**3GPP TSG RAN meeting #102 RP-23xxxx**

**Edinburg, GB, December 11-15, 2023**

## Status Report to TSG

**Agenda item:** 10.2.1 IoT (Internet of Things) NTN (non-terrestrial network) enhancements

|  |  |
| --- | --- |
| **WI / SI Name** | IoT (Internet of Things) NTN (non-terrestrial network) enhancements |
| included in this status report | Study Item: No | Core part: Yes | Performance part:Yes | Testing part:- |
| **Acronym** | IoT\_NTN\_enh |
| **Unique ID** | 941004 |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-231407 |
| **Target Completion Date****(indicate if changed)** | Study Item:  | Core part:12/2023  | Performance part: 06/2024 | Testing part: - |
| **Overall Completion level** | Study Item:  | Core part: Overall: 100%For informationRAN1: 100% RAN2: 100%RAN3: 100%RAN4: 100% | Performance Part: 10% | Testing part: - |

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

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

**Source:**

|  |  |
| --- | --- |
| **Leading WG** | RAN2 |
| **Rapporteur** | **Name** | Abhishek Roy |
| **Company** | MediaTek |
| **Email** | abhishek.roy@mediatek.com  |
| **Secondary WG** | RAN2 |

## 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#114-bis, October 9th – October 13th, 2023, Xiamen, China**

**Agreements on “8.13.3 Disabling of HARQ feedback for IoT NTN”**

Agreement

Confirm the following working assumptions from RAN1#113:

For single TB scheduled by DCI,

* Working assumption 2 For Option 1 + Option 3 DCI based overridden mechanism, for a HARQ process configured as HARQ feedback disabled by per-HARQ process bitmap signaling and further reversed to HARQ feedback enabled by DCI, the NBIoT UE does not wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH for the same HARQ process (or monitoring any NPDCCH for the case of single HARQ process configuration).

Agreement

The TP1b in section 13 of [R1-2310356](file:///U%3A%5Cwork%5CR17-R18%20NTN%5CDocs%5CR1-2310356.zip) is endorsed for TS36.213 clause 7.3.

Agreement

The TP2b in [R1-2310356](file:///U%3A%5Cwork%5CR17-R18%20NTN%5CDocs%5CR1-2310356.zip) is endorsed for TS36.213 clause 16.4.2.

Agreement

There is ambiguity for definition of *NTB* in clause 7.1.7.1 and 10.2 as follows:

* For clause 10.2: *NTB* is the number of TBs with HARQ feedback enabled
* For clause 7.1.7.1: *NTB* is the number of scheduled TBs

It is recommended to the spec editor of TS36.213 to resolve that ambiguity accounting for HARQ feedback enabling/disabling.

**Agreements on “8.13.4 Improved GNSS operations for IoT NTN”**

Agreement

When timeAlignmentTimer is infinity, the duration X is equal to Y. Network can configure Y via a 3-bit field at least with component values [sf500, sf750, sf1280, sf1920, sf2560, sf5120, sf10240].

FFS: whether there is a new value.

Agreement

The feature of *“UL transmission after original validity duration expires with duration X”* can be enabled/disabled by network via RRC signalling.

Agreement

For the aperiodic GNSS measurement gap triggered by eNB with MAC CE, the start time of the gap should be at p+ X2, where p is the end of HARQ feedback transmission subframe/slot when HARQ feedback for the MAC CE is enabled and X2 is a predefined value, down select

* Alt- A: X2 = 1ms
* Alt- B: X2 = 2ms
* Alt- C: X2 = 3ms
* Alt- E: X2 = 1ms for NB-IoT, X2 = 4ms for eMTC

Agreement

New texts for GNSS measurement gaps for NB-IoT and eMTC in TS36.213 should be added to capture the determination of the start time of GNSS measurement gap triggered by MAC CE.

Agreement

For the aperiodic GNSS measurement gap triggered by eNB with MAC CE, the start time of the gap should be at p+ X2, where p is the end of HARQ feedback transmission subframe/slot when HARQ feedback for the MAC CE is enabled and X2 is predefined value, where X2 = 2ms.

Agreement

Endorsed the TP below for TS36.213, and leave it to the spec editor whether to create new clauses for this TP and if so to decide the title of the new clauses.

* **Reason for change:** In the TS 36.213 v18.0.0, the determination of the start time of GNSS measurement gap triggered by MAC CE for IoT NTN is not captured.
* **Summary of change:** Introduce the determination of the start time of GNSS measurement gap triggered by MAC CE for IoT NTN in TS36.213.
* **Consequence if not approved:** The RAN1 agreements for the start time of GNSS measurement gap triggered by MAC CE are not captured in specification.

|  |
| --- |
| ================== Start of TP #1 for TS 36.213 ===================< Unchanged parts are omitted >**16.10** **[GNSS measurement gap related procedures for a NB-IoT UE]**For a NB-IoT UE in a NTN FDD serving cell, when the UE receives a GNSS Measurement Command MAC CE in a NPDSCH ending in DL subframe *n** if the UE shall not provide HARQ-ACK information for the HARQ process associated with the transport block in the NPDSCH carrying the GNSS Measurement Command MAC CE,
	+ the UE shall assume the start of the measurement gap in subframe *n*+12;
* otherwise,
	+ the UE shall assume the start of the measurement gap in subframe *k+*2, where *k* is the first DL subframe after the end of the transmission of the NPUSCH carrying ACK/NACK response for the HARQ process associated with the transport block in the NPDSCH.

< Unchanged parts are omitted >**18** **[GNSS measurement gap related procedures for a BL/CE UE]**For a BL/CE UE in a NTN FDD serving cell, when the UE receives a GNSS Measurement Command MAC CE in a PDSCH ending in DL subframe *n** if the UE shall not provide HARQ-ACK information for the HARQ process associated with the transport block in the PDSCH carrying the GNSS Measurement Command MAC CE,
	+ the UE shall assume the start of the measurement gap in subframe *n*+6;
* otherwise,
	+ the UE shall assume the start of the measurement gap in subframe *k+*2, where *k* is the first DL subframe after the end of HARQ-ACK transmission for the HARQ process associated with the transport block in the PDSCH.

================End of TP #1 for TS 36.213 =================== |

**RAN1#115, November 13th – November 17th, 2023, Chicago, USA**

**Agreements on “8.13.3 Disabling of HARQ feedback for IoT NTN”**

Agreement

When multiple TBs are scheduled by a single DCI:

* For Option 1 + Option 3 DCI based overridden mechanism, when DCI indicates HARQ feedback enabled, then the NB-IoT UE always wait for an RTT+3ms (i.e., till subframe n+Kmac+3 in TS36.213 section 16.6) before monitoring NPDCCH.

