**3GPP TSG RAN meeting #93-e RP-212312**

**Electronic Meeting, September 13 - 17, 2021**

## Status Report to TSG

**Agenda item:** 10.4.3 NB-IoT/eMTC support for Non-Terrestrial Networks (NTN)

|  |  |
| --- | --- |
| **WI / SI Name** |  |
| included in this status report | Study Item: No | Core part: Yes | Performance part:No | Testing part:- |
| **Acronym** | LTE\_NBIOT\_eMTC\_NTN |
| **Unique ID** |  |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-211601 |
| **Target Completion Date****(indicate if changed)** | Study Item:  | Core part:  | Performance part:  | Testing part: - |
| **Overall Completion level** | Study Item:  | Core part: Overall: 30% | Performance Part:  | 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** | RAN1 |
| **Rapporteur** | **Name** | Gilles Charbit |
| **Company** | MediaTek |
| **Email** | Gilles.charbit@mediatek.com |

## 1 Work plan related evaluation

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

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

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

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

## 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#106-e, 16th August – 27th August 2021, e-meeting**

**Agreements on “8.15.1 Enhancements to time and frequency synchronization”**

The following agreements from NR NTN are re-used for IoT NTN as working assumption.

1. 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.
2. The orbital propagator model to be used at UE side can be left to implementation
3. Timing Advance formula can be transposed to IoT-NTN with Ts used instead of Tc

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

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

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 in NR NTN WI.

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 in NR NTN WI.

1. Support the delivery of ephemeris information using both ephemeris formats, i.e., state vectors and orbital elements
* Set 1: Satellite position and velocity state vectors (position/velocity)
	+ Position X,Y,Z in ECEF (m)
	+ Velocity VX,VY,VZ in ECEF (m/s)
* Set 2: 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
1. For TA update in RRC\_CONNECTED state, combination of both open (i.e. UE autonomous TA estimation, and common TA estimation) and closed (i.e., received TA commands) control loops shall be supported for IoT-NTN
2. In Rel-17 IoT-NTN, at least support UE which can compute timing advance and frequency adjustment for serving link based on its GNSS position and serving satellite ephemeris signalled by the network and apply corresponding timing advance and frequency adjustment in RRC\_IDLE and RRC\_CONNECTED modes
3. Serving satellite ephemeris Epoch time is implicitly known as a reference time defined by the starting time of a DL slot and/or frame.

FFS: Whether this starting time is given by predefined rule or it is indicated by the Network

The following agreements below were made for IoT-NTN specific topics:

For sporadic short transmission, UE in RRC\_CONNECTED should go back to idle mode and re-acquire a GNSS position fix if GNSS becomes outdated.

Satellite ephemeris read on SIB are valid for the duration of sporadic short transmission in RRC\_CONNECTED.

Common TA parameters if indicated and read on SIB are valid for the duration of sporadic short transmission in RRC\_CONNECTED.

Note: The duration of the short transmission is not longer than the “validity timer for UL synchronization” referred to in the WID objective (but which still needs further discussion for specifying further details)

The validity timer of UL synchronization is configured by the network

* FFS: Whether a single validity timer or separate validity timers are used for satellite ephemeris and common TA parameters

UE in RRC\_IDLE reads the satellite ephemeris on SIB and the common TA parameters if indicated on SIB and (re-)start the validity timer(s) for UL synchronization before moving to RRC\_CONNECTED.

* FFS: Details of the precise (re-)start time for the validity timer for UL synchronization to ensure a common understanding between gNB and UE.
* Other signaling details for validity timer are up to RAN2

Duration of UL transmission segment for UE pre-compensation for PRACH transmission is a number of RACH repetition units configured by the network

* For NB-IoT, repetition unit is P symbol groups.
* For eMTC, repetition unit is one preamble including guard period.
* FFS: Configuration details

Duration of UL transmission segment for UE pre-compensation for PUSCH transmission is a number of PUSCH repetition units configured by the network

* For NB-IoT, repetition unit is $M\_{identical}^{NPUSCH}×N\_{slot}^{UL}×T\_{slot}$
* For eMTC, repetition unit is $N\_{slot}^{UL}×T\_{slot}$ for sub-PRB allocation, where Tslot = 0.5 ms. For full-PRB allocation, repetition unit is one subframe.
* NOTE1: $M\_{identical}^{NPUSCH}, N\_{slot}^{UL}, T\_{slot}$ are defined in TS 36.211 10.1.2.3 and 10.1.3.6 for NB-IoT
* NOTE2: $M\_{symb}^{UL}, M\_{slot}^{UL}$M\_^UL\_slot is defined in TS 36.211, 5.2.3A for eMTC
* FFS: RAN1 to further discuss valid and invalid subframes
* FFS: Configuration details

For NB-IoT, if a mapping to Nslots slots or a repetition of the mapping in an UL transmission segment for UE pre-compensation for NPUSCH transmission contains a resource element which overlaps with any configured NPRACH resource, the NPUSCH transmission in overlapped Nslots slots is postponed until the next Nslots slots not overlapping with any configured NPRACH resource.

