plane”

* If enabled by the network, the UE reports information about UE specific TA pre-compensation at the random access procedure (MSGA/MSG3 or MSG5) using a MAC CE. Actual content is FFS and also depends on further RAN1 input (we can revise this whole agreement if RAN1 come to a different conclusion in terms of what needs to be conveyed to the NW)
* The following options are supported for drx-HARQ-RTT-TimerUL in NTN per HARQ process: 1) Timer length is extended by offset; 2) Timer set to zero and/or 3) Timer disabled (i.e. not started). FFS if this is based on explicit configuration or not. We can also come back to see whether both 2 and 3 are needed
* RAN2 working assumption: Offset for drx-HARQ-RTT-TimerUL is equal to UE-gNB RTT (if RAN1 decides something that requires to change this we can revisit it).
* drx-RetransmissionTimerDL timer length is not extended in NTN.
* The drx-HARQ-RTT-TimerUL behaviour applied for each HARQ process is up to the network (e.g. to support NW scheduling strategy to avoid HARQ stalling).
* RAN2 Working Assumption: No new CG-specific LCP restriction is introduced for NTN. If a new LCP restriction is agreed for dynamic grant, the proposal does not preclude future discussion on whether it may also apply to configured grant
* Repetition transmission based HARQ retransmission is always allowed and is explicitly indicated per HARQ process via DCI (as in legacy).
* At least the following options for LCP in NTN are further studied: 1) allowedPHY-PriorityIndex is re-used; and 2) A new LCP restriction is introduced to map LCH to one or more HARQ process(es). FFS if HARQ processes can be classified as having retransmission “enabled” or “disabled” in this case.

Agreements on “Control plane”

* Change in TAC in SIB1 triggers SI update notification procedure as legacy behaviour. It is FFS whether broadcasting TAC update time can also be considered
* In rel-17, other enhancements like virtual tracking area concept might be considered with low priority at the end of the WI.
* At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area is needed to assist cell reselection in NTN for earth fixed scenario.
* At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area is used to decide when to perform measurement on neighbor cells.
* At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area for earth fixed scenario is broadcast to UE via system information.
* Support CHO location trigger as the distance between UE and a reference location which may be configured as the serving cell reference location or the candidate target cell reference location. FFS if combination can be allowed.
* The reference location for the event description is defined as cell center.
* For CHO, joint configuration of location and RSRP as well as time and RSRP triggers are supported.
* For idle mode reselection, based on configuration NTN UE can prioritise TN over NTN. Configuration details FFS.
* CHO time trigger event is defined as time duration [t1, t2] associated for each CHO candidate cell. The UE shall execute CHO to that candidate cell during the time duration, if all other configured CHO execution conditions will apply and there is only one triggered candidate cell.
* Same CHO trigger conditions and RRM events can be used within NTN and NTN-TN mobility provided these are supported by the UE. NTN-TN means both “from NTN to TN (hand-in)” and “from NTN to TN (hand-in) and from TN to NTN (hand-out)". FFS for enhancements.
* RAN2 will work on a solution to ensure that the CGI constructed by NG-RAN corresponds to a fixed geographical area with a size comparable with a cell for TN including connected mode and initial access.
* RAN2 Working Assumption: RAN2 doesn’t need to do anything to ensure that final UE location information at the core network is trustable so far (it's other WGs business to define solutions to verify the UE location).
* RAN2 will work on a solution to ensure that the CGI constructed by NG-RAN can correspond to a fixed geographical area comparable with a TN cell with a radius of ~2km or more.
* Send an LS to RAN3, SA2, SA3 and SA3-LI to inform them of RAN2 decision and check whether it's consistent with their requirements.

Agreed LS out:

* R2-2106543 New LS on UE location aspects (CATT)

Draft running CR endorsed

* R2-2106539 [POST114-e][101][NTN] Stage 2 running CR (Thales)
* R2-2106540 [POST114-e][102][NTN] 304 running CR (ZTE)
* R2-2106541 [POST114-e][103][NTN] RRC running CR (Ericsson)
* R2-2106542 [POST114-e][104][NTN] MAC running CR (Interdigital)

[Essential corrections]

None

#### 2.2.2 Remaining Open issues

NOTE: offset based solutions for timer adaptations are assumed.

The following user plane procedures enhancements should be specified (see TR 38.821)

* MAC
	+ Random access:
		- Definition of an offset for the start of the ra-ResponseWindow for NTN.
		- Introduction of an offset for the start of the ra-ContentionResolutionTimer to resolve Random access contention
		- Adaptation for Msg-3 scheduling
			* Only for the case with pre-compensation of timing and frequency offset at UE side)
	+ Enhancement on UL scheduling to reduce scheduling latency.
	+ DRX:
		- If HARQ feedback is enabled, introduction of offset for*drx-HARQ-RTT-TimerUL*.
		- If HARQ is turned off per HARQ process, adaptions in HARQ procedure
	+ Scheduling Request: Extension of the value range of *sr-ProhibitTimer*
* RLC
	+ Status reporting: Extension of the value range of *t-Reassembly*
* PDCP
	+ SDU discard: Extension of the value range of *discardTimer*.

The following control plane procedures enhancements should be specified (see TR 38.821)

* Idle mode:
	+ Definition of additional assistance information for cell selection/reselection (e.g. using UE location information, satellite Ephemeris information)
	+ Definition of NTN (satellite/HAPS) cell specific information in SIB
* Connected mode
	+ Enhancement necessary to take into account location information (UE & Satellite/HAPS) and/or ephemeris in determining when to perform hand-over, in order to have a high degree of hand-over control for hand-over robustness and coverage management.
	+ Enhancement to existing measurement configurations to address absolute propagation delay difference between satellites (e.g. SMTC measurement gap adaptation to the SSB/CSI-RS measurement window) [RAN2/4].
* Service continuity for mobility from TN to NTN and from NTN to TN systems (to be addressed when connected mode mobility has sufficiently progressed)
* Identify potential issues associated to the use of the existing Location Services (LCS) application protocols to locate UE in the context of NTN and specify adaptations if any [RAN2/3]

Furthermore the following can be considered with 2nd priority

* Verify the applicability of existing Rel-16 ANR techniques to solve PCI confusion in order to support co-channel operation between HAPS & terrestrial networks and develop enhancements if needed [RAN2/3]

## 2.3 RAN3

#### 2.3.1 Agreements

* **RAN3#112-e, 17th May – 28th May 2021, e-meeting**

[General]

Agreements

* Mapped CGIs are used in ULI, AoI, Paging Optimization, PWS.
* UE Location at least at TN cell granularity is required for CGI mapping. Details of acquisition of the information by the RAN are treated in RAN2, and RAN3 can continue to provide issues / requirements via LS traffic.
* NTN impacts from CGI mapping to F1 are out of scope in rel-17.
* Mapping details (including mapped cell configuration, and mapping of UE location to mapped cell) are a matter of implementation / configuration.
* Serving/neighbor NTN cell information, if any, may be exchanged between gNBs via Xn.
* The NTN related parameters provided by O&M to the gNB may depend on the type of service links supported (Earth fixed beams, quasi Earth fixed beams, Earth moving beams)
* RAN2 is expected to be responsible for how the NG-RAN acquires location (from the UE or otherwise); RAN3 will keep providing feedback or requirements as needed.
* The gNB is expected to know when the UE moves across the country border, in case the serving NTN cell serves part (or all) of more than 1 country”, liaise RAN2 for feedback.
* WA: introduce RAN UE NGAP ID in the Source NG-RAN Node to Target NG-RAN Node Transparent Container IE, which enables the target gNB to know the handover is related to an existing UE.
* No explicit statement for cell reconfiguration for energy saving is needed
* No explicit statement for resource coordination is needed
* No explicit statement for load management is needed
* SON function specifically for NTN over Xn is not supported in Release 17
* TN-NTN mobility depends on RAN2 progress. The interface management over Xn should not be precluded.
* Xn between a HAPS and local terrestrial neighbors is not precluded.
* Preferred RAN2 approach b) [The cell ID used on Uu SIB content are decoupled from cell ID used on NG(N2)] is endorsed by RAN3

BL CRs endorsed:

* R3-211497 draft BL CR 38.300 (Stage 2 document with only RAN3 text)
* R3-211486 draft BL CR 38.410
* R3-211487 draft BL CR 38.413 (QC,Th,E///,Nok,NokSB,CATT)
* R3-211488 draft BL CR 38.423 (QC,Th,E///,Nok,NokSB,CATT)
* R3-211278 draft BL CR 38.362 (QC,Th,E///,Nok,NokSB,CATT)
* R3-211279 draft BL CR 38.363 (QC,Th,E///,Nok,NokSB,CATT)
* R3-211154 draft BL CR 38.366
* R3-211155 draft BL CR 38.516

TP agreed

* R3-212244, R3-212789, R3-212945, R3-212793 for draft CR 38.300:
* [R3-211890](file:///C%3A%5CUsers%5Cchuberrn%5CAppData%5CLocal%5CTemp%5CTemp1_RAN3_112-e_agenda_with_Tdocs20210527_1018.zip%5CDocs%5CR3-211890.zip) “Correction of round trip delay drift rate for NTN scenarios” (Nokia, Nokia Shanghai Bell, Thales) for CR agreed for TR 38.821