Agreement

It is up to editor to select TP 2-2b or TP 2-3a in section 7 of R1-2312389 to be endorsed for TS36.213 clause 7.3.

Agreement

The TP 4-1c in section 8 of R1-2312460 is endorsed for TS36.213 clause 7.3.1.

**Agreements on “8.13.4 Improved GNSS operations for IoT NTN”**

Agreement

Modify X1 value of RAN1#114 agreement on start time of GNSS measurement gap as below and endorse the corresponding TP below:

For the aperiodic GNSS measurement gap triggered by eNB with MAC CE, the start time of the gap should be at n+ X1, where n is the end of MAC CE receiving subframe/slot when HARQ feedback for the MAC CE is disabled

* X1=12ms for NB-IoT
* X1=5ms for eMTC

**Reason for change:**

In the endorsed CR R1-2310771 Clause 16.10, the starting point of a measurement gap is counted from the starting point of last subframe carrying triggering MAC CE, which is one subframe early than the agreement in RAN1#114. To keep the same time budget for processing the triggering MAC CE, the starting point of measurement gap should be in subframe n+13 for NB-IoT.

**Summary of change:**

Change the start of the measurement gap in subframe n+13 if UE shall not provide HARQ-ACK information for the NPDSCH carrying the triggering MAC CE.

**Consequence if not approved:**

The RAN1 agreement for GNSS measurement is not captured correctly in specification.

|  |
| --- |
| ========================= Start of TP #1 for TS 36.213 =========================< Unchanged parts are omitted >**16.10 GNSS measurement gap related procedures**For a NB-IoT UE in a NTN FDD serving cell, when the UE receives a GNSS Measurement Command MAC CE in a NPDSCH ending in DL subframe *n*,- if the UE shall not provide HARQ-ACK information for the HARQ process associated with the transport block in the NPDSCH carrying GNSS Measurement Command MAC CE,- the UE shall assume the start of the measurement gap in subframe *n*+13- otherwise,- the UE shall assume the start of the measurement gap in subframe *k*+2, where *k* is the first DL subframe after the end of the transmission of the NPUSCH carrying ACK/NACK response for the HARQ process associated with the transport block in the NPDSCH.============================= End of TP #1 for TS 36.213 ============================= |

Agreement

Delete the TBD length in the value range column of higher layer parameters downlinkHARQ-FeedbackDisabled-Bitmap and downlinkHARQ-FeedbackDisabled-Bitmap-NB for R18 IoT NTN as follows:

|  |  |  |
| --- | --- | --- |
| **Parameter name in the text** | **Description** | **Value range** |
| downlinkHARQ-FeedbackDisabled-Bitmap | Used to disable the DL HARQ feedback, sent in the uplink, per HARQ process ID | Bitmap  |
| downlinkHARQ-FeedbackDisabled-Bitmap-NB | Used to disable the DL HARQ feedback, sent in the uplink, per HARQ process ID | Bitmap  |

Agreement

Add new higher layer parameters ULTransmissionExtension and ULTransmissionExtension-NB for R18 IoT NTN as follows:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **RAN1 specification** | **Section** | **RAN2 Parent IE** | **RAN2 ASN.1 name** | **Parameter name in the spec** | **New or existing?** | **Parameter name in the text** | **Description** | **Value range** | **Default value aspect** | **Per (UE, cell, TRP, …)** | **Required for initial access or IDLE/INACTIVE** | **Specification** | **Comment** |
| IoT\_NTN\_enh-Core | UL transmission after original GNSS validity duration expires for eMTC | 36.213 | 　 | 　 | 　 | ULTransmissionExtension | New | ULTransmissionExtension | “UL transmission after original GNSS validity duration expires with duration X” is enabled/disabled by network. | BOOLEAN |   | per UE | No | 36.331 | 　 |
| IoT\_NTN\_enh-Core | UL transmission after original GNSS validity duration expires for NB-IoT | 36.213 | 　 | 　 | 　 | ULTransmissionExtension-NB | New | ULTransmissionExtension-NB | “UL transmission after original GNSS validity duration expires with duration X” is enabled/disabled by network. | BOOLEAN |   | per UE | No | 36.331 | 　 |

Agreement

From RAN1 perspective, the start time of duration X is at the point where original GNSS validity duration expires

* when timeAlignmentTimer is infinity, the end of X is at the point where new timer ULTransmissionExtentionTimer expires and ULTransmissionExtentionTimer is reset with length equal to Y every time when a MAC CE (to be defined by RAN2) is received
	+ Note 1: It is up to RAN2 to decide whether the MAC CE is the legacy TAC or a new TAC or a new MAC CE.
* Note 2: It is up to RAN2 to implement the above behaviour based on new timer, existing timer, or by extending GNSS validity.
* Send an LS to RAN2

R1-2312696 LS on improved GNSS operations in Rel-18 IoT NTN Moderator (MediaTek Inc.)

Agreement

TP#2 in section 4.2.5 of R1-2312299 is endorsed for TS36.213 Clause 16.10 and Clause 18.

Agreement

Add new higher layer parameter ul-TransmissionExtensionValue for eMTC and NB-IoT for R18 IoT NTN as follows:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **RAN1 specification** | **Section** | **RAN2 Parent IE** | **RAN2 ASN.1 name** | **Parameter name in the spec** | **New or existing?** | **Parameter name in the text** | **Description** | **Value range** | **Default value aspect** | **Per (UE, cell, TRP, …)** | **Required for initial access or IDLE/INACTIVE** | **Specification** | **Comment** |
| IoT\_NTN\_enh-Core | UL transmission after original GNSS validity duration expires for eMTC | 36.213 | 　 | 　 | 　 | ul-TransmissionExtensionValue | New | ul-TransmissionExtensionValue | Indicates the duration after original GNSS validity duration expires within which UL transmission is allowed. Value in number of sub-frames, value sf500 corresponds to 500 sub-frames, sf750 corresponds to 750 sub-frames and so on. | {sf500, sf750, sf1280, sf1920, sf2560, sf5120, sf10240, spare1} |   | per UE | No | 36.331 | 　 |
| IoT\_NTN\_enh-Core | UL transmission after original GNSS validity duration expires for NB-IoT | 36.213 | 　 | 　 | 　 | ul-TransmissionExtensionValue-NB | New | ul-TransmissionExtensionValue | Indicates the duration after original GNSS validity duration expires within which UL transmission is allowed. Value in number of sub-frames, value sf500 corresponds to 500 sub-frames, sf750 corresponds to 750 sub-frames and so on. | {sf500, sf750, sf1280, sf1920, sf2560, sf5120, sf10240, spare1} |   | per UE | No | 36.331 | 　 |