* NOTE: Nslots is defined in TS 36.211, 10.1.3.6

The UL transmission segment duration is configured by the network

* FFS: Details of the configuration signalling.

For NB-IoT NTN, the network configures one of K values for the UL transmission segment duration of each PRACH preamble format in a k-bit field, where the size of the k-bit field and the number of K candidate values depend on the preamble format.

* Format 0 and format 1: 3-bit field, K=6 candidate values 2.4.(TCP+TSEQ), 4.4.(TCP+TSEQ), 8.4.(TCP+TSEQ), 16.4.(TCP+TSEQ), 32.4.(TCP+TSEQ), 64.4.(TCP+TSEQ)
* Format 2:  2-bit field, K=4 candidate values 2.6.(TCP+TSEQ), 4.6.(TCP+TSEQ), 8.6.(TCP+TSEQ), 16.6.(TCP+TSEQ)

FFS: Down scoping of K candidate values, size of k-bit field

FFS: Whether the same segment duration can be used for all preambles within a preamble format

For eMTC, the network configures one of K values for the UL transmission segment duration of PRACH in a k-bit field.

* FFS: K candidate values, size of k-bit field

For NB-IoT/eMTC NTN, the network configures one of K candidate values for the UL transmission segment duration of NPUSCH/PUSCH in a k-bit field.

* For NB-IoT, maximum 3-bit field with a maximum number of K=8 candidate values 2 ms, 4 ms, 8 ms, 16 ms, 32 ms, 64 ms, 128 ms, 256 ms

FFS: Down scoping of K candidate values, size of k-bit field

The UL transmission segment duration is provided by UE-specific RRC signalling or by signalling in SIB.

NOTE: the values of UL transmission segment duration for NB-IoT can be different to those for eMTC

**Agreements on “8.15.2 Timing relationship enhancements”**

For NB-IoT, on receiving UL grant on DCI format N0 in subframe n, NPUSCH Format 1 is transmitted with a delay of Koffset as compared to transmission as per current specification.

For NB-IoT, on receiving a NPDSCH with a RAR message that ends in subframe n, the corresponding Msg3 is transmitted on NPUSCH format 1, with a delay of Koffset as compared to transmission as per current specification.

For NB-IoT, a UE upon detection of a NPDSCH transmission for which it should provide an ACK/NACK feedback, shall transmit the HARQ ACK/NACK with a delay of Koffset as compared to transmission as per current specification.

For NB-IoT, on receiving a timing advance command ending in DL subframe n, the corresponding adjustment of the uplink transmission timing by the received time advance shall be delayed by Koffset as compared to current specification.

For eMTC, on receiving an UL grant via MPDCCH that ends in DL subframe n, PUSCH is transmitted with a delay of Koffset as compared to transmission as per current specification.

For eMTC, on receiving a RAR in a PDSCH that ends in subframe n, PUSCH for Msg3 is transmitted with a delay of Koffset as compared to transmission as per current specification.

For eMTC, when an MPDCCH ending in subframe n activates UL SPS, the time of the first subframe in which the UE is allowed to transmit SPS-PUSCH is delayed by Koffset as compared to transmission per current specification.

For eMTC, on reception of a PDSCH ending in subframe n, the corresponding HARQ-ACK feedback on PUCCH is transmitted with a delay of Koffset as compared to transmission as per current specification.

For eMTC, the ending time for DL physical resources forming a CSI reference resource set is advanced by Koffset as compared to current specification.

For eMTC, for an MPDCCH received in subframe n that triggers aperiodic SRS transmission, SRS is transmitted with a delay of Koffset as compared to transmission as per current specification.

For eMTC, on receiving a timing advance command ending in subframe n, the corresponding adjustment of the uplink transmission timing by the received time advance shall be delayed by Koffset as compared to current specification.

For IoT NTN, support cell-specific Koffset configuration for use during initial access.

For IoT NTN, support the use of UE-specific Koffset in CONNECTED mode.