LS out agreed

* R3-212917 Reply LS on UE location aspects in NTN  (Qualcomm)
* [R3-212916](file:///C%3A%5CUsers%5Cchuberrn%5CAppData%5CLocal%5CTemp%5CTemp1_RAN3_112-e_agenda_with_Tdocs20210527_1018.zip%5CInbox%5CR3-212916.zip) Reply LS on SA WG2 assumptions from conclusion of study on architecture aspects for using satellite access in 5G (Ericsson)

[Essential corrections]

None

#### 2.3.2 Remaining Open issues

* For use of cell ID in NGAP procedures outside ULI and for other interfaces (e.g. handover target cell, paging, served cells), analysis is needed on case by case basis.
* For impacts on generating ULI when e.g. location information is not available or rough, RAN3 can wait for the LS reply from RAN2.
* Cell relation handling between gNBs for NTN can be handled by OAM; the Xn/NG signaling based enhancement is FFS.
* Which functions are needed over Xn for NTN (currently discussed in other CB)?
* How to manage neighbor cells which appear and disappear? (check potential impact to CN, if any)
* - The benefit of the Xn signaling based enhancement for cell relations handling needs to be clarified.
* - In the case of NTN-TN mobility, whether the exchange of neighbor information is needed?
* FFS: source and target NCGI mapping at handover.
* FFS: clarify the de-centralized coordination scenario, and whether 3GPP supports NTNs with de-centralized coordination of switch overs. In case of de-centralized coordinated switch over, Source and target gNB aspects have to be further discussed.
* 3GPP supports Xn-connected gNBs providing non-terrestrial NR access.
* FFS: Based on the common understanding, that in non-terrestrial networks, Served Cell Information and Neighbor Cell Information for cells providing non-terrestrial NR access may be provided to the gNBs via OAM or exchanged via XnAP means, it is proposed to continue discussing XnAP protocol impacts for both options.
* Acknowledge SA2 requirements on NNSF (S2-2009486)
* Consider inclusion of FFSs for connected / inactive in above
* NTN specific adaptations in Rel-17 for Xn Setup, Load Management and Energy Saving related function are FFS
* To be continued...
* Whether Resource coordination over Xn and SON functions are applicable for NTN in Rel-17, at least for some scenarios only (like HAPS) is FFS, as well as NTN specific adaptations for Rel-17.

## 2.4 RAN4

#### 2.4.1 Agreements

[General]

The RAN4 work plan described in R4-2104879 should be considered as a basis for work.

* **RAN4#98-bis-e, 12th April – 20th April 2021, e-meeting**

[Agreements on BSRF Test Demod aspects (General)]

General agreements:

* Baseline assumption: The linkage between NTN Gateway and non-NTN gNB is up to implementation and without 3GPP standardized solution
	+ Pending on further check on the test feasibility of Rx requirements on gNB side of service link (refer to the figure in the next slide)
* RAN4 to decide if there are any testing concerns for Satellite + feeder link + NTN-Gateway + gNB as a single entity, and why.
* RAN4 shall take into account the inputs from companies to decide if the typical satellite implementation considers wired or non-wired connection with the GW.
* RAN4 shall consider the architecture defined by RAN3 as baseline and shall allow further potential modifications if required pending further check on test feasibility.
* RAN4 shall consider the architecture defined by RAN3 as baseline for test setup pending on further check on test feasibility.
* For NTN S-band, RAN4 shall consider 5, 10, 15, 20, 25, 30 MHz channel BW configurations.
	+ Note1: This current agreement may evolve depending on operator requests.
	+ Note2: This current agreement considers the possible band configuration for S-band (and can be different from the one used for the coexistence, which might be a subset).
* For NTN S-band, RAN4 shall at least consider 1 DL spectrum + 1 UL spectrum in the range (1980 - 2010 MHz) and (2170 - 2200 MHz).
* RAN4 shall continue discussion on NTN channel raster for S-Band, and L-band.
	+ Option 1: 15 kHz
	+ Option 2: 100 kHz
	+ Other options not precluded
	+ NTN operators’ input are encouraged for channel arrangements
* RAN4 shall continue discussion to clarify L-band frequency range for NTN operation.
	+ List candidate options if any.
* RAN4 shall consider inputs from NTN operators for the NTN-NTN coexistence scenarios for MSS S-band.
* RAN4 shall further refine FR1 NR band description for HAPS deployment at @2GHz for use in coexistence studies.
* NR band n1 as example band for HAPS related coexistence studies at 2GHz.
* Separate HAPS coexistence scenarios from Satellite coexistence scenarios.
	+ Note: the two NTN systems may consider different bands, different simulation parameters

Way forward approved:

* R4-2106103 WF on [307] NTN\_Solutions\_Part1 (Thales)

LS out approved

* R4-2106174 draft LS reply on NTN UL time and frequency synchronization requirements

[Agreements on BSRF Test Demod aspects (Coexistence)]

Way forward approved:

* R4-2106105 Simulation assumptions for NTN co-existence (CATT)
* R4-2106106 Simulation assumptions for HAPS co-existence (Nokia)
* R4-2106104 WF on [308] NTN\_Solutions\_Part2 (Samsung)

Additional agreements (GTW session):

Table 1.4-2 Interference Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No. | Combination | **Aggressor** | **Victim** | Notes | Study Phase |
| 1 | TN with NTN | TN DL | NTN DL |  | Phase 1 |
| 2 | TN with NTN | TN UL | NTN UL |  | Phase 1 |
| 3 | TN with NTN | NTN DL | TN DL |  | Phase 1 |
| 4 | TN with NTN | NTN UL | TN UL |  | Phase 1 |
| 5 | TN with NTN | NTN UL | TN DL | Applicable for satellite operating in S band, e.g. coexistence with n34 TDD.  | Phase 1 |
| 6 | TN with NTN | TN DL | NTN UL | Applicable for satellite operating in S band, e.g. coexistence with n34 TDD.  | Phase 1 |
| 7 | TN with NTN | TN UL | NTN DL | Applicable for satellite operating in S band, e.g. coexistence with n41 TDD. | Phase 2 |
| 8 | TN with NTN | NTN DL  | TN UL | Applicable for satellite operating in S band, e.g. coexistence with n41 TDD. | Phase 1 |
| 9 | NTN with NTN | NTN DL | NTN DL | LEO-LEO | Phase 2 |
| GEO-GEO | Phase 2 |
| GEO-LEO@600 or HAPS-HAPS | Phase 2 |
| NTN UL | NTN UL | LEO-LEO | Phase 2 |
| GEO-GEO | Phase 2 |
| GEO-LEO@600 or HAPS-HAPS | Phase 2 |

|  |  |
| --- | --- |
| **Satellite and NR Bandwidth** | TN NR: 20MHzNTN Single carrier BW: [5MHz] (FRF=3), [15MHz/30MHz] (FRF=1) |
| **NTN FRF** | To consider FRF in 2 phases as following: * FRF=1 in phase 1 for simplification.
* FRF=3 in phase 2 or it is found FRF=1 is too stringent.
 |

[Agreements on RRM aspects]

Way forward approved:

* R4-2105795 WF on NR NTN RRM general and measurement requirements (Fraunhofer)
* R4-2105796 WF on timing requirements for NR NTN (Xiaomi)

Additional agreements (GTW session):

The impact of GNSS accuracy should be considered when defining each RRM requirement

* GNSS accuracy (e.g. as a function of UE GNSS capability) and side conditions and exact impact on the RRM requirements are FFS.
* GNSS accuracy enhancements are out of scope

The UE specific TA estimation accuracy is counted into the UE transmit timing error requirement

* UE specific TA estimation accuracy is FFS
* FFS whether the UE specific TA estimation accuracy shall be also defined as a separate accuracy requirement
* Specify UE behavior related to UE specific TA estimation and the detailed behavior is FFS

[Other documents]:

* R4-2106147 Email discussion summary for [98-bis-e][307] NTN\_Solutions\_Part1 (Thales)
* R4-2106148 Email discussion summary for [98-bis-e][308] NTN\_Solutions\_Part2 (Samsung)
* R4-2106149 Email discussion summary for [98-bis-e][309] NTN\_Solutions\_Part3 (CATT)
* R4-2105822 Email discussion summary: [98-bis-e][222] NR\_NTN\_solutions\_RRM\_1 (Fraunhofer)
* R4-2105823 Email discussion summary: [98-bis-e][223] NR\_NTN\_solutions\_RRM\_2 (Xiaomi)
* **RAN4#99-e, 19th May – 27th May 2021, e-meeting**

[Agreements on BSRF Test Demod aspects (General)]

General agreements:

* RAN4 shall consider for NTN framework similar testing procedures as in TS 38.141-like. Based on different combinations and following similar testing procedures as in e.g. TS 38.141-like, the throughput measurement point at the Non-NTN infrastructure gNB can be used to determine the 5% throughput loss.
* Satellite companies and some other companies expressed strong concerns if (Satellite+Feederlink+GW) is considered as a Repeater, because it would reduce NTN capacity and in general would not align with real satellite payload design.
* RAN4 confirms the baseline assumption that from RF Tx, Rx requirements (for conductive RF requirements) perspective, NTN-Payload RF, Feederlink, GW, Non-NTN infrastructure gNB shall be considered as single entity.
	+ Note: The detailed test set-up can be further discussed. Further confirmation still required for OTA based RF requirements if introduced.
* RAN4 should first consider conducted mode testing (e.g. 1-H) for NTN gNB. 1-O can be considered in a later stage. FFS for 1-C.
* Additional evidence should be provided before concluding that **OTA based** REFSENS test is feasible for (Satellite + feeder link + NTN-Gateway + Non-NTN infrastructure gNB) as a single entity.
	+ Note1: **RAN4 confirms conducted mode REFSENS test** for (Satellite + feeder link + NTN-Gateway + Non-NTN infrastructure gNB) as a single entity.
	+ Note2: For the Non-NTN infrastructure gNB, please refer to RAN3 NTN architecture.
	+ Note3: RAN4 to identify any additional evidence to be provided.
* Additional evidence should be provided before concluding that **OTA based** Blocking test is feasible for (Satellite + feeder link + NTN-Gateway + Non-NTN infrastructure gNB) as a single entity.
	+ Note1: **RAN4 confirms conducted mode Blocking test** for (Satellite + feeder link + NTN-Gateway + Non-NTN infrastructure gNB) as a single entity.
	+ Note2: For the Non-NTN infrastructure gNB, please refer to RAN3 NTN architecture.
	+ Note3: RAN4 to identify any additional evidence to be provided.
* Additional evidence should be provided before concluding that **OTA based** Intermodulation test is feasible for (Satellite + feeder link + NTN-Gateway + Non-NTN infrastructure gNB) as a single entity.
	+ Note1: **RAN4 confirms conducted mode Intermodulation test** for (Satellite + feeder link + NTN-Gateway + Non-NTN infrastructure gNB) as a single entity.
	+ Note2: For the Non-NTN infrastructure gNB, please refer to RAN3 NTN architecture.
	+ Note3: RAN4 to identify any additional evidence to be provided.
* RAN4 should reconsider/adapt the reference measurement channels for NTN use case.
	+ Note:Details are FFS.
* **It can be assumed** that the linkage between NTN-Gateway and Non-NTN Infrastructure gNB functions is expected to be typically implemented with a **non-RF connection.**
* The common definition for channel bandwidth, transmission bandwidth configuration, minimum guard band, and RB alignment in 38.104 and 38.101-1 can be reused for NTN system.
* The supported channel bandwidth per operating band should be defined based on NTN operator input.
* The channel spacing in 38.104 can be reused for NTN. Exact definition pending channel raster decision.
* UE NTN FR1 may use similar specification as TS 38.101-1 (with different clauses for NTN).
* The first NTN band will have the following frequency range definition: 1980-2010 MHz in UL and 2170-2200 MHz in DL. Its band number is FFS.
	+ Note: Companies are encouraged to provide a NTN band numbering scheme for next RAN4 meeting.
* RAN4 to study and agree on the reference assumption to be used for the on-board satellite amplification process.
	+ Note:Clarifications required on what “reference assumption” means, and typical implementations for on-board satellite amplification processes.
* RAN4 to consider **Constant Equivalent Isotropic Radiated Power (EIRP)** and/or **Constant Power at Receiver** options for on-board satellite amplification process.
* RAN4 shall consider the following bandwidth size configuration for MSS S-Band with SCS 15 kHz: 5, 10, 15, 20 MHz.
* RAN4 shall consider the following bandwidth size configuration for MSS S-Band with SCS 30 kHz and SCS 60 kHz: 10, 15, 20 MHz.
* The supported channel bandwidth per operating band should be defined based on NTN operator input.
* RAN4 shall consider a 100 kHz MSS S-Band Channel Raster.
* With respect to MSS S-Band Synchronization Raster, one solution is to reuse current NR work frame for NTN system, but for applicable SS raster entries per operating band RAN4 may need to further study it.
* RAN4 shall consider a 100 kHz MSS L-Band Channel Raster.
* 3GPP should take the relevant FCC and ETSI regulation into account when defining Tx and Rx NTN requirements for the pairing of 1610 - 1618.725 MHz UL and 2483.5 – 2500 MHz DL.
* RAN4 shall use S-Band Reference Operational Deployment Scenario using 1980-2010 MHz for UL and 2170-2200 MHz for DL.
* RAN4 may consider S-band extension in a new WI on operator’s request, as it’s common practice for any TN band in RAN4.
* RAN4 may consider mixed pairing of (L-band) and (S-band) in a separate dedicated WI, as it’s common practice for any TN band in RAN4. The core functionality should be forward compatible with mixed pairing.
* RAN4 may consider pairing of 1610 - 1618.725 MHz UL (L-band) and 2483.5 – 2500 MHz DL (S-band) in a separate dedicated WI, as it’s common practice for any TN band in RAN4. The core functionality should be forward compatible with mixed pairing.

Way forward approved:

* R4-2108099 Way Forward on NTN\_solutions\_Part1 (Thales)
* R4-2108100 WF on NTN RF Aspect (CATT)

LS out approved

* R4-2108648 Response LS on NTN UL frequency synchronization requirements (CATT)

[Agreements on BSRF Test Demod aspects (Coexistence)]

Way forward approved:

* R4-2108645 Simulation assumptions for NTN co-existence (CATT)
* R4-2108646 Simulation assumptions for HAPS co-existence (Nokia)
* R4-2108093 WF on [313] NTN\_Solutions\_Part2 (Samsung)

[Agreements on RRM aspects]

Way forward approved:

* R4-2108033 WF on general, GNSS and measurement-related NR NTN RRM requirements (Fraunhofer)
* R4-2108350 WF on timing requirements for NR NTN (Xiaomi)

[Other documents]

* R4-2108699 Email discussion summary for [99-e][312] NTN\_Solutions\_Part1 (Thales)
* R4-2108700 Email discussion summary for [99-e][313] NTN\_Solutions\_Part2 (Samsung)
* R4-2108101 Email discussion summary for [99-e][314] NTN\_Solutions\_Part3 (CATT)
* R4-2108401 Email discussion summary: [99-e][229] NR\_NTN\_solutions\_RRM\_1 (Fraunhofer)
* R4-2108402 Email discussion summary: [99-e][230] NR\_NTN\_solutions\_RRM\_2 (Xiaomi)

[Essential corrections]

None

#### 2.4.2 Remaining Open issues

Decision about NTN FR2 study (coexistence) phase before the introduction to specification/normative phase

## 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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Work Area |  WIDs/SIDs | Rapporteurs | RAN WIDs | Rapporteurs |
| 5G Satellite Aspects | SA2 led WI 5GSAT\_ARCH | jean-yves.fine@thalesgroup.com | RAN2 led WI NR\_NTN\_solutions | nicolas.chuberre@thalesaleniaspace.com |
| 5G Satellite Aspects | CT1 led SI 5GSAT\_ARCH-CT | amerc@qti.qualcomm.com | RAN2 led WI NR\_NTN\_solutions | nicolas.chuberre@thalesaleniaspace.com |

#### 3.1.1 Agreements with cross-TSG impacts

a Cell ID as used in the User Location Information on the NG/N2 interface corresponds to a fixed geographical area, and the Tracking Area is coupled with geographical area.

Note: NTN WID includes “identification of potential issues associated to the use of the existing Location Services (LCS) application protocols to locate UE in the context of NTN and specify adaptations if any [RAN2/3]”. This could be used to determine the UE location with sufficient level of accuracy if needed.

#### 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#104-bis-e, 12th April – 20th April 2021, e-meeting**

Submitted TDOCs:

* R1-2102836 NR\_NTN\_solutions work plan THALES
* R1-2102884 Discussion on timing relationship enhancements for NTN CMCC
* R1-2102873 Timing relationship for NTN Panasonic Corporation
* R1-2102864 Discussion on Timing Relationship Enhancements in NR-NTN China Telecom
* R1-2102914 Discussion on timing relationship for NR-NTN ZTE
* R1-2102732 Timing relationship enhancements in NTN Asia Pacific Telecom, FGI, ITRI, III
* R1-2102751 Timing relationship enhancements for NR-NTN MediaTek Inc.
* R1-2102799 Timing relationship enhancements for NTN Zhejiang Lab
* R1-2102633 Timing relationship enhancement for NTN CATT
* R1-2102572 Timing relationship enhancements to support NTN CAICT
* R1-2102397 Discussion on timing relationship enhancement OPPO
* R1-2102458 Consideration on timing relationship enhancements Spreadtrum Communications
* R1-2102341 Discussion on timing relationship enhancements for NTN Huawei, HiSilicon
* R1-2103578 Discussion on timing relationship enhancements for NTN NTT DOCOMO, INC.
* R1-2103532 Discussion on NTN timing relationship Lenovo, Motorola Mobility
* R1-2103633 Timing relationship enhancements for NTN ITRI
* R1-2103619 Discussions on timing relationship enhancements in NTN LG Electronics
* R1-2103032 On timing relationship enhancements for NTN Intel Corporation
* R1-2102985 Discussion on the timing relationship enhancement for NTN Xiaomi
* R1-2103168 Enhancements on Timing Relationship for NTN Qualcomm Incorporated
* R1-2103107 Discussion on Timing Relationship Enhancements in NTN Apple
* R1-2103241 Timing relationship enhancements for NTN Samsung
* R1-2103276 Timing relationship enhancement for NTN InterDigital, Inc.
* R1-2103058 On timing relationship enhancements for NTN Ericsson
* R1-2103304 Calculation of timing relationship offsets Sony
* R1-2103669 Discussion on time relations for NTN operation Nokia, Nokia Shanghai Bell
* R1-2103656 Discussion on Timing Relationship Enhancements for NTN Fraunhofer IIS, Fraunhofer HHI
* R1-2103671 Discussion on timing relationship enhancement in NTN THALES
* R1-2103655 Discussion on UL Time Synchronization for NTN Fraunhofer IIS, Fraunhofer HHI
* R1-2103670 Discussion on time and frequency synchronization for NTN operation Nokia, Nokia Shanghai Bell
* R1-2103305 Enhancement for UL time synchronization Sony
* R1-2103059 On UL time and frequency synchronization enhancements for NTN Ericsson
* R1-2103277 UL time/frequency synchronization for NTN InterDigital, Inc.
* R1-2103242 Enhancements on UL time and frequency synchronization for NTN Samsung
* R1-2103108 On Uplink Time and Frequency Synchronization for NTN Apple
* R1-2103169 UL time and frequency synchronization for NTN Qualcomm Incorporated
* R1-2102986 Discussion on UL time and frequency synchronization for NTN Xiaomi
* R1-2103011 UL time synchronization acquisition for NTN Mitsubishi Electric RCE
* R1-2103033 On UL synchronization for NTN Intel Corporation
* R1-2103620 Discussions on UL time and frequency synchronization enhancements in NTN LG Electronics
* R1-2103687 On UL time and frequency synchronization enhancements for NR NTN Sequans Communications
* R1-2103731 Further discussion on UL time synchronization methods for NTN systems CEWiT, IITM, IITH
* R1-2103533 Discussion on NTN uplink time synchronization Lenovo, Motorola Mobility
* R1-2103544 Discussions on doppler effect in time synchronization for NTN BUPT
* R1-2103579 Discussion on UL time synchronization enhancements for NTN NTT DOCOMO, INC.
* R1-2102342 Discussion on UL time and frequency synchronization enhancement for NTN Huawei, HiSilicon
* R1-2102360 Considerations on UL timing and frequency synchronization in NTN THALES
* R1-2102459 Consideration on enhancements on UL time and frequency synchronization Spreadtrum Communications
* R1-2102398 Discussion on UL time and frequency synchronization OPPO
* R1-2102573 Considerations on Enhancements on UL Time Synchronization in NTN CAICT
* R1-2102634 UL time and frequency compensation for NTN CATT
* R1-2102752 Enhancements on UL Time and Frequency Synchronisation for NR-NTN MediaTek Inc.
* R1-2102733 UL time and frequency synchronization in NTN Asia Pacific Telecom, FGI, ITRI, III
* R1-2102555 Discussion on UL time and frequency synchronization for NTN PANASONIC R&D Center Germany
* R1-2102915 Discussion on UL synchronization for NR-NTN ZTE
* R1-2102865 Discussion on UL time and frequency synchronization for NR NTN China Telecom
* R1-2102885 Enhancements on UL time and frequency synchronization for NTN CMCC
* **RAN1#105-e, 10th May – 27th May 2021, e-meeting**

Submitted TDOCs:

* R1-2104607 Discussion on timing relationship enhancements for NTN CMCC
* R1-2104708 Timing relationship enhancements for NTN Zhejiang Lab
* R1-2104770 Discusson on timing relationship enhancement OPPO
* R1-2104721 Timing relationship enhancements to support NTN CAICT
* R1-2104827 Further discussion of time relation aspects for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2104727 On timing relationship enhancements for NTN Ericsson
* R1-2104903 On timing relationship enhancements for NTN Intel Corporation
* R1-2104424 Consideration on timing relationship enhancements for NTN Spreadtrum Communications
* R1-2104516 Timing relationship enhancement for NTN CATT
* R1-2104564 Timing relationship enhancements for NR-NTN MediaTek Inc.
* R1-2104667 Enhancements on Timing Relationship for NTN Qualcomm Incorporated
* R1-2105410 Discussion on timing relationship enhancements for NTN NEC
* R1-2104255 Discussion on timing relationship enhancements for NTN Huawei, HiSilicon
* R1-2105477 Discussions on timing relationship enhancements in NTN LG Electronics
* R1-2105101 Timing Relationship Enhancements for NR NTN Apple
* R1-2105164 Calculation and application of timing relationship offsets Sony
* R1-2105306 Timing relationship enhancements for NTN Samsung
* R1-2105207 Discussion on Timing Relationship Enhancements for NTN Fraunhofer IIS, Fraunhofer HHI
* R1-2105208 Timing relationship enhancements for NTN ITL
* R1-2105189 Discussion on timing relationship for NR-NTN ZTE
* R1-2104857 Timing Relationship Enhancements in NR-NTN China Telecom
* R1-2105619 Timing relationship for NTN Panasonic Corporation
* R1-2105623 Discussion on NTN timing relationship Lenovo, Motorola Mobility
* R1-2105667 Timing relationship enhancement for NTN InterDigital, Inc.
* R1-2105559 Discussion on the timing relationship enhancement for NTN Xiaomi
* R1-2105697 Discussion on timing relationship enhancements for NTN NTT DOCOMO, INC.
* R1-2105820 Timing relationship enhancements in NTN Asia Pacific Telecom, FGI, ITRI, III
* R1-2105821 UL time and frequency synchronization in NTN Asia Pacific Telecom, FGI, ITRI, III
* R1-2105952 Enhancements on UL Time and Frequency Synchronisation for NR-NTN MediaTek Inc.
* R1-2105812 On satellite pass predictions under NTN discontinuous coverage Sateliot, Gatehouse, ESA, Kepler
* R1-2105947 UL time synchronization acquisition for NTN Mitsubishi Electric RCE
* R1-2105698 Discussion on UL time and frequency synchronization enhancements for NTN NTT DOCOMO, INC.
* R1-2105560 Discussion on UL time and frequency synchronization for NTN Xiaomi
* R1-2105668 UL time/frequency synchronization for NTN InterDigital, Inc.
* R1-2105634 Enhancements on frequency synchronization for NTN Sharp
* R1-2105190 Discussion on UL synchronization for NR-NTN ZTE
* R1-2105307 Enhancements on UL time and frequency synchronization for NTN Samsung
* R1-2105272 Discussion on UL Time Synchronization for NTN Fraunhofer IIS, Fraunhofer HHI
* R1-2105214 Discussion on NTN uplink time synchronization Lenovo, Motorola Mobility
* R1-2105165 Considerations on UL time synchronisation Sony
* R1-2105102 Uplink Time and Frequency Synchronization for NR NT Apple
* R1-2105478 Discussions on UL time and frequency synchronization enhancements in NTN LG Electronics
* R1-2104256 Discussion on UL time and frequency synchronization enhancement for NTN Huawei, HiSilicon
* R1-2104668 UL time and frequency synchronization for NTN Qualcomm Incorporated
* R1-2104565 Enhancements on UL Time and Frequency Synchronisation for NR-NTN MediaTek Inc.
* R1-2104517 UL time and frequency synchronization for NTN CATT
* R1-2104425 Consideration on enhancements on UL time and frequency synchronization for NTN Spreadtrum Communications
* R1-2104301 Considerations on UL timing and frequency synchronization in NTN THALES
* R1-2104315 Enhancements on UL time and frequency synchronization PANASONIC R&D Center Germany
* R1-2104904 On UL synchronization for NTN Intel Corporation
* R1-2104828 Discussion on time and frequency synchronization for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2104811 On UL time and frequency synchronization enhancements for NTN Ericsson
* R1-2104722 Considerations on Enhancements on UL Time Synchronization in NTN CAICT
* R1-2104771 Discussion on UL time and frequency synchronization OPPO
* R1-2104608 Enhancements on UL time and frequency synchronization for NTN CMCC
* R1-2104609 Enhancements on HARQ for NTN CMCC
* R1-2104772 Discussion on HARQ enhancements OPPO
* R1-2104723 Enhancements on HARQ to support NTN CAICT
* R1-2104812 On HARQ enhancements for NTN Ericsson
* R1-2104829 Further discussion related to HARQ operation for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2104402 Discussion on HARQ for NTN Magister Solutions Ltd
* R1-2104357 Discussion on HARQ enhancements for NR-NTN vivo
* R1-2104426 Consideration on enhancements on HARQ for NTN Spreadtrum Communications
* R1-2104518 HARQ operation enhancement for NTN CATT
* R1-2104566 Enhancements on HARQ for NR NTN MediaTek Inc.
* R1-2104669 Enhancements on HARQ for NTN Qualcomm Incorporated
* R1-2104257 Discussion on HARQ enhancement for NTN Huawei, HiSilicon
* R1-2105479 Discussions on HARQ enhancements in NTN LG Electronics
* R1-2105411 Discussion on HARQ enhancements for NR NTN NEC
* R1-2105103 On HARQ Enhancements for NR NTN Apple
* R1-2105166 Enhancement on HARQ for NTN Sony
* R1-2105215 Enhancements on HARQ for NTN Lenovo, Motorola Mobility
* R1-2105308 Enhancements on HARQ for NTN Samsung
* R1-2105191 Discussion on HARQ for NR-NTN ZTE
* R1-2105054 HARQ enhancements for NTN networks CEWiT
* R1-2105222 Discussion on HARQ Enhancements for NTN ETRI
* R1-2105669 HARQ enhancement for NTN InterDigital, Inc.
* R1-2105620 HARQ enhancement for NTN Panasonic Corporation
* R1-2105561 Discussion on the HARQ enhancement for NTN Xiaomi
* R1-2105757 Enhancements on HARQ for NTN ITRI
* R1-2105822 Enhancements on HARQ in NTN Asia Pacific Telecom, FGI, ITRI, III
* R1-2105671 On beam management for NTN InterDigital, Inc.
* R1-2105562 Discussion on other design aspects for NTN Xiaomi
* R1-2105529 Discussion on other design aspects for NTN Huawei, HiSilicon
* R1-2105223 Discussion on beam management for NTN ETRI
* R1-2105209 Discussion on Beam Management for NTN Fraunhofer IIS, Fraunhofer HHI
* R1-2105148 Beam management and polarization signaling for NTN Panasonic
* R1-2105192 Discussion on additional enhancement for NR-NTN ZTE
* R1-2105309 Remaining issues for NTN Samsung Samsung
* R1-2105216 Discussion on other aspects for NTN Lenovo, Motorola Mobility
* R1-2105167 Discussion on beam management and polarization for NTN Sony
* R1-2105104 Discussions on Other Aspects of NR NTN Apple
* R1-2105480 Discussions on other aspects of NTN LG Electronics
* R1-2104670 BWP operation and other issues for NTN Qualcomm Incorporated
* R1-2104519 Beam management and other aspects for NTN CATT
* R1-2104427 Consideration on beam management and other aspects for NTN Spreadtrum Communications
* R1-2104358 Discussion on other aspects for NR-NTN vivo
* R1-2104307 Beam management and BWP operation in NTN THALES
* R1-2104830 Discussion of other aspects for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2104813 On other enhancements for NTN Ericsson
* R1-2104773 Discusson on beam management OPPO
* R1-2104610 Other Aspects for NTN CMCC