#### Remaining Open issues

## 2.2 RAN2

#### 2.2.1 Agreements

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

**Agreements on “7.6.2.1 HARQ Enhancements”**

Agreements:

* For NB-IoT UEs configured with two HARQ processes and at least one of them is configured with HARQ feedback disabled, RAN2 does not change the operation on drx-InactivityTimer for single-TB scheduling case.
* For a HARQ process configured as HARQ feedback disabled by RRC and further reversed to HARQ feedback enabled by DCI, UE behaviour on DRX follows the case when HARQ feedback is disabled.
* For multiple UL TBs scheduling, it is up to network implementation to configure multiple TBs using HARQ processes in the same or different HARQ modes. Start time for UL HARQ RTT timer for mode A will not change
* For multiple TB scheduling with the same HARQ feedback enabled/disabled configuration (by RRC/DCI), HARQ RTT Timer for HARQ process with HARQ feedback enabled is calculated as legacy (can further check in offline 308)
* For multiple TB scheduling with mixed HARQ feedback enabled/disabled configuration (by RRC), if HARQ-ACK bundling is configured, HARQ RTT Timer for HARQ process with HARQ feedback enabled is calculated as legacy.
* HARQ mode configuration is not applicable for PUR in IoT NTN
* For NB-IoT UE configured with two HARQ processes and at least one of them is configured with HARQ mode B, RAN2 does no change to the operation on drx-InactivityTimer for single TB scheduling case.
* For eMTC over NTN with HARQ process configured with HARQ mode B, there is no need to change drx-InactivityTimer operation.
* For NB-IoT, for a HARQ process configured as HARQ feedback enabled by RRC and further reversed to HARQ feedback disabled by DCI, UE behaviour on DRX follows the case when HARQ feedback is disabled (e.g., not start the corresponding DL HARQ RTT Timer for this HARQ process, and for NB-IoT NTN with single HARQ processes, start drx-InactivityTimer in the subframe containing the last repetition of the PDSCH plus 12 subframes plus deltaPDCCH).
* For multiple TB scheduling with the same HARQ feedback enabled configuration at least by RRC, HARQ RTT Timer for HARQ process with HARQ feedback enabled is calculated as legacy.
* In Rel-18 IoT NTN, if a NB-IoT UE receives a PDCCH indicating the transmission for multiple DL TBs, UE stops drx-InactivityTimer as legacy, regardless of the enabling/disabling HARQ feedback configuration for each of the multiple scheduled TB.
* For UL multiple TB scheduling, UE only starts the UL HARQ RTT Timer for the HARQ process(es) with HARQ mode A.
* In Rel-18 IoT NTN, if a NB-IoT UE receives a PDCCH indicating the transmission for UL multiple TBs, UE stops drx-InactivityTimer as legacy, regardless of the HARQ mode configuration for each of the multiple scheduled TB.
* HARQ feedback enabled/disabled and HARQ mode configuration related to SPS are already perfectly captured by the NOTE in stage-2 running CR (no further spec changes are needed)

**Agreements on “7.6.2.2 GNSS Operation Enhancements”**

* A new RRC parameter is introduced in dedicated RRC signalling to enable/disable duration X.
* A new RRC parameter is introduced in dedicated RRC signalling to configure duration Y when timeAlignmentTimer is infinity.
* GNSS Duration Report MAC CE will not trigger SR; instead CBRA will be used.
* A reserved LCID will be used for GNSS measurement command MAC CE (in DL).
* GNSS measurement validity duration report MAC CE priority is in-between TAR MAC CE and BSR MAC CE.
* The following update in NOTE in Stage 2 running CR is agreed:

NOTE: The AS operations (e.g. RLM related timers, dataInactivityTimer, CHO execution, neighbour cell measurement, RACH, SR, and BSR) are suspended when UE is performing GNSS measurement during GNSS measurement gap and resumed when the GNSS measurement is finished

* The following update in NOTE in Stage 2 running CR is agreed ((FFS whether to suspend T317, T318 during measurement gap):

NOTE: The AS operations (e.g. RLM related timers, dataInactivityTimer, CHO execution, neighbour cell measurement, RACH, SR, and BSR) are suspended when UE is performing GNSS measurement during GNSS measurement gap

* For both network-triggered and UE-autonomous Measurement Gap Length Configuration: Use MAC CE (with 1 bit indication to differentiate the two cases) (FFS if a RRC configuration is needed for NW trigger case)

**Agreements on “7.6.3 Mobility Enhancements”**

* Upon absence of satellite IDs for intra-frequency, the UE assumes Rel-17 behavior for intra-frequency measurements, i.e., measurement according to UE implementation.
* Upon absence of satellite IDs for inter-frequency, the UE assumes Rel-17 behavior for inter-frequency measurements, i.e., measurement according to UE implementation.
* RAN2 understands that if SIBxx is present, then satellite IDs in either SIB3, SIB5 or both SIB3 and SIB5 should be present (up to NW implementation, no spec impact)
* Satellite assistance information is provided per frequency, and not associated with PCIs. The satellite IDs for intra-frequency measurements are in SIB3 as in the current running CR (no need to place them into SIB4).
* Introduce satellite ID for serving satellite (in SIB31) as well. RAN2 does not consider implicitly reusing serving satellite assistance information.
* t-ServiceStartNeigh is signalled per satellite
* Separate reference locations are introduced for earth-quasi fixed cells and earth-moving cells.
* Working assumption:
* Adopt the same decision as for NR NTN to discriminate whether a frequency is for TN or NTN

**Agreements on “7.6.4 Enhancements to discontinuous coverage”**

* Provide carrier frequency for the existing satellite list in SIB32 to facilitate cell selection and reduce service interruption after an NTN coverage gap (FFS if the information can be considered as valid after the validity of SI)

**RAN2#124, November 13th – November 17th, 2023, Chicago, USA**

**Agreements on “7.6.2.1 HARQ Enhancements”**

Agreements:

* For multiple TB scheduling with mixed HARQ feedback enabled/disabled configuration, if HARQ-ACK bundling is not configured, HARQ RTT Timer for HARQ process with HARQ feedback enabled is calculated based on the number of scheduled TBs with HARQ feedback enabled.
* For DL multiple TB scheduling for a NB-IoT UE, if both HARQ processes are with disabled HARQ feedback, UE starts drx-InactivityTimer in the subframe containing the last repetition of the PDSCH corresponding to the last scheduled TB plus 12 subframes plus deltaPDCCH.
* For UL multiple TB scheduling for a NB-IoT UE, if both HARQ processes are configured with HARQ mode B, UE starts drx-InactivityTimer in the subframe containing the last repetition of the PUSCH corresponding to the last scheduled TB plus 1 subframe plus deltaPDCCH.
* RAN2 confirms that for both single TB scheduling and multiple TB scheduling. for a HARQ process configured as HARQ feedback enabled by RRC and further reversed to HARQ feedback disabled by DCI, UE behaviour on DRX follows the case when HARQ feedback is disabled.