UE-specific TA reporting is supported in IoT-NTN

* FFS: Detailed contents of report

Conclusion:

In IoT NTN the initialisation of generators for scrambling codes for UL channels and DM-RS shall use the subframe number of the UL channel or UL signal that is indicated by the Koffset-modified timing relationship.

NOTE: In the view of RAN1, this does not necessarily involve a specification change.

Conclusion:

For IoT NTN, no modifications are needed for the calculation in NR NTN for estimate of UE-eNB RTT.

#### Remaining Open issues

Specify the following time and frequency synchronization enhancements, using NR\_NTN\_solutions WI agreements as baseline, according to Section 8 in TR 36.763:

- UE pre-compensation including ephemeris format (orbital / Position -Velocity)

- UE pre-compensation for UL synchronization in RRC\_IDLE and RRC\_CONNECTED states based at least on its GNSS-acquired position and the serving satellite ephemeris

- Timing advance formula (granularity of the timing advance may be different)

- Combination of Open (i.e. UE autonomous TA estimation, and common TA estimation) and Closed TA (i.e., received TA commands) control loops in RRC\_CONNECTED state

Agreements on the above are up to the decision in NR\_NTN\_Solutions WI and will be used for IoT NTN with minimum changes, if any.

Specify the following time and frequency synchronization enhancements that are not covered by NR\_NTN\_Solutions WI agreements, according to Section 8 in TR 36.763:

- Long PUSCH and PRACH Transmission enhancements: segmented UE pre-compensations, new UL gaps and/or implementation solutions, time units and duration of segments.

- Validity timer for UL synchronization: satellite ephemeris, and potentially other aspects

- DL synchronization enhancements: A single solution will be selected between: new channel raster, (part of) ARFCN-indication-in-MIB.

- GNSS Measurements: Validity of a GNSS position fix and details of acquiring a GNSS position fix, duration of validity, in RRC CONNECTED mode for sporadic short transmission

Specify the following IoT NTN specific timing relationships enhancements according to Section 8 in TR 36.763:

- Timing relationships for NB-IoT / eMTC: as listed in Section 6.6.3 in TR 36.763

- UL scheduling for FDD-HD: Use of UE-specific TA and/or K\_offset to avoid UL-DL collisions in FDD-HD

- Signalling aspects in UE-specific TA maintenance and reporting, techniques to reduce the signalling load and determination of the UE-specific TA.

## 2.2 RAN2

#### 2.2.1 Agreements

* **RAN2#115-e, 9th August – 27th August 2021, e-meeting**

Agreements from AI 9.2.1: Organizational

Agreements from AI 9.2.2: Support of Non continuous coverage

RAN2 confirms that the following will be supported: discontinuous coverage without excessive UE power consumption and without excessive failures / recovery actions. It is expected that this need to be taken into account at least for Idle mode. The requirement is applicable for all reference scenarios (GEO, MEO and LEO).

Sattelite assistance information will be used by the UE for predicting coverage discontinuity. The details of the assistance information is FFS. FFS whether any applicable agreements made in NR-NTN can be reused.

The details of UEs actions when predicted to be out of coverage is FFS, e.g. stopping unnecessary cell search in the Idle mode, and FFS to what extent this need to be specified.

It is FFS to what extent it need to be specified the details of UE’s prediction of discontinuous coverage and its ability to detect when it is back in coverage.

RAN2 sends an LS to SA2 and CT1 (cc: RAN3) for the possible alignment work in their specification due to the support of discontinuous coverage. LS out is approved, final version in R2-2109213

Agreements from AI 9.2.3: User Plane Impact

Start of ra-ResponseWindow is delayed by an offset. Postpone discussion on the offset value until further agreements regarding RACH are made in RAN1.

If the start of the RA Response window is accurately compensated by UE-eNB RTT and no extension of repetition is required, there is no need to extend the ra-ResponseWindowSize for IoT NTN.

Start of mac-ContentionResolutionTimer is delayed by an offset, (assumed equal to UE-eNB RTT). This can be revisited if RAN1 decides something that requires to change this.

If the start of mac-ContentionResolutionTimer is accurately compensated by UE-eNB RTT and no extension of repetition is required, there is no need to extend the mac-ContentionResolutionTimer for IoT NTN.

From RAN2 perspective, for UE with UE-specific pre-compensation as a baseline it is up to eNB implementation to ensure sufficient time on UE side for the Msg3 transmission for IoT NTN.

RAN2 assumes that TA information (FFS what) reporting by the UE on network enabling will be needed in IoT NTN. Expect RAN1 need to progress on this, and can maybe reuse NR NTN progress. FFS in which message this is provided.

UE-eNB RTT is taken into account when calculating the (UL) HARQ RTT timer.