## 4.2 RAN2

* **RAN2#113-bis-e, 12th April – 20th April 2021, e-meeting**

Submitted TDOCs:

* R2-2102617 Reply LS on AN-PDB and PER targets for satellite access (R1-2102074; contact: Qualcomm) RAN1
* R2-2103469 NR\_NTN\_solutions work plan THALES
* R2-2103829 Stage-3 running RRC CR for NTN Rel-17 Ericsson
* R2-2103698 DRAFT LS to RAN1 about PCI issue in NTN CMCC
* R2-2103627 Discussion on decoupled cell ID Huawei, HiSilicon
* R2-2103969 Stage 3 running CR 38.321 - RAN2#113bis-e InterDigital
* R2-2103968 MAC open issues - RAN2#113bis-e InterDigital
* R2-2103951 On Random Access in NTNs Ericsson
* R2-2104141 Discussion on RA type selection and TA report LG Electronics Inc.
* R2-2104146 NTN 2-step RACH selection enhancements Convida Wireless
* R2-2104190 Consideration on Random Access and TA ZTE Corporation, Sanechips
* R2-2103630 Report of [POST113-e][106][NTN] MAC aspects (Huawei) Huawei, HiSilicon
* R2-2103460 BSR over 2-step RA ASUSTeK
* R2-2103406 Considerations on TA pre-compensation capability for RACH in NTN Lenovo, Motorola Mobility
* R2-2103407 Further clarification and consideration for RA type selection Lenovo, Motorola Mobility
* R2-2103263 BSR over 2-step RACH Asia Pacific Telecom co. Ltd, FGI
* R2-2103261 Triggering of UE-specific TA report Asia Pacific Telecom co. Ltd, FGI
* R2-2102738 Discussion on the left RACH issues in NTN OPPO
* R2-2103074 Timing Compensation, 4-Step RA Enhancements, and RA Resource Selection for an NTN Samsung Research America
* R2-2102932 Considerations on RACH procedure enhancements in NTN CAICT
* R2-2103053 Start offset for RAR window and contention resolution timer Qualcomm Incorporated
* R2-2103054 Support of dynamic disabling of UL HARQ retransmission Qualcomm Incorporated
* R2-2102951 Discussion on UL Scheduling Enhancements in NR NTN CATT
* R2-2102952 Discussion on HARQ Aspects in NTN CATT
* R2-2103075 HARQ Stalling, RNTI Enhancements, Enhanced UL Scheduling, and Logical Channel Prioritization for an NTN Samsung Research America
* R2-2103175 HARQ related issues Beijing Xiaomi Mobile Software
* R2-2102739 Discussion on HARQ impact in NTN OPPO
* R2-2102823 Round trip delay offset for configured grant timers MediaTek Inc.
* R2-2102824 On disabling uplink HARQ retransmission and associated LCP impacts MediaTek Inc.
* R2-2103262 HARQ retransmission schemes in NTN Asia Pacific Telecom co. Ltd, FGI
* R2-2103230 On DRX and LCP impact for NTN Nokia, Nokia Shanghai Bell
* R2-2103232 Discussion on UL scheduling enhancements for NTN Nokia, Nokia Shanghai Bell
* R2-2103445 Co-existence issue of BSR over CG and BSR over 2-step RACH PANASONIC R&D Center Germany
* R2-2103446 DRX impact of disabling HARQ feedback and uplink retransmission PANASONIC R&D Center Germany
* R2-2103629 Further consideration on HARQ and LCP in NTN Huawei, HiSilicon
* R2-2103599 Other MAC enhancements in NTN Sony Europe B.V.
* R2-2103725 Left Issues for HARQ operation in NTN CMCC
* R2-2103839 Considerations for RA Type and TA Timer MAC Enhancements in Non Terrestrial Networks Apple
* R2-2103826 TA Adjustment in RRC\_CONNECTED state NEC Telecom MODUS Ltd.
* R2-2104191 Consideration on HARQ aspects ZTE Corporation, Sanechips
* R2-2104144 Discussion on UL scheulding and UL retranmission LG Electronics Inc.
* R2-2104038 Discussion on MAC timers about UL scheduling in NTN CAICT
* R2-2103950 On scheduling, HARQ, and DRX for NTNs Ericsson
* R2-2103967 UL HARQ RTT timer in NTN InterDigital
* R2-2103964 On RLC t-Reassembly for NTN Sequans Communications
* R2-2103827 RLC t-Reassembly timer configuration NEC Telecom MODUS Ltd.
* R2-2103836 Analysis of Mobility Management with Earth Fixed and Earth Moving Beams/Cells in NTN Networks Apple
* R2-2103699 Discussion on SI modification for TAC Update CMCC
* R2-2103749 Aspects concerning soft TAC switch Ericsson
* R2-2103747 Aspects for Earth fixed and Earth moving beams for NTN Ericsson
* R2-2103628 Discussion on remaining issues on soft TAU Huawei, HiSilicon
* R2-2103244 Discussion on TAC updating in NTN Spreadtrum Communications
* R2-2103334 On Feeder Link Mobility in Transparent Satellite Payload Scenarios Nokia, Nokia Shanghai Bell
* R2-2103307 Contents of ephemeris including beam type information LG Electronics Inc.
* R2-2102740 Discussion on TAC update OPPO
* R2-2103134 Discussion on TAC aspects for NTN Xiaomi
* R2-2103076 TAC Management and Neighbor Search in an NTN Samsung Research America
* R2-2103055 TAC update procedure Qualcomm Incorporated
* R2-2102990 Issues on the TAC update due to satellite movement PANASONIC R&D Center Germany
* R2-2103008 Signalling Solution for Feeder Link Switching of NTN VODAFONE Group Plc
* R2-2103912 NR-NTN: Multi-TAI Broadcast Fraunhofer IIS, Fraunhofer HHI
* R2-2103965 Cell reselection in NTN InterDigital
* R2-2103966 Ephemeris in NTN InterDigital
* R2-2104066 Further consideration on cell selection and reselection in NTN ZTE corporation, Sanechips
* R2-2104147 NTN indication and idle mode enhancements Convida Wireless
* R2-2104148 NTN Cell Selection and Idle Mode Enhancements Convida Wireless
* R2-2104149 NTN Cell (re)selection and idle mode enhancements Convida Wireless
* R2-2104210 Understanding on the newly introduced Access Technology identifier for NTN ZTE corporation, Sanechips
* R2-2102953 Leftover issues on IDLE and inactive mode CATT
* R2-2103077 Cell Reselection, System Information, and Paging Enhancements for an NTN Samsung Research America
* R2-2103135 Cell selection and reselection enhancements for NTN Xiaomi
* R2-2102741 Discussion on idle/inactive mode procedures in NTN OPPO
* R2-2102825 On Cell-Reselection in NR-NTN MediaTek Inc.
* R2-2102826 On Soft-switch based Tracking Area Updates in NR-NTN MediaTek Inc.
* R2-2103245 Issues on cell selection and reselection in NTN Spreadtrum Communications
* R2-2103408 Ephemeris provision and network type indication for NTN Lenovo, Motorola Mobility
* R2-2103461 PLMN separation for NTN & TN ASUSTeK
* R2-2103631 WF for cell reselection in NTN Huawei, HiSilicon, BT Plc, CAICT, China Telecom
* R2-2103597 Idle mode enhancement in NTN Sony Europe B.V.
* R2-2103837 Cell Selection And Cell Reselection Solutions for Non Terrestrial Networks Apple, British Telecom
* R2-2103838 Considerations on ephemeris database and parameter distribution to UEs in Non Terrestrial Networks Apple
* R2-2103825 Discussion on CHO for NTN NEC Telecom MODUS Ltd.
* R2-2103751 Connected mode aspects for NTN Ericsson
* R2-2103700 Discussion on SMTC/Gap enhancements for NTN CMCC
* R2-2103701 Consideration on signaling issues for mobility enhancements CMCC
* R2-2103702 Discussion on service continuity between NTN and TN CMCC
* R2-2103632 WF for CHO in NTN Huawei, HiSilicon, BT Plc, CAICT, CMCC
* R2-2103600 Mobility management in NTN Sony Europe B.V.
* R2-2103602 Cell coverage spillage over multiple countries issue in NTN Sony Europe B.V.
* R2-2103409 Enhancement to measurement reporting in NTN Lenovo, Motorola Mobility
* R2-2103410 CHO in NTN system Lenovo, Motorola Mobility
* R2-2103465 Configuration of CHO in NTN China Telecom, Huawei, HiSilicon
* R2-2103308 Connected mode enhancements in NTN LG Electronics Inc.
* R2-2103335 On Connected mode mobility for NTN Nokia, Nokia Shanghai Bell
* R2-2103336 Post-[108][NTN] views on SMTC and measurement gaps Nokia, Nokia Shanghai Bell
* R2-2103362 Measurement window enhancements for NTN cell LG Electronics Inc.
* R2-2103356 Discussion on updating the timing for SMTC and measurement gap configuration ITRI
* R2-2102827 Mobility for NTN-TN scenarios MediaTek Inc.
* R2-2102866 Report of [post113-e][108][NTN] SMTC and measurement gap Intel Corporation
* R2-2102742 Discussion on mobility management for connected mode UE in NTN OPPO
* R2-2103181 Discussion on conditional handover in NTN Xiaomi Communications
* R2-2103182 Discussion on measurement in NTN Xiaomi Communications
* R2-2103078 Handover Enhancements for an NTN Samsung Research America
* R2-2102954 Further discuss CHO solutions for NR NTN CATT
* R2-2103056 Configuration and execution of CHO Qualcomm Incorporated
* R2-2103057 Multiple SMTC configurations Qualcomm Incorporated
* R2-2104200 Measurement enhancement for NTN ETRI
* R2-2104145 SMTC and MG configuration for NTN Convida Wireless
* R2-2104153 NTN ANR enhancements Convida Wireless
* R2-2104065 Further consideration on CHO in NTN ZTE corporation, Sanechips
* R2-2103976 Service continuity between NTN and TN Hughes/EchoStar, Thales, BT Plc, Turkcell, Vodafone, ESA, Inmarsat
* R2-2102955 Discussion on network selection impact on LCS CATT
* **RAN2#114-e, 19th May – 27th May 2021, e-meeting**