**Agreements on “7.6.2.2 GNSS Operation Enhancements”**

Agreements:

* Upon start of GNSS measurement, UE keeps T317 running if it is currently running.
* If T317 expires during GNSS measurement gap, the SIB31 reacquisition and also T318 are not started until after GNSS measurement completion.
* Upon start of GNSS measurement, T318 needs to be stopped if it is currently running. The T318 is restarted after GNSS measurement completion.
* The duration X is not used to extend the original GNSS validity duration but at least to perform uplink transmission
* If UL transmission extension is enabled, e.g., ul-TransmissionExtensionEnabled is set to TRUE:

- If no indication of network triggered GNSS measurement is received from lower layers and gnss-AutonomousEnabled is not configured, upon duration X expires, UE moves to idle mode.

- If no indication of network triggered GNSS measurement is received from lower layers and gnss-AutonomousEnabled is configured, upon duration X expires, UE keeps in RRC\_CONNECTED and triggers autonomous GNSS measurement.

* For both NB-IoT and eMTC over NTN, either we use the remaining LCID value for GNSS validity duration report MAC CE or we repurpose one of the existing codepoint.
* The start time of duration X is at the point where original GNSS validity duration expires (The wording can be rephrased based on how to capture it).
* If an indication of network triggered GNSS measurement is received from lower layers within duration X, UE triggers GNSS measurement (no specification impact).
* For both NB-IoT and eMTC over NTN, use the remaining LCID value for GNSS validity duration report MAC CE.
* UE may use the outdated GNSS position within the duration X at least for mobility. The network can limit the number of times X is extended and/or the value of X (can check if we need some different behaviour to handle the CHO in Earth Moving Cell case)
* For the case when timeAlignmentTimer is infinity, a (legacy/new) MAC CE is introduced/used to reset ULTransmissionExtentionTimer with length equal to Y).

**Agreements on “7.6.3 Mobility Enhancements”**

Agreements:

* For NB-IoT NTN, it is up to UE implementation which frequencies to be measured/prioritized in RRC\_CONNECTED
* Same as NR NTN, the network does not configure the location-based CHO and time-based CHO simultaneously for the same candidate cell.
* For both RRC\_CONNECTED and RRC\_IDLE, time/location based neighbour cell measurement triggering can be configured together with the existing RSRP based triggering. If configured jointly, the UE starts measure neighbour cell when either of the triggering condition is met.
* UE may acquire SIBxx during T318.
* Clarify in the spec that RLF is not triggered if T318 expires and SIB31 has been obtained.
* UE stops T318 when both SIB31 and SIBxx have been acquired. If the UE hasn’t finished acquiring SIBxx during T318, UE aborts the acquisition of SIBxx and resumes UL operations.
* UE discriminates whether a frequency is for TN or NTN in an implicit way, i.e., if the SIBxx is present and the satellite ID is absent for a frequency in SIB5, the UE assumes TN frequency measurement. If the SIBxx is present and the satellite ID is present for a frequency in SIB5, but the same satellite ID is absent in the SIBxx, the UE is not required to measure this frequency.
* eMTC UEs in NTN should use MeasObject(s) for performing measurements based on time/location criteria.
* We introduce the possibility to broadcast neighbor NTN cell information (SIBXX) in a TN cell (We remove the restriction in 36.331 that SIBXX can only be sent in a NTN cell. No changes expected to other Stage 3 specs)
* For CHO in EMC a new event is introduced.
* New event comprises a reference location and distance threshold for source and target cell.
* Ephemeris and epochTime information for candidate CHO cell is also provided in RRC Reconfiguration (configuring the CHO) within the configuration prepared by the source cell (outside of the new event).

**Agreements on “7.6.4 Enhancements to discontinuous coverage”**

* Capture a NOTE in RRC Spec “UE may directly go to RRC\_IDLE after RLF is triggered if there is not enough time for the UE to finish the procedure of RRC re-establishment due to the discontinuous coverage” (actual wording can be further discussed in the CR review). We leave it to UE implementation on how to evaluate whether there is “enough time” or not
* UE should apply early stop of T310 and go to RRC\_IDLE state upon expiry of t-Service for the discontinuous coverage scenario.
* UE should apply early stop of T310 and go to RRC\_IDLE, if it becomes out of the current serving cell coverage for the discontinuous coverage scenario.
* UE behavior on how to use the frequency information in SIB32 for cell selection in discontinuous coverage scenario should be captured in TS 36.304. (discuss exact wording as part of the 38.304 CR review)
* For discontinuous coverage, explicit RRC Release using a new RRC Release cause is not supported.

#### 2.2.2 Remaining Open issues

* All WI RAN2 objectives are completed, with some pending clarifications, which will be discussed as part of maintenance activity:
	+ Update 36.300, 36.321 and 36.331 CRs considering the following aspects:
		- DRX inactivity timer starting during HARQ enabling/disabling in multi-TB scheduling (DL and UL).
		- Select new or existing MAC CE for time alignment timer (X and/or Y) handling in GNSS improvement.

## 2.3 RAN3

#### 2.3.1 Agreements

**RAN3#121bis, October 9th – October 13th, 2023, Xiamen, China**

**Agreements on “18.2 Support discontinuous coverage”**

* Miscellaneous correction on the BL CRs.

#### 2.3.2 Remaining Open issues

* All WI RAN3 objectives are completed, no critical outstanding issues. Any further clarifications will be discussed as part of maintenance activity (if needed).

## 2.4 RAN4

#### 2.4.1 Agreements:

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

Core Part - RRM

*Sub-Topic 1: K\_satellite and other general issue*

Agreement:

* For Idle mode, each frequency carrier
	+ Ksatellite =2, if there are at least two NGSO satellites (including UE serving satellite) to be monitored by UE in this frequency carrier
	+ Ksatellite =1, if there is only one NGSO satellite to be monitored in this frequency carrier
* For Connected mode, each frequency carrier
	+ Ksatellite =2, if there are ~~at least~~ two NGSO satellites (including UE serving satellite) to be monitored by UE in this frequency carrier
	+ Ksatellite =1, if there is only one NGSO satellite to be monitored in this frequency carrier

Issue 1-1-2: K\_satellite for NGSO and t-ServiceStart(Neigh)

Agreement:

* For Ksatellite, all neighbor cell of neighboring NGSO satellite are not considered to be monitored before t-serviceStart(Neigh) if t-serviceStart(Neigh) is configured.