RAN2 assumes that sr-ProhibitTimer need to be extended. Postpone treatment of sr-ProhibitTimer values until the NR NTN details have been decided.

From RAN2’s perspective, delayed start of pur-ResponseWindowTimer with UE-eNB RTT can be supported. This can be revised if RAN1 finds issues to support PUR that are not small.

pur-ResponseWindowSize is not extended for IoT NTN.

SPS is supported without modification for IoT NTN.

RAN2 confirm the SI agreement that the value range of the RLC t-Reordering timer will be extended to support IoT NTN.

Do not extend the PDCP discardTimer for NB-IoT over NTN.

FFS whether to extend the PDCP discardTimer for eMTC over NTN.

Do not extend PDCP t-Reordering for IoT NTN.

Agreements from AI 9.2.4: Control Plane Impact

Agreements from AI 9.2.4.1: TA and Mobility related

Cell selection / reselection procedures for NB-IoT and LTE-M in TN is the baseline in NB-IoT/LTE-M NTN.

RAN2 assumes that Satellite assistance information, e.g. for cell selection reselection, for serving cell is provided to UE.

Wait for the progress in RAN1 before discussion on whether satellite assistance information is broadcast in a separate information block.

The timing information on when a cell is going to stop serving the area is broadcast at least for the quasi-earth fixed case. FFS details.

The network may broadcast more than one TAC per PLMN in a cell, which is up to network implementation.

The UE determines the Tracking Area based on the broadcast information (the use of other information is not excluded).

When the network stops broadcasting a TAC, the UE needs to know it. FFS how this is done.

UE does not do TAU if one of the currently broadcasted TAC belongs to UE’s registration area.

Rel-16 LTE CHO mechanism is supported for LTE-M devices in IoT NTN. FFS which CE Mode(s) to apply

No procedural update is required to support connected mode mobility for LTE-M.

Rel-16 RLF / connection re-establishment mechanisms are supported in IoT NTN assuming that minor adjustments to UE specific timers and constants would be sufficient.

FFS if Satellite assistance information for neighbour cell(s) is provided to UE for cell selection/reselection (justification would be needed).

The value range for parameter t304 is not extended with larger values.

Send an LS to RAN4 to inform that RRM impacts for supporting CHO should be taken into consideration.

Postpone the discussion on whether specific timers and constants for RLF and RRC connection re-establishment procedures require extended value range and/or new behaviour till next meeting.

System information update notification procedure is not used to inform TAC updates, at least for TAC additions (FFS removals)

Agreements from AI 9.2.4.2: Other

#### 2.2.2 Remaining Open issues

All cellular IoT features specified up to Rel-16 are supported for IoT NTN unless problems are found.

Specify the following enhancements re-using NR\_NTN\_Solutions WI agreements as a baseline, according to Section 8 in TR 36.763:

- User Plane:

- Enhancements to ra-ResponseWindowSize, mac-ContentionResolutionTimer, HARQ RTT timer, UL HARQ RTT timer, and sr-ProhibitTimer.

- Enhancements to RLC t-Reordering timer.

- Others:

- Provisioning of ephemeris

Specify the following IoT NTN specific enhancements not covered by NR\_NTN\_Solutions WI agreements, according to Section 8 in TR 36.763:

- Architecture:

- Support for EPC

- Mobility and Tracking Area:

- Enhancements to tracking area management using the earth-fixed TA concept, considering both hard-switch and soft-switch options, where in the soft-switch option the network may broadcast more than one Tracking Area Code per PLMN.

- Support of legacy (Rel-16) cell selection/reselection mechanisms without major enhancements. Minor adjustments to existing mobility mechanisms, such as a new parameter values, change to timing etc. can be considered to adapt functionality to NTN.

- Support of legacy (Rel-16) Handover and RLF/reestablishment mechanisms without major enhancements. For eMTC, Rel-16 LTE CHO procedure can be considered without major enhancements. Minor adjustments to existing mobility mechanisms, such as a new parameter values, change to timing etc. can be considered to adapt functionality to NTN.

- Others:

- Support of discontinuous coverage without excessive UE power consumption and without excessive failures / recovery actions. Minor enhancements to the existing power saving mechanisms e.g. DRX, PSM, eDRX, relaxed monitoring, and (G)WUS can be considered, and if found needed, specified, to support discontinuous coverage;

## 2.3 RAN3

#### 2.3.1 Agreements:

**RAN3#113-e, 13th August – 26th August 2021, e-meeting**

* IoT NTN WI has not been discussed in RAN3 until now, which will be treated in 2022 Q1 RAN3 meetings.