Submitted TDOCs:

* R2-2104962 NTN Stage2 running CR 38.300 THALES
* R2-2104963 NR-NTN-solutions work plan THALES
* R2-2104806 Stage-3 running 304 CR for NTN ZTE corporation, Sanechips
* R2-2104730 Reply to LS on UE location aspects in NTN (S2-2103550; contact: Thales) SA2
* R2-2104731 LS on PDB for new 5QI (S2-2103552; contact: Ericsson) SA2
* R2-2104703 LS to ITU-T on extraterritorial use of MCC+MNC for satellite networks (C1-212539; contact: Qualcomm) CT1
* R2-2105953 Stage-3 running RRC CR for NTN Rel-17 Ericsson
* R2-2106091 DRAFT Reply LS on PDB for new 5QI Ericsson
* R2-2106049 Stage 3 NTN running CR for 38.321 - RAN2#114 InterDigital
* R2-2106048 MAC open issues in NTN - RAN2#114 InterDigital
* R2-2105116 Way forward for NTN Ephemeris Discussions for pre-compensation, idle mode and connected mode procedures Apple
* R2-2105118 On reporting UE specific TA pre-compensation during RACH in NTN Apple
* R2-2105199 Discussion of RACH in NTN China Telecommunication
* R2-2104812 Discussion on RACH in NTN OPPO
* R2-2104966 Discussion on UE-specific TA report Asia Pacific Telecom, FGI
* R2-2106015 NTN Remaining RACH issues NEC Telecom MODUS Ltd.
* R2-2105817 Considerations on new criteria for RA type selection Lenovo, Motorola Mobility
* R2-2105412 On RACH aspects for NTN Nokia, Nokia Shanghai Bell
* R2-2105381 Discussion on LCH-based RA type selection ASUSTeK
* R2-2105382 BSR over 2-step RA ASUSTeK
* R2-2106090 Reporting information about UE specific TA pre-compensation Ericsson. Apple
* R2-2106197 Discussion on RACH and TA report aspects LG Electronics Inc.
* R2-2106362 Discussion On TA report Xiaomi, Saumsung, Qualcomm Incorporated, Asia Pacific Telecom, Huawei, HiSilicon, OPPO, Lenovo, Motorola Mobility
* R2-2106385 NTN MAC enhancements Convida Wireless
* R2-2106444 UL HARQ RTT timer in NTN InterDigital, MediaTek, Samsung, ZTE
* R2-2106201 Discussion on other MAC aspects LG Electronics Inc.
* R2-2106245 Left Issues for HARQ operation in NTN CMCC
* R2-2106047 UL HARQ RTT timer in NTN InterDigital, MediaTek, Samsung
* R2-2105249 Round trip delay offset for configured grant timers MediaTek Inc.
* R2-2105250 On disabling uplink HARQ retransmission and associated LCP impacts MediaTek Inc.
* R2-2105498 Co-existence issue of BSR over CG and BSR over 2-step RACH PANASONIC R&D Center Germany
* R2-2105490 DRX impact of disabling HARQ feedback PANASONIC R&D Center Germany
* R2-2105414 Discussion on UL scheduling enhancements for NTN Nokia, Nokia Shanghai Bell
* R2-2105413 On LCP and DRX impact for NTN Nokia, Nokia Shanghai Bell
* R2-2105431 LCP restriction for an UL HARQ process Qualcomm Incorporated, Xiaomi, Huawei, HiSilicon, Samsung
* R2-2105528 LCP enhancement for NTN Spreadtrum Communications
* R2-2105529 Discussion on extending of SR-prohibitTimer Spreadtrum Communications
* R2-2105698 Other MAC enhancements in NTN Sony
* R2-2105612 Discussion on remaining MAC issues in NTN Huawei, HiSilicon
* R2-2105836 Considerations on LCP in NTN ZTE Corporation, Sanechips
* R2-2106068 Remaining Issues on HARQ Stalling, RNTI Capacity, UL Scheduling, LCP, and UL HARQ Behaviors for an NTN Samsung Research America
* R2-2106089 On DRX, LCP, timing, HARQ, SR/BSR, and CG and SPS Ericsson
* R2-2104967 HARQ retransmission schemes in NTN Asia Pacific Telecom, FGI
* R2-2104813 Discussion on UL HARQ operation in NTN OPPO
* R2-2104850 About HARQ for NTN THALES
* R2-2104851 Discussion on HARQ Aspects and UL Scheduling Enhancement in NTN CATT
* R2-2105119 Other MAC aspects for NR NTN Apple
* R2-2104814 Discussion on PDB for new 5QI OPPO
* R2-2106088 On RLC and PDCP for NTNs Ericsson
* R2-2106016 RLC and PDCP timers extension NEC Telecom MODUS Ltd.
* R2-2105837 Considerations on RLC/PDCP aspects ZTE Corporation, Sanechips
* R2-2106055 On RLC t-Reassembly for NTN Sequans Communications
* R2-2105252 On Soft-switch based Tracking Area Updates in NR-NTN MediaTek Inc.
* R2-2106069 Tracking Area Management using Virtual Tracking Areas in an NTN Samsung Research America, Apple, Rakuten Mobile
* R2-2106070 Enhancements for the Soft TAC Update for Earth-moving Beams in an NTN Samsung Research America
* R2-2105610 Discussion on decoupled cell ID Huawei, HiSilicon
* R2-2105611 Discussion on remaining issues on soft TAU Huawei, HiSilicon
* R2-2105571 Discussion on TAC aspects for NTN Beijing Xiaomi Electronics
* R2-2105530 Discussion on TAC updating in NTN Spreadtrum Communications
* R2-2105432 Hard and soft TAC update timing Qualcomm Incorporated
* R2-2104852 Discussion on TAC update in NTN CATT
* R2-2104826 Signalling Solution for Feeder Link Switching of NTN VODAFONE Group Plc
* R2-2105117 Satellite cell ID mapping to earth fixed locations for efficient cell selection and cell reselection in NTN Apple
* R2-2104805 Report of [POST113bis-e][101][NTN] cell reselection ZTE corporation, Sanechips
* R2-2104857 Leftover issues on IDLE and inactive mode CATT
* R2-2104815 Discussion on idle/inactive mode procedures in NTN OPPO
* R2-2105531 Issue on cell selection and reselection in NTN Spreadtrum Communications
* R2-2105487 Discussion on IDLE issues Xiaomi communications
* R2-2105699 Idle mode enhancement in NTN Sony
* R2-2105818 Considerations on ephemeris provision for NTN Lenovo, Motorola Mobility
* R2-2105786 Cell reselection based on time and location condition LG Electronics Inc.
* R2-2105251 On Cell-Reselection in NR-NTN MediaTek Inc.
* R2-2106231 Discussion on GNSS tracking for cell (re)selection and ephemeris division&provision CMCC
* R2-2106171 NTN Idle/Inactive mode cell re-selection ITL
* R2-2106387 NTN type and scenario indication Convida Wireless
* R2-2106392 NTN Cell (re)selection enhancements Convida Wireless
* R2-2106388 NTN ANR enhancements Convida Wireless
* R2-2106386 SMTC and MG configuration for NTN Convida Wireless
* R2-2106347 Measurement window enhancements for NTN cell LG Electronics Inc.
* R2-2106232 SMTC and measurement Gap configuration for NTN CMCC
* R2-2106233 Signaling issues resolution for connected mobility CMCC
* R2-2106234 Discussion on NTN-TN mobility CMCC
* R2-2106045 Location-based CHO in NTN InterDigital
* R2-2106046 Time-based CHO for soft feeder-link switch InterDigital
* R2-2105253 Mobility for NTN-TN scenarios MediaTek Inc.
* R2-2105787 Further considerations on NTN CHO LG Electronics Inc.
* R2-2105819 UE assistance for measurement gap and SMTC configuration in NTN Lenovo, Motorola Mobility
* R2-2105820 NTN specific CHO trigger condition Lenovo, Motorola Mobility
* R2-2106071 Handover Enhancements and Power-saving Neighbor Search for an NTN Samsung Research America
* R2-2106024 Further discussion on CHO in NTN NEC Telecom MODUS Ltd.
* R2-2105936 Connected mode aspects for NTN Ericsson
* R2-2105923 Further consideration on CHO in NTN ZTE corporation, Sanechips
* R2-2105700 Signaling storm during HOs and Timer based trigger details Sony
* R2-2105701 Cell coverage spillage over multiple countries issue in NTN Sony
* R2-2105702 SMTC enhancement in NTN Sony
* R2-2105613 Discussion on remaining issues for CHO in NTN Huawei, HiSilicon
* R2-2105614 Discussion on service continuity between NTN and TN Huawei, HiSilicon
* R2-2105460 Discussion on connected mode aspects for NTN Xiaomi Communications
* R2-2105433 Open issues in CHO Qualcomm Incorporated
* R2-2105434 SMTC and MG enhancements Qualcomm Incorporated
* R2-2105383 Location-based measurement report ASUSTeK
* R2-2105384 Discussion on measurement event triggering in NTN ASUSTeK
* R2-2105389 Discussion on UE feedback based SMTC and GAPS measurement configuration Rakuten Mobile, Inc
* R2-2104816 Discussion on mobility management for connected mode UE in NTN OPPO
* R2-2104853 Discussion on connected mode in NTN CATT
* R2-2104999 Further thoughts on connected mode mobility in NTN Nokia, Nokia Shanghai Bell
* R2-2105000 Further views on SMTC configurations for NTN Nokia, Nokia Shanghai Bell
* R2-2105006 Service continuity between NTN and TN Hughes/EchoStar, Thales, BT Plc, Turkcell, Vodafone, ESA, Inmarsat
* R2-2105120 On connected mode issues for NR NTN Apple
* R2-2104854 Discussion on reply LSs on UE location aspects in NTN CATT
* R2-2105435 UE positioning methods for NTN Qualcomm Incorporated
* R2-2105558 Discussion on location service for NTN Xiaomi
* R2-2105924 Understanding on the UE location aspects in NTN ZTE corporation, Sanechips
* R2-2105935 NTN location reporting aspects Ericsson
* R2-2106072 Area Management in an NTN Samsung Research America and Thales