*Sub-Topic 2: IDLE mode measurements*

Issue 2-2: Location-based triggering cell reselection measurements

Agreement:

* For IDLE mode neighbour cell measurements for eMTC and NB-IoT, the location-based measurement initiation condition for NR-NTN in R18 (in clause 4.2C.2.3 and 4.2C.2.4 in TS 38.133) can be reused with necessary modifications of parameters names
* Note:
	+ Requirements apply for quasi-fixed cell and earth-moving cell
		- For defining the requirements for earth-moving cell, further discuss based on the agreement from R18 NR NTN.
	+ margin for distanceThresh is discussed in other issue

*Sub-Topic 3: CONN mode measurements*

Issue 3-0 (new): For NGSO, neighbor NGSO satellite measurement in connected mode

Discuss the following options until next meeting:

* Option 1: For NB-IoT, best effort measurement for inter-satellite neighbor NGSO satellite for intra-frequency measurement, similar to inter-frequency.
* Option 2: other options are not precluded.

Issue 3-1: K\_satellite, update NB-IoT inter-frequency measurement in connected mode

Agreement:

* NTN NB-IoT inter-frequency measurement in connected mode, update Tdetect\_inter NB1-NC and Tmeasure \_inter NB1-NC as
	+ $T\_{detect\\_inter\\_NB1-NC}=\sum\_{i}^{N\*K\\_satellite}Min(5000, T\_{a,i})$ ms
	+ $T\_{measure\\_inter\\_NB1-NC}=\sum\_{i}^{M\*K\\_satellite}Min(5000, T\_{b,i})$ ms

Issue 3-2-1: Time-based triggering Neighbour cell measurements in connected mode for NB-IoT - requirement

Agreement:

* For NB-IoT, time-based (t-Service) measurement initiation requirements apply to earth fixed cell.
	+ RAN4 understand that the exact time for UE to start the measurement is up to UE implementation according to RAN2.
	+ FFS whether to capture the exact time for UE to start the measurement in RAN4 requirements.
* For earth moving cell, UE shall initiate the measurement before losing its coverage and this needs to reflected in RAN4 requirements.
	+ RAN4 understand that the exact time for UE to start the measurement is up to UE implementation according to RAN2.
	+ FFS whether to capture the exact time for UE to start the measurement in RAN4 requirements.

Issue 3-3-1: Time-based triggering Neighbour cell measurements in connected mode for eMTC – applicability

Agreement:

* For eMTC, time-based (t-Service) measurement initiation requirements apply to earth fixed cell.
	+ RAN4 understand that the exact time for UE to start the measurement is up to UE implementation according to RAN2.
	+ FFS whether to capture the exact time for UE to start the measurement in RAN4 requirements.
* For earth moving cell, UE shall initiate the measurement before losing its coverage and this needs to reflected in RAN4 requirements.
	+ RAN4 understand that the exact time for UE to start the measurement is up to UE implementation according to RAN2.
	+ FFS whether to capture the exact time for UE to start the measurement in RAN4 requirements.
* Further discuss for time-based neighbor cell measurement, requirements apply for the eMTC UE provided the measurement gaps are configured.

Issue 3-3-2: Time-based triggering Neighbour cell measurements in connected mode for eMTC – Trigger

Agreement:

* Trigger is defined as Max (Tidentify\_intra\_UE cat M1­, Tidentify\_inter\_UE cat M1)

Issue 3-4-2: Location-based triggering Neighbour cell measurements in connected mode – requirement

FFS:

* For CONNECTED mode location-based triggering of neighbour cell measurements for eMTC and NB-IoT, add the location-conditions ~~to the existing list of conditions~~ to trigger the neighbor cell measurements. But the delay requirements remain same
	+ Note: for eMTC, it needs to consider measurement gap. How to capture it should be discussed in the CR phase.

Agreement:

* For NB-IoT, CONNECTED mode, UE shall perform measurement when location condition is met. And the existing delay requirements apply.

FFS eMTC, whether measurement gap should be provided.

Issue 3-5 (new): Time-based triggering Neighbour cell measurements in connected mode for eMTC – impact on measurement gap

Discuss until the next meeting:

* If *t-ServiceStartNeigh* is provided, measurement gap pattern(s) configured for neighbour cell measurements are suspended until time *t-ServiceStartNeigh*.

*Sub-Topic 4: eMTC, CHO*

Issue 4: For eMTC, CHO requirements

Agreement:

* Introduce CHO requirements for NTN eMTC with time and location-based trigger conditions. DCHO = TRRC + Tmeasure + TEvent\_DU +Tinterrupt + TCHO\_execution

Where:

* + TRRC is the RRC procedure delay
	+ TEvent\_DU is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until the time/location condition fulfilled.
	+ Tmeasure is the measurements time. Tmeasure=0 if only *condEventD1* or *condEventT1* is configured.
	+ TCHO\_execution is the conditional execution preparation time
	+ Tinterrupt is the interruption time.
	+ FFS Update Tinterrupt to include Tsearch, based on handover interruption requirement as in
		- 5.5A.2.1.2 Interruption time for CEMode A
		- 5.5A.3.1.2 Interruption time for CEMode A

*Sub-Topic 5: GNSS re-acquisition gap in connected mode*

Issue 5-1&5-2: GNSS gap, spec impact

Discuss the following options until next meeting.

* Option 1: add generic description that the measurement delay could be longer if GNSS fix happens during measurement period.
* Option 2: The measurement delay requirements are extended by the duration of the GNSS-MG.
	+ When the UE triggers an early termination of the GNSS-MG, the measurement delay requirements are extended by the duration of the early-terminated GNSS-MG.
* Option 3: The measurement delay requirements are suspended until the termination of the GNSS-MG.

Issue 5-3: GNSS gap for eMTC, overlapping between MG and GNSS gap

Agreement:

* If gaps configured for reacquiring GNSS and gaps configured for mobility measurements at least partially overlaps in time with other, then UE shall suspend the gaps configured for mobility measurements and instead prioritize the use of GNSS gaps
	+ Note: it considers as no overlapping between GNSS-MG and gaps configured for mobility measurements after the UE has performed early termination of GNSS-MG.