#### 2.3.2 Remaining Open issues:

NB-IoT and eMTC NTN support for E-UTRAN (i.e. including S1 interface) will be specified by re-using NR NTN functionality as a baseline, e.g.

- Support for cell identity and TA corresponding to Earth-fixed area in relevant network interfaces (taking Rel-17 NR NTN as baseline where appropriate)

- Support for country-specific CN routing (taking Rel-17 NR NTN as baseline where appropriate)

- Support for identification and restriction of satellite access (following Rel-17 NR NTN, and if confirmed by SA2)

- OAM requirements (taking Rel-17 NR NTN as baseline where appropriate).

Where needed, adjustments will be considered for IoT NTN specific alignments in line with functionality defined in other WGs.

## 2.4 RAN4

#### 2.4.1 Agreements: N/A (RAN4 is not involved in the SI)

#### 2.4.2 Remaining Open issues: N/A

## 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#106-e, 13th August – 27th August, 2021**

Submitted to AI 8.15: NB-IoT/eMTC support for Non-Terrestrial Network

* [**R1-2108215**](file:///C%3A%5CUsers%5CDocs%5CR1-2108215.zip) LTE\_NBIOT\_eMTC\_NTN work plan Rapporteur (MediaTek)

Submitted to AI 8.15.1 Enhancements to time and frequency synchronization

* [R1-2106485](file:///C%3A%5CUsers%5CDocs%5CR1-2106485.zip) Discussion on time and frequency synchronization enhancement for IoT in NTN Huawei, HiSilicon
* [R1-2106633](file:///C%3A%5CUsers%5CDocs%5CR1-2106633.zip) Discussion on time and frequency synchronization enhancements for NB-IoT/eMTC over NTN vivo
* [R1-2106719](file:///C%3A%5CUsers%5CDocs%5CR1-2106719.zip) Discussion on enhancements to time and frequency synchronization for IOT NTN Spreadtrum Communications
* [R1-2106760](file:///C%3A%5CUsers%5CDocs%5CR1-2106760.zip) Enhancements to time and frequency synchronization Qualcomm Incorporated
* [R1-2106823](file:///C%3A%5CUsers%5CDocs%5CR1-2106823.zip) Enhancement to time synchronisation for IoT-NTN Sony
* [R1-2106920](file:///C%3A%5CUsers%5CDocs%5CR1-2106920.zip) On enhancements to time and frequency synchronization Samsung
* [R1-2106953](file:///C%3A%5CUsers%5CDocs%5CR1-2106953.zip) Time and frequency synchronization enhancement for IoT over NTN CATT
* [R1-2107018](file:///C%3A%5CUsers%5CDocs%5CR1-2107018.zip) Enhancements to time and frequency synchronization NEC
* [R1-2107047](file:///C%3A%5CUsers%5CDocs%5CR1-2107047.zip) On enhancements to time and frequency synchronization Nordic Semiconductor ASA
* [R1-2107067](file:///C%3A%5CUsers%5CDocs%5CR1-2107067.zip) Enhancements to time and frequency synchronization for IoT NTN MediaTek Inc.
* [R1-2107173](file:///C%3A%5CUsers%5CDocs%5CR1-2107173.zip) Enhancement to time and frequency synchronization for NB-IoT/eMTC over NTN Nokia, Nokia Shanghai Bell
* [R1-2107247](file:///C%3A%5CUsers%5CDocs%5CR1-2107247.zip) Discussion on enhancements to time and frequency synchronization OPPO
* [R1-2107291](file:///C%3A%5CUsers%5CDocs%5CR1-2107291.zip) Enhancements to time and frequency synchronization to NB-IoT NTN FGI, Asia Pacific Telecom, III, ITRI
* [R1-2107430](file:///C%3A%5CUsers%5CDocs%5CR1-2107430.zip) Enhancements on time and frequency synchronization for IoT NTN CMCC
* [R1-2107619](file:///C%3A%5CUsers%5CDocs%5CR1-2107619.zip) On synchronization for NB-IoT and eMTC NTN Intel Corporation
* [R1-2107659](file:///C%3A%5CUsers%5CDocs%5CR1-2107659.zip) On time and frequency synchronization enhancements for IoT NTN Ericsson
* [R1-2107772](file:///C%3A%5CUsers%5CDocs%5CR1-2107772.zip) On Time and Frequency Synchronization in IoT NTN Apple
* [R1-2107779](file:///C%3A%5CUsers%5CDocs%5CR1-2107779.zip) Discussion on synchronization for IoT-NTN ZTE
* [R1-2107909](file:///C%3A%5CUsers%5CDocs%5CR1-2107909.zip) Discussion on time and frequency synchronization for IoT NTN Xiaomi
* [R1-2107942](file:///C%3A%5CUsers%5CDocs%5CR1-2107942.zip) Time and frequency synchronization for IoT NTN Lenovo, Motorola Mobility
* [R1-2108038](file:///C%3A%5CUsers%5CDocs%5CR1-2108038.zip) On Time/Frequency Synchronization for IoT NTN InterDigital, Inc.
* R1-2107069 "Summary #1 of AI 8.15.1 Enhancements to time and frequency synchronization for IoT NTN" MediaTek Inc.
* R1-2108338 "Summary #2 of AI 8.15.1 Enhancements to time and frequency synchronization for IoT NTN" MediaTek Inc.
* R1-2108348 "Summary #3 of AI 8.15.1 Enhancements to time and frequency synchronization for IoT NTN" MediaTek Inc.
* R1-2108430 "Summary #4 of AI 8.15.1 Enhancements to time and frequency synchronization for IoT NTN" MediaTek Inc.
* R1-2108516 "Summary #5 of AI 8.15.1 Enhancements to time and frequency synchronization for IoT NTN" MediaTek Inc.
* R1-2108558 "Summary #6 of AI 8.15.1 Enhancements to time and frequency synchronization for IoT NTN" MediaTek Inc.