## 4.3 RAN3

* **RAN3#112-e, 17th May – 28th May 2021, e-meeting**

Submitted TDOCs:

* R3-211497 Support Non-Terrestrial Networks Huawei, Thales, Ericsson, ZTE, Qualcomm Incorporated
* R3-212244 (TP for BL CR TS 38.300) NTN Stage 2 clean-up Huawei
* R3-212245 On mapping of the Cell identities of NTN cells Huawei
* R3-212109 Discussion on handling and applicability of Network Identifiers on Xn and NG interface Ericsson
* R3-212476 Discussion on Network Identifier Handling CMCC
* R3-211487 Support of NTN RAT identification and NTN RAT restrictions Qualcomm Incorporated, Huawei, Thales, , Ericsson, Nokia, Nokia Shanghai Bell, CATT
* R3-211488 Support of NTN RAT identification and NTN RAT restrictions Qualcomm Incorporated, Huawei, Thales, , Ericsson, Nokia, Nokia Shanghai Bell, CATT
* R3-211705 Discussion of open issues related to LS traffic on CGI mapping, location information, and TAC update Qualcomm Incorporated
* R3-211707 General usage of cell identity signalling in NGAP Qualcomm Incorporated
* R3-211896 (TP for BL CR for TS 38.300) Cell ID handling on NG interface Nokia, Nokia Shanghai Bell
* R3-211815 Discussion on CGI handling in RAN CATT
* R3-211719 Discussion on Cell relation handling China Telecommunication
* R3-212477 Discussion on cell relation CMCC
* R3-212450 Further Discussion on Cell Relation for NTN ZTE
* R3-212110 Further discussion on neighbor relations and NTN Ericsson
* R3-212246 Time Windows management for signalling reduction including TP for BL CRs Huawei
* R3-212454 Further Discussion on LEO Feeder Link Switch-Over ZTE
* R3-212478 Discussion on feeder link switch for NTN CMCC
* R3-212419 Discussion on enhancements for feeder link switch over Samsung
* R3-211720 Further discussion on switch over for NTN China Telecommunication
* R3-211816 Further discussion on Feeder Link Switch CATT
* R3-211787 NTN control data THALES
* R3-211897 Discussion on Feeder Link Switchover Nokia, Nokia Shanghai Bell
* R3-211898 (TP for BL CR for TS 38.413) Country Specific Routing for an RRC CONNECTED UE Nokia, Nokia Shanghai Bell
* R3-211817 (TP for BL CR for TS 38.300)Clarification on country-specific CN selection CATT
* R3-211805 Consideration on Location aspects in NTN CATT
* R3-211806 [Draft] Reply LS on UE location aspects in NTN CATT
* R3-211706 [DRAFT] Reply LS on UE location aspects in NTN Qualcomm Incorporated
* R3-211486 Clarification of NAS Node Selection Function for NTN nodes providing access over multiple countries Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, Huawei
* R3-211418 LS on UE location aspects in NTN RAN2
* R3-212247 Aspects Related to Country-Specific Routing, mobility for RRC Connected and RRC Inactive modes Huawei
* R3-212114 NTN and Location Reporting Ericsson
* R3-212115 [DRAFT] [Reply] LS on location aspects in NTN Ericsson
* R3-212111 Continuing Discussion on Xn Functions and NTN Ericsson
* R3-211920 NR-U plane protocol enhancement for NTN Rakuten Mobile, Inc
* R3-211921 Non-Terrestrial Networks support for NR-U plane protocol Rakuten Mobile,

## 4.1 RAN4

* **RAN4#98-bis-e, 12th April – 20th April 2021, e-meeting**

Submitted TDOCs:

* R4-2104879 NR\_NTN\_solutions work plan THALES
* R4-2107217 On the FR2 NTN coexistence scenarios Hughes/EchoStar, Inmarsat, Thales, ESA, Intelsat
* R4-2107193 On NTN System parameters Nokia, Nokia Shanghai Bell
* R4-2106607 Discussion on system parameters for NTN ZTE Corporation
* R4-2106899 Reference points and reference model for NTN Ericsson
* R4-2106608 Discussion on NTN architecture ZTE Corporation
* R4-2106545 Discussion on RF interfaces for NR to support non-terrestrial networks Xiaomi
* R4-2106686 Further discussion on Network architecture on NTN system Huawei, HiSilicon
* R4-2104808 on NTN architecture and RF requirements CATT
* R4-2107263 NTN Architecture Aspects THALES
* R4-2106897 NTN - Regulatory and spectrum aspects Ericsson
* R4-2105045 Simulation assumptions for FR1 coexistence study Samsung
* R4-2105046 Initial simulation results of some NR-NTN co-ex scenarios Samsung
* R4-2107270 On the S-band NTN coexistence scenarios and simulation parameters THALES
* R4-2107194 HAPS simulation assumptions for coexistence study Nokia, Nokia Shanghai Bell
* R4-2107120 Simulation assumptions for NR NTN co-existence study Qualcomm Incorporated
* R4-2106684 Further discussion on NTN simulation assumptions Huawei, HiSilicon
* R4-2106609 Further discussion on simulation assumptions for NTN ZTE Corporation
* R4-2106476 Simulation assumptions for NTN co-existence CATT
* R4-2106544 Preminary simulation result for coexistence study on NR to support non-terrestrial networks Xiaomi
* R4-2106685 Initial analysis and results about the NTN simulation Huawei, HiSilicon
* R4-2106901 NTN - simulation results for alignment Ericsson
* R4-2107121 Simulation restuls for NTN co-existence calibtartion Qualcomm Incorporated
* R4-2107195 HAPS adjacent channel coexistence simulation results Nokia, Nokia Shanghai Bell
* R4-2107275 NTN UL frequency synchronization requirement THALES
* R4-2106610 Discussion on RF requirements from satellite network perspective ZTE Corporation
* R4-2104761 Initial consideration on NTN-BS requirements CATT
* R4-2104762 Discussion on RF requirements for NTN UE CATT
* R4-2106900 Reply LS to RAN4 on NTN UL time and frequency synchronization requirements (frequency) Ericsson
* R4-2106361 Discussion on UE UL frequency synchronization requirements in NTN MediaTek inc.
* R4-2107122 Frequency synchronization requirements in NTN Qualcomm Incorporated
* R4-2107277 NTN UL timing accuracy THALES
* R4-2107254 NTN - On reference points Nokia, Nokia Shanghai Bell
* R4-2105142 Discussion on NTN GNSS requirement LG Electronics UK
* R4-2107030 Discussion on general issues for NTN RRM Huawei, HiSilicon
* R4-2104763 Discussion on RRM requirements for NTN CATT
* R4-2104764 draft LS reply on NTN UL time and frequency synchronization requirements CATT
* R4-2104603 Discussion on general NTN RRM related issues CMCC
* R4-2104604 Discussion on NTN timing requirements CMCC
* R4-2104689 Discussion on timing requirements for NR NTN Xiaomi
* R4-2104765 Discussion on timing requirements for NTN CATT
* R4-2104927 Discussion on timing requirements for NTN ZTE Corporation
* R4-2104985 Discussion on RRM timing related requirements for NTN NEC
* R4-2106947 Discussion on NTN timing related requirements Huawei, HiSilicon
* R4-2105139 Timing requirements Ericsson
* R4-2105140 Reply LS to RAN1: LS on NTN UL time and frequency synchronization requirements (Timing) Ericsson
* R4-2106360 Discussion on timing requirements in NTN MediaTek inc.
* R4-2106444 Discussion on NTN timing pre-compensation Intel Corporation
* R4-2107291 Timing requirements in NTN Systems Qualcomm Incorporated
* R4-2107259 NTN - On timing requirements Nokia, Nokia Shanghai Bell
* R4-2107292 Measurement requirements in NTN Systems Qualcomm Incorporated
* R4-2107256 NTN - On measurement requirements Nokia, Nokia Shanghai Bell
* R4-2105143 Discussion on measurement requirements for NTN LG Electronics UK
* R4-2106939 Discussion on measurement in NTN Huawei, HiSilicon
* R4-2104986 Discussion on RRM measurement requirements for NTN NEC
* R4-2104766 Discussion on measurement requirements for NTN CATT
* R4-2104834 On GNSS measurement for NTN Apple
* R4-2104816 Measurement RRM requirements for NTN Ericsson
* R4-2104690 Discussion on measurement requirements for NR NTN Xiaomi
* R4-2104598 NTN RRM measurement requirements CMCC
* **RAN4#99-e, 19th May – 27th May 2021, e-meeting**

Submitted TDOCs:

* R4-2110813 Discussion of FR2 (Ka/Ku) Satellite bands for NR based satellite networks Intelsat, Hughes, Inmarsat, ESA, Thales, Fraunhofer
* R4-2110688 On NTN System parameters Nokia, Nokia Shanghai Bell
* R4-2110614 Discussion on system parameters for NTN ZTE Corporation
* R4-2110413 Discussion on system parameters on NTN system Huawei, HiSilicon
* R4-2111423 Reference Deployment Scenario for NTN MSS S-Band THALES, Hughes/EchoStar, Inmarsat, ESA
* R4-2109053 Discussion on NTN System parameters for NTN CATT
* R4-2111460 On the Rx Parameters and Rx Testing Setup for NTN gNB THALES
* R4-2110615 Discussion on NTN architecture ZTE Corporation
* R4-2109116 Open issues for NTN architecture CATT
* R4-2109504 NTN reference point CMCC
* R4-2110194 Discussion on RF interfaces for NR to support non-terrestrial networks Xiaomi
* R4-2110120 Reference points and reference model for NTN Ericsson
* R4-2110993 About Ka-band proposed for NR-NTN in Rel-17 Hughes/EchoStar, Inmarsat, Thales, Fraunhofer
* R4-2109117 On NTN band definition CATT
* R4-2109327 Band plan and regulatory requirements related to L-band UL and S-band DL operation GLOBALSTAR Inc.
* R4-2110689 HAPS simulation assumptions for coexistence study Nokia, Nokia Shanghai Bell
* R4-2110799 Simulation scenarios and assumptions for NTN co-existence Qualcomm Incorporated
* R4-2110800 HAPS coexistence simulation assumptions Qualcomm Incorporated
* R4-2110412 Further discussion on NTN simulation assumptions Huawei, HiSilicon
* R4-2111462 On the S-band NTN Scenarios and Parameters for Coexistence Study THALES
* R4-2109118 Updated simulation assumptions for NTN co-existence CATT
* R4-2109645 On simplification of TN UL --> NTN UL simulation CATT
* R4-2109544 Proposed simulation assumptions for NTN co-existence study Samsung
* R4-2110119 NTN Simulations assumptions Ericsson
* R4-2110690 HAPS adjacent channel coexistence simulation results Nokia, Nokia Shanghai Bell
* R4-2110121 NTN - simulation results for alignment Ericsson
* R4-2110193 Preminary simulation result for coexistence study on NR to support non-terrestrial networks Xiaomi
* R4-2109119 Comparison of co-existence performance w/w.o. consideration on earthe curvature CATT
* R4-2110616 Discussion on RF requirements from satellite network perspective ZTE Corporation
* R4-2109120 Discussion on NTN network side CATT
* R4-2110801 NTN and GNSS interfrence analysis Qualcomm Incorporated
* R4-2111474 NTN UL Frequency Accuracy Pre-Compensation Budget THALES
* R4-2109054 Discussion on UE RF requirements for NTN CATT
* R4-2109055 Response LS on NTN UL frequency synchronization requirements CATT
* R4-2109056 Discussion on RRM requirements for NTN CATT
* R4-2110914 Discussion on GNSS for NTN RRM Huawei, HiSilicon
* R4-2110418 UE positioing and timing requirements Ericsson
* R4-2109057 Discussion on GNSS-related requirements CATT
* R4-2109492 Discussion on NTN GNSS related issues CMCC
* R4-2110416 Timing requirements Ericsson
* R4-2110417 Reply LS to RAN1: LS on NTN UL time and frequency synchronization requirements (Timing) Ericsson
* R4-2111477 NTN UL Timing Accuracy THALES
* R4-2111271 NTN - On UE timing requirements Nokia, Nokia Shanghai Bell
* R4-2111075 On timing requirements for NR NTN Apple
* R4-2109493 Discussion on NTN timing requirements CMCC
* R4-2109714 Discussion on timing requirements for NR NTN LG Electronics Inc.
* R4-2109752 Discussion on timing requirements for NTN ZTE Corporation
* R4-2109896 Discussion on RRM timing related requirements for NTN NEC
* R4-2109855 Discussion on timing requirements in NTN MediaTek inc.
* R4-2109058 Discussion on timing requirements for NTN CATT
* R4-2109059 Response LS on NTN UL time synchronization requirements CATT
* R4-2109220 Discussion on NTN timing requirements Intel Corporation
* R4-2109254 Further discussion on timing requirements for NR NTN Xiaomi
* R4-2108971 Timing requirements in NTN Systems Qualcomm Incorporated
* R4-2110302 Discussion on NTN timing related requirements Huawei, HiSilicon
* R4-2111270 NTN - On measurement requirements Nokia, Nokia Shanghai Bell
* R4-2110382 Discussion on measurement in NTN Huawei, HiSilicon
* R4-2110218 RRM Measurement requirements for NTN Ericsson
* R4-2110224 RRM Measurement requirements for NTN Ericsson
* R4-2109949 Discussion on measurement requirements for NTN LG Electronics UK
* R4-2108972 Measurement requirements in NTN Systems Qualcomm Incorporated
* R4-2109255 Further discussion on measurement requirements for NR NTN Xiaomi
* R4-2109060 Discussion on Measurement requirements for NTN CATT
* R4-2109483 Discussion on NTN RRM measurement requirements CMCC

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