*Sub-Topic 6: CR split*

|  |  |  |  |
| --- | --- | --- | --- |
| **UE Cat** | **Requirement** | **Clause in TS36.133** | **Volunteer** |
| NB-IoT | IDLE mode measurements | 4.6A | MTK |
|   | CONNECTED mode measurement on neighbour cells  | (New) 8.14A.X1 | Nokia |
|   | GNSS re-acqusition impact related, e.g. RLM, ... | … | Huawei |
| Cat M1 | IDLE mode measurements | 4.7A | Huawei |
|   | CONNECTED mode measurement on neighbour cells | 8.13A | Nokia |
|   | conditional HO for Cat-M1  | 5.5A.2.3/4 (CEModeA)5.5A.3.3/4 (CEModeB) | CMCC |
|   | GNSS re-acqusition impact related, e.g. RLM, ... | ... | Ericsson |

**RAN4#109, November 13th – November 17th, 2023, Chicago, USA**

Core Part - RRM

*Sub-Topic 1-1: IDLE mode measurements*

Issue 1-1-1: Skipping serving cell measurement before t-service

* No agreement

*Sub-Topic 1-2: CONN mode neighbour cell measurements*

Issue 1-2-1: For NB-IoT NGSO, intra-frequency inter-satellite neighbour cell measurement

Agreement:

* Define requirements for NGSO intra-frequency inter-satellite neighbour cell measurement as “inter-frequency” case
* Add condition that requirements apply provided that cell is available as indicated by t-ServiceStartNeigh if indicated.

Issue 1-2-2: For NB/eMTC, time-based triggering, the exact time for UE to start the measurement

* no consensus to capture the exact time for UE to start measurement in RAN4 spec

Issue 1-2-3: For eMTC, time-based triggering and MG perspectives

Agreement:

* For eMTC neighbour cell measurement, MG shall be configured as legacy TN case.
* RAN4 agree that the MG is suspended till the time t-serviceStartNeigh
* Detailed wording to be updated in CR

Issue 1-2-4: For eMTC, location-based triggering and MG perspectives

* no consensus to introduce new conditions on when the neighbour cell measurements can be performed without gaps.

Issue 1-2-5: For eMTC, suspend MG upon t-ServiceStarNeigh

* To resolve in CR

Issue 1-2-6: For NB/eMTC NGSO, Ksatellite in Re-establishment delay requirement

* no consensus to revise Ksatellite in Re-establishment delay requirement

*Sub-Topic 1-3: eMTC, CHO*

Issue 1-3-1: For eMTC, CHO requirements

Agreement:

* Update Tinterrupt to include Tsearch, based on handover interruption requirement with KSAT =1, and Nfreq=1

*Sub-Topic 1-4: GNSS re-acquisition gap in connected mode*

Issue 1-4-1: GNSS-MG spec impact

Agreement:

* Add generic description that the measurements are suspended when UE is performing GNSS measurement during GNSS measurement gap. Wording to be discussed directly in the CR.
* For NB-IoT, UE shall restart the cell measurement when the interval between two samples are larger than 5000 ms.
* For eMTC, the modification for the case that GNSS-MG is larger than the eDRX cycle can be further study in the maintenance phase.

Issue 1-4-2: For eMTC, GNSS-MG overlapping with MG

Agreement:

* When GNSS gap overlaps with MG, MG applies if GNSS-MG is terminated earlier than MG and after RA procedure.

Issue 1-4-3: RRC re-establishment when carrierFreqList is provided

* FFS: If the carrierFreqList in SIB32 indicates that current and target cells belong to the same carrier, then Ksatellite,I can be set to 1. Otherwise, Ksatellite,I shall correspond to the number of NGSO satellites the UE shall monitor.

*Sub-Topic 1-5: Others*

Issue 1-5-1: Requirement terminologies

* To resolve in CR

Issue 1-5-2: Location-based triggering cell measurements – margin for distanceThresh

* Postpone the margin discussion in performance part.

Issue 1-5-3: Clarification on more than two NGSO satellites on a frequency layer

* No agreement

Performance part - RRM

Issue 2-2-1: For NB/eMTC, test cases suspended due to lack of neighbour cell assistant information

FFS

* Define test cases which are suspended due to lack of neighbour cell assistant information.
	+ Introduce inter-frequency test cases
	+ Introduce NGSO configuration for the existing intra-frequency test cases

Issue 2-2-2: For NB-IoT, neighbour cell measurement in CONNNECTED mode

FFS

* For NB-IoT, introduce test cases for neighbour cell measurement in CONNNECTED mode.

Issue 2-2-3: For NB/eMTC, test cases for time/location based triggering of cell reselection in IDLE mode

FFS

* RAN4 to define test cases for time/location based triggering of cell reselection in IDLE mode based on the following table:

|  |  |
| --- | --- |
| **Requirements**  | **NB/eMTC** |
| IDLE: Time-based measurement triggering | NB/eMTC |
| IDLE: Location-based measurement triggering | NB/eMTC |

* RAN4 to further discuss whether and how to reduce the number of test cases

Issue 2-2-4: For NB/eMTC, test cases for time/location based triggering of neighbour cell measurements in CONNECTED mode

FFS RAN4 to discuss feasibility of defining tests for time- and location based triggering of neighbour cell measurements.

* Option 1: not to define the corresponding test cases.
* Option 2: RAN4 to define test cases for time- and location based triggering of neighbour cell measurements, based on the following table:

|  |  |
| --- | --- |
| **Requirements**  | **NB/eMTC** |
| CONN: Location-based measurement triggering [NB/eMTC] | NB/eMTC |
| CONN: Time-based measurement triggering | eMTC |

Issue 2-2-5: For eMTC, test cases for CHO

FFS

* RAN4 to define test cases for eMTC CHO based on the following table:

|  |  |
| --- | --- |
| **Requirements**  | **NB/eMTC** |
| CHO configured with condEventD1 | eMTC |
| CHO configured with condEventT1 | eMTC |

* RAN4 to further discuss whether and how to reduce the number of test cases

Performance part - Demod

**Issue 1: Work plan**

* Agreement:

|  |
| --- |
| **UE Demodulation performance part (36.102)*** **November, 2023 (RAN4#109)**
	+ Approve the work plan.
	+ Discuss UE demodulation requirements for IoT-NTN enhancement.
	+ Discuss simulation assumptions.
* **February 2024 (RAN4#110)**
	+ Continue discussion on UE demodulation requirements for IoT-NTN enhancement.
	+ Agree on simulation assumptions.
	+ Discuss possible work split for the CR work, if needed.
* **April 2024 (RAN4#110bis)**
	+ Collect the simulation results.
	+ Provide CR/Draft CR based on work split and discuss CRs/Draft CRs.
* **May 2024 (RAN4#111)**
	+ Update simulation assumptions if necessary.
	+ Finalize CRs and close the performance part.
 |

**Issue 2-1: Whether to define PDSCH requirements with HARQ disabled?**

* Agreement:
	+ Continue the discussion in the next meeting.