Submitted TDocs to 8.15.2: Timing relationship enhancements

* [R1-2106486](file:///C%3A%5CUsers%5CDocs%5CR1-2106486.zip) Discussion on timing relationship enhancement for IoT in NTN Huawei, HiSilicon
* [R1-2106634](file:///C%3A%5CUsers%5CDocs%5CR1-2106634.zip) Discussion on timing relationship enhancements for NB-IoT/eMTC over NTN vivo
* [R1-2106720](file:///C%3A%5CUsers%5CDocs%5CR1-2106720.zip) Discussion on timing relationship enhancements for IOT NTN Spreadtrum Communications
* [R1-2106761](file:///C%3A%5CUsers%5CDocs%5CR1-2106761.zip) Timing relationship enhancements Qualcomm Incorporated
* [R1-2106824](file:///C%3A%5CUsers%5CDocs%5CR1-2106824.zip) Timing relationship enhancements for IoT-NTN Sony
* [R1-2106921](file:///C%3A%5CUsers%5CDocs%5CR1-2106921.zip) Timing relationship enhancements Samsung
* [R1-2106954](file:///C%3A%5CUsers%5CDocs%5CR1-2106954.zip) Timing relationship enhancement for IoT over NTN CATT
* [R1-2107048](file:///C%3A%5CUsers%5CDocs%5CR1-2107048.zip) On timing relationship enhancements Nordic Semiconductor ASA
* [R1-2107068](file:///C%3A%5CUsers%5CDocs%5CR1-2107068.zip) Timing relationship enhancements for IoT NTN MediaTek Inc.
* [R1-2107174](file:///C%3A%5CUsers%5CDocs%5CR1-2107174.zip) Timing relationship enhancements for NB-IoT/eMTC over NTN Nokia, Nokia Shanghai Bell
* [R1-2107248](file:///C%3A%5CUsers%5CDocs%5CR1-2107248.zip) Discussion on timing relationship enhancements OPPO
* [R1-2107292](file:///C%3A%5CUsers%5CDocs%5CR1-2107292.zip) Timing relationship enhancements to NB-IoT NTN FGI, Asia Pacific Telecom, III, ITRI
* [R1-2107431](file:///C%3A%5CUsers%5CDocs%5CR1-2107431.zip) Discussion on timing relationship enhancements for IoT NTN CMCC
* [R1-2107620](file:///C%3A%5CUsers%5CDocs%5CR1-2107620.zip) On timing relationship for NB-IoT and eMTC NTN Intel Corporation
* [R1-2107660](file:///C%3A%5CUsers%5CDocs%5CR1-2107660.zip) On timing relationship enhancements for IoT NTN Ericsson
* [R1-2107773](file:///C%3A%5CUsers%5CDocs%5CR1-2107773.zip) On Timing Relationship Enhancements in IoT NTN Apple
* [R1-2107780](file:///C%3A%5CUsers%5CDocs%5CR1-2107780.zip) Discussion on timing relationship for IoT-NTN ZTE
* [R1-2107910](file:///C%3A%5CUsers%5CDocs%5CR1-2107910.zip) Discussion on the timing relationship enhancement for IoT NTN Xiaomi
* [R1-2107943](file:///C%3A%5CUsers%5CDocs%5CR1-2107943.zip) Timing Relationship for IoT NTN Lenovo, Motorola Mobility
* [R1-2108039](file:///C%3A%5CUsers%5CDocs%5CR1-2108039.zip) On Timing relationship enhancement for IoT NTN InterDigital, Inc.
* **R1-2108397** FL summary #1 of AI 8.15.2: Timing relationships for IoT-NTN Moderator (Sony)
* **R1-2108493** FL summary #2 of AI 8.15.2: Timing relationships for IoT-NTN Moderator (Sony)
* **R1-2108519** FL summary #3 of AI 8.15.2: Timing relationships for IoT-NTN Moderator (Sony)