**Issue 3-1: Whether to define PUSCH requirements with HARQ disabled**

* Agreement:
	+ Do not define PUSCH requirements with HARQ disabled.

#### 2.4.2 Remaining Open issues:

Core Part

All WI RAN4 objectives are completed, no critical outstanding issues. Any further proposed clarifications will be discussed as part of maintenance activity.

Performance Part

Work on Performance requirements for RRM and Demod if agreed.

## 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#114-bis, October 9th – October 13th, 2023, Xiamen, China**

Submitted TDocs to AI 8.13.3

* R1-2308911 Maintenance of disabling of HARQ feedback for IoT NTN Huawei, HiSilicon
* R1-2309000 Remaining issues on disabling of HARQ feedback for IoT NTN Spreadtrum Communications
* R1-2309172 Remaining issue on disabling of HARQ feedback ZTE
* R1-2309280 Disabling of HARQ feedback for IoT NTN NEC
* R1-2309600 Discussion on remaining issue on disabling of HARQ feedback for IoT NTN OPPO
* R1-2309651 Maintenance on disabling of HARQ feedback for IoT NTN Nokia, Nokia Shanghai Bell
* R1-2309794 Disabling of HARQ feedback for IoT NTN Lenovo
* R1-2309852 On Higher Layer Signaling for HARQ Feedback Disabling for IoT NTN Apple
* R1-2309888 Maintenance on disabling HARQ feedback for IoT NTN Ericsson
* R1-2309979 Remaining issues on disabling of HARQ for IoT NTN MediaTek Inc.
* R1-2310161 Disabling HARQ Feedback for IoT-NTN Qualcomm Incorporated
* R1-2310356 FLS#1 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)
* R1-2310615 FLS#2 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)

Submitted TDocs to AI 8.13.4

* R1-2308912 Maintenance of improved GNSS operations for IoT NTN Huawei, HiSilicon
* R1-2309001 Remaining issues on improved GNSS operations for IoT NTN Spreadtrum Communications
* R1-2309152 Remaining issue on improved GNSS operation ZTE
* R1-2309395 Remaining issues on improved GNSS operations for IoT NTN Samsung
* R1-2309436 Discussion on the remaining issues for the improved GNSS operation for IoT NTN xiaomi
* R1-2309506 Discussion on remaining issues of improved GNSS operations for IoT NTN CATT
* R1-2309601 Discussion on remaining issue for improved GNSS operation for IoT NTN OPPO
* R1-2309652 Maintenance on improved GNSS operations for IoT NTN Nokia, Nokia Shanghai Bell
* R1-2309688 Remaining issues on improved GNSS operations for IoT NTN CMCC
* R1-2309853 On improved GNSS operations for IoT NTN Apple
* R1-2309980 Remaining issues on improved GNSS operations for IoT NTN MediaTek Inc.
* R1-2310162 Improved GNSS Operations for IoT-NTN Qualcomm Incorporated
* R1-2310188 Improved GNSS operations for IoT NTN Nordic Semiconductor ASA
* R1-2310235 On maintenance of improved GNSS operations for IoT NTN Ericsson Limited
* R1-2310297 Feature lead summary#1 of AI 8.13.4 on improved GNSS operations Moderator (MediaTek)
* R1-2310298 Feature lead summary#2 of AI 8.13.4 on improved GNSS operations Moderator (MediaTek)
* R1-2310299 Feature lead summary#3 of AI 8.13.4 on improved GNSS operations Moderator (MediaTek)

**RAN1#115, November 13th – November 17th, 2023, Chicago, USA**

Submitted TDocs to AI 8.13.3

* R1-2310878 Maintenance of disabling of HARQ feedback for IoT NTN Huawei, HiSilicon
* R1-2310965 Maintenance on disabling HARQ feedback for IoT NTN Ericsson
* R1-2311180 Remaining issues on disabling of HARQ feedback for IoT NTN Spreadtrum Communications
* R1-2311202 Remaining issue on disabling of HARQ feedback ZTE
* R1-2311247 Discussion on remaining issue on disabling of HARQ feedback for IoT NTN OPPO
* R1-2311654 Maintenance on disabling of HARQ feedback for IoT NTN Nokia, Nokia Shanghai Bell
* R1-2311702 On Higher Layer Signaling for HARQ Feedback Disabling for IoT NTN Apple
* R1-2311728 Disabling of HARQ feedback for IoT NTN Lenovo
* R1-2311998 Remaining issues of disabling of HARQ feedback for IoT NTN MediaTek Inc.
* R1-2312388 FLS#1 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)
* R1-2312389 FLS#2 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)
* R1-2312460 FLS#3 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)

Submitted TDocs to AI 8.13.4

* R1-2310879 Maintenance of improved GNSS operations for IoT NTN Huawei, HiSilicon
* R1-2311181 Remaining issues on improved GNSS operations for IoT NTN Spreadtrum Communications
* R1-2311203 Remaining issue on improved GNSS operation ZTE
* R1-2311248 Discussion on remaining issue for improved GNSS operation for IoT NTN OPPO
* R1-2311512 Remaining issues on Improved GNSS Operations for IoT NTN NEC
* R1-2311586 Discussion on the remaining issues for the improved GNSS operation for IoT NTN Beijing Xiaomi Mobile Software
* R1-2311655 Maintenance on improved GNSS operations for IoT NTN Nokia, Nokia Shanghai Bell
* R1-2311703 Remaining issues on improved GNSS operations for IoT NTN Apple
* R1-2311863 Remaining issues for improved GNSS operations for IoT NTN Samsung
* R1-2311943 On maintenance of improved GNSS operations for IoT NTN Ericsson Inc.
* R1-2311999 Remaining issues on improved GNSS operations for IoT NTN MediaTek Inc.
* R1-2312054 Improved GNSS Operations for IoT-NTN Qualcomm Incorporated
* R1-2312128 Improved GNSS operations for IoT NTN Nordic Semiconductor ASA
* R1-2312298 Feature lead summary#1 of AI 8.13.4 on improved GNSS operations Moderator (MediaTek)
* R1-2312299 Feature lead summary#2 of AI 8.13.4 on improved GNSS operations Moderator (MediaTek)
* R1-2312300 Feature lead summary#3 of AI 8.13.4 on improved GNSS operations Moderator (MediaTek)
* R1-2312656 Draft LS on improved GNSS operations in Rel-18 IoT NTN Moderator (MediaTek Inc.)
* R1-2312696 LS on improved GNSS operations in Rel-18 IoT NTN Moderator (MediaTek Inc.)