Submitted TDocs to AI 8.15.5: Others

* [R1-2106776](file:///C%3A%5CUsers%5CDocs%5CR1-2106776.zip) On LEO satellite flyover timing and discontinuous coverage Eutelsat S.A.
* [R1-2107175](file:///C%3A%5CUsers%5CDocs%5CR1-2107175.zip) Discussion on other aspects for NB-IoT/eMTC over NTN Nokia, Nokia Shanghai Bell
* [R1-2107661](file:///C%3A%5CUsers%5CDocs%5CR1-2107661.zip) Mobile IoT in the 5G future – NB-IoT and eMTC for NTN Ericsson
* [R1-2107676](file:///C%3A%5CUsers%5CDocs%5CR1-2107676.zip) Other aspects to support IoT in NTN Huawei, HiSilicon
* [R1-2107781](file:///C%3A%5CUsers%5CDocs%5CR1-2107781.zip) Discussion on additional enhancement for IoT-NTN ZTE
* [R1-2107911](file:///C%3A%5CUsers%5CDocs%5CR1-2107911.zip) Discussion on the other design aspects for IoT NTN Xiaomi

## 4.2 RAN2

**RAN2#115-e, 9th August – 27th August 2021**

Submitted TDocs to AI 9.2.1: Organizational

* [R2-2106929](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2106929.zip) Reply LS to LS on IoT-NTN basic architecture (R3-212806; contact: Qualcomm) RAN3 LS in Rel-17 LTE\_NBIOT\_eMTC\_NTN To:RAN2, SA2 Cc:RAN, CT1
* [R2-2108849](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108849.zip) LTE\_NBIOT\_eMTC\_NTN Work Plan MediaTek, Eutelsat work plan Rel-17 LTE\_NBIOT\_eMTC\_NTN work plan

Submitted TDocs to AI 9.2.2: Support of Non continuous coverage

* [R2-2109059](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2109059.zip) Summary of 9.2.2 Non continuous coverage, MediaTek Inc.
* [R2-2109201](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2109201.zip) Draft LS on supporting discontinuous coverage in IoT NTN, Mediatek LS out
* [R2-2107081](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107081.zip) Discussion on the support of discontinuous coverage for IoT over NTN, OPPO
* [R2-2107319](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107319.zip) Discussion on discontinuous coverage, CATT
* [R2-2107400](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107400.zip) UE behavior for Discontinuous coverage in NTN IoT, Rakuten Mobile, Inc
* [R2-2107424](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107424.zip) Discussion on non continuous coverage, Huawei, HiSilicon
* [R2-2107453](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107453.zip) On LEO satellite flyover timing and discontinuous coverage, Eutelsat S.A.
* [R2-2107559](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107559.zip) Support of non-continuous coverage, Qualcomm Incorporated
* [R2-2107613](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107613.zip) Support of discontinuous coverage, Apple
* [R2-2107765](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107765.zip) Support of discontinuous coverage in IoT NTN, ZTE Corporation, Sanechips
* [R2-2107913](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107913.zip) Enhancement for idle UE power saving in discontinuous coverage, Lenovo, Motorola Mobility
* [R2-2107914](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107914.zip) RRC connection handling for discontinuous coverage in IoT NTN Lenovo, Motorola Mobility
* [R2-2108116](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108116.zip) On support of Non continuous coverage, Nokia, Nokia Shanghai Bell
* [R2-2108171](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108171.zip) Discussion on discontinuous coverage, Xiaomi
* [R2-2108325](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108325.zip) Support of discontinuous coverage, NEC Telecom MODUS Ltd.
* [R2-2108336](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108336.zip) On Discontinuous coverage in IoT-NTN, MediaTek Inc.
* [R2-2108500](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108500.zip) Discussion on support of Non continuous coverage, CMCC
* [R2-2108740](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108740.zip) Discontinuous coverage in IoT NTN, Ericsson

Submitted TDocs to AI 9.2.3: User Plane Impact

* [R2-2109043](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2109043.zip) Summary of [AT115-e][037][IoT-NTN] User Plane Impact (OPPO), OPPO
* [R2-2107082](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107082.zip) Discussion on UP impact for IoT over NTN, OPPO
* [R2-2107320](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107320.zip) User Plane Impact for IOT NTN, CATT
* [R2-2107425](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107425.zip) User plane for IOT NTN Huawei, HiSilicon
* [R2-2107614](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107614.zip) Provision of ephemeris Apple discussion
* [R2-2107766](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107766.zip) User plane aspects of IoT NTN, ZTE Corporation, Sanechips
* [R2-2107915](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107915.zip) Further enhancement for PUR in IoT NTN Lenovo, Motorola Mobility
* [R2-2108117](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108117.zip) Discussion on User Plane impact for IoT NTN Nokia, Nokia Shanghai Bell
* [R2-2108335](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108335.zip) On User-Plane Timers in NB-IoT based NTN MediaTek Inc. discussion
* [R2-2108454](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108454.zip) User plane aspects of NB-IoT and LTE-M in NTNs Ericsson discussion
* [R2-2108529](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108529.zip) User plane for IoT-NTN CMCC

Submitted TDocs to AI 9.2.4.1: TA and Mobility related

* [R2-2109093](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2109093.zip) Summary of AI 9.2.4.1 TA and Mobilty related, Ericsson
* [R2-2109176](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2109176.zip) Summary of AI 9.2.4.1 “TA and Mobility related” (Ericsson) - Ph2, Ericsson
* [R2-2107083](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107083.zip) Discussion on CP impact for IoT over NTN, OPPO
* [R2-2107084](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107084.zip) Discussion on idle mode procedures for IoT over NTN, OPPO
* [R2-2107321](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107321.zip) Discussion on connected mode UE of IoT NTN, CATT
* [R2-2107322](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107322.zip) Discussion on IDLE mode UE of IoT NTN, CATT
* [R2-2107371](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107371.zip) Discussion on the issue of mobility for IoT over NTN, Spreadtrum Communications
* [R2-2107426](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107426.zip) TA and mobility for IOT NTN Huawei, HiSilicon
* [R2-2107562](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107562.zip) TAC update procedure Qualcomm Incorporated,
* [R2-2107767](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107767.zip) Mobility issues of IoT NTN, ZTE Corporation, Sanechips
* [R2-2107813](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107813.zip) Analysis on mobility aspects for IoT-NTN, Nokia, Nokia Shanghai Bell
* [R2-2107916](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107916.zip) Considerations on NB-IoT mobility for IoT NTN, Lenovo, Motorola Mobility
* [R2-2108018](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108018.zip) Discussion on connected mode mobility for IoT NTN Xiaomi Communications
* [R2-2108172](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108172.zip) Discussion on TA and idle mode mobility enhancement Xiaomi
* [R2-2108328](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108328.zip) Mobility enhancement for IoT-NTN NEC Telecom MODUS Ltd.
* [R2-2108338](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108338.zip) On Cell Re-selection in IoT-NTN MediaTek Inc.
* [R2-2108339](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108339.zip) On Improving Tracking Area Updates in IoT NTN MediaTek Inc.
* [R2-2108546](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108546.zip) Enhanced RRC re-establishment for mobility in IoT-NTN, CMCC
* [R2-2108548](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108548.zip) Discussion on TA Update for IoT-NTN, CMCC
* [R2-2108757](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108757.zip) Mobility for NB-IoT and LTE-M in NTN, Ericsson

Submitted TDocs to AI 9.2.4.2: Other

* [R2-2107427](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107427.zip) Control plane - Other for IOT NTN, Huawei, HiSilicon
* [R2-2107560](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107560.zip) Recovery of synchronization in RRC\_CONNECTED, Qualcomm Incorporated
* [R2-2107561](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107561.zip) UL synchronization and Paging response delay, Qualcomm Incorporated
* [R2-2107768](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107768.zip) Other control plane aspects of IoT NTN ZTE Corporation, Sanechips
* [R2-2107814](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107814.zip) On Paging and idle mode cell reselection enhancements for IoT-NTN, Nokia, Nokia Shanghai Bell
* [R2-2107988](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107988.zip) Consideration on RRC release for IOT NTN, Beijing Xiaomi Mobile Software
* [R2-2108750](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108750.zip) SIB acquisition during cell reselection in IoT NTN Ericsson

## 4.3 RAN3

**RAN3#113-e, 13th August – 26th August 2021, e-meeting**

***END***