## 4.2 RAN2

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

Submitted TDocs to AI 7.6.1

* R2-2309416 LS on Rel-18 RAN1 UE features list for LTE after RAN1#114 (R1-2308520; contact: NTT DOCOMO, AT&T) RAN1
* R2-2309532 Discussion on R18 IoT NTN UE capabilities OPPO
* R2-2310180 Running CR for TS 36.306 for Rel-18 IoT NTN Qualcomm Incorporated
* R2-2310410 36331 running CR for IOT NTN Huawei, HiSilicon
* R2-2311070 Stage-3 running CR for TS 36.321 for Rel-18 IoT-NTN MediaTek Inc.
* R2-2311194 36304 Running CR for IoT-NTN Nokia Solutions & Networks (I)
* R2-2311244 Introduction of IoT NTN enhancements Ericsson
* R2-2311245 Rapporteur input on 36.300 Ericsson

Submitted TDocs to AI 7.6.2.1

* R2-2309527 Discussion on HARQ enhancement for IoT NTN OPPO
* R2-2309657 Remaining Issues on HARQ Enhancement for IoT NTN vivo
* R2-2309701 Remaining issues of HARQ enhancement Huawei, Turkcell, HiSilicon
* R2-2309752 Discussion on HARQ enhancements in IoT NTN CATT
* R2-2309758 Discussion on HARQ enhancement Xiaomi
* R2-2309781 On Disabling HARQ Feedback in IoT-NTN MediaTek Inc.
* R2-2309956 Views on some remaining issues for HARQ in IoT NTN Lenovo
* R2-2310181 DCI-based HARQ feedback overriding solution Qualcomm Incorporated
* R2-2310269 Discussion on the HARQ enhancement for IoT-NTN CMCC
* R2-2310651 Further discussion on HARQ enhancements for IoT NTN Nokia, Nokia Shanghai Bell
* R2-2310805 Disabling HARQ feedback for IoT-NTN Interdigital, Inc.
* R2-2310820 Remaining issues of HARQ enhancements ZTE Corporation, Sanechips
* R2-2311243 R18 IoT NTN HARQ enhancements Ericsson

Submitted TDocs to AI 7.6.2.2

* R2-2309531 Discussion on GNSS operation for IoT NTN OPPO
* R2-2309658 Discussion on GNSS Operation for IoT NTN vivo
* R2-2309702 Discussion on the impact of GNSS measurement Huawei, Turkcell, HiSilicon
* R2-2309751 Discussion on GNSS operation enhancements CATT
* R2-2309757 Discussion on GNSS operation enhancement Xiaomi
* R2-2309782 Enhancements on GNSS operation MediaTek Inc.
* R2-2309957 Views on some remaining issues for GNSS operations in IoT NTN Lenovo
* R2-2309997 Remaining issues on the GNSS operation Google Inc.
* R2-2310184 GNSS fix in RRC\_CONNECTED Qualcomm Incorporated
* R2-2310270 Discussion on GNSS enhancement for IoT-NTN CMCC
* R2-2310323 Concluding critical issues in improved GNSS operation Apple
* R2-2310650 GNSS Validity duration Reporting Nordic Semiconductor ASA
* R2-2310652 Further discussion on GNSS operation enhancement in Rel-18 IoT NTN Nokia, Nokia Shanghai Bell
* R2-2310806 GNSS acquisition and reporting for IoT NTN Interdigital, Inc.
* R2-2310821 Remaining issues of GNSS enhancements ZTE Corporation, Sanechips
* R2-2311036 On improved GNSS operation for IoT NTN Samsung Electronics Polska
* R2-2311086 Discussion of GNSS operation enhancements SHARP Corporation
* R2-2311242 R18 IoT NTN GNSS operation enhancements Ericsson

Submitted TDocs to AI 7.6.3.1

* R2-2309528 Discussion on mobility enhancement for IoT NTN OPPO
* R2-2309762 Discussion on UE behavior when serving cell t-service expires Xiaomi
* R2-2309783 Enhancements on neighbor cell measurement MediaTek Inc.
* R2-2310183 Measurement and Mobility enhancements Qualcomm Incorporated
* R2-2310271 Discussion on mobility enhancements for IoT-NTN CMCC
* R2-2310324 Neighbour cell measurements before RLF for eMTC-NTN Apple, MediaTek Inc.
* R2-2310411 Remaining issues on mobility enhancements Huawei, HiSilicon, Turkcell
* R2-2310628 On enhancements for neighbour cell measurements Samsung Electronics Polska
* R2-2310807 Fast RLF and re-establishment in the discontinuous coverage scenario Interdigital, Inc.
* R2-2310822 Remaining issues of mobility enhancements ZTE Corporation, Sanechips
* R2-2311012 On Remaining issues for IoT-NTN Mobility Enhancements Nokia, Nokia Shanghai Bell
* R2-2311069 Discussion on gaps for neighbour cell measurements in IoT NTN Ericsson
* R2-2311240 Discussion on triggering RA for RRC connection re-establishment in IoT NTN Ericsson

Submitted TDocs to AI 7.6.3.2

* R2-2309659 Discussion on CHO Enhancement for IoT NTN vivo
* R2-2310192 NB-IoT NTN Coarse UE location reporting Inmarsat, Viasat, Sateliot, Novamint, ESA, Thales
* R2-2310325 Mobility enhancement in IoT NTN Apple
* R2-2310629 On other mobility enhancements for IoT NTN Samsung Electronics Polska

Submitted TDocs to AI 7.6.4

* R2-2309660 Discussion on Discontinuous Coverage vivo
* R2-2309703 Remaining issues of discontinuous coverage Huawei, Turkcell, HiSilicon
* R2-2309753 Discussion on discontinuous coverage enhancement CATT
* R2-2309882 Discussion on TN coverage for discontinuous coverage ASUSTeK
* R2-2309959 Views on some remaining issues for discontinuous coverage in IoT NTN Lenovo
* R2-2310021 Discussion on enhancement to discontinuous coverage for IoT NTN Transsion Holdings
* R2-2310071 Considerations on Supporting Discontinuous Coverage NEC
* R2-2310182 RRC release procedure in discontinuous coverage Qualcomm Incorporated
* R2-2310808 RRC Release in discontinuous coverage Interdigital, Inc.
* R2-2310826 Remaining issues of discontinuous coverage ZTE Corporation, Sanechips
* R2-2310919 Enhancements to discontinuous coverage Samsung Electronics Iberia SA
* R2-2311013 Discussion on discontinuous coverage Enhancements Nokia, Nokia Shanghai Bell
* R2-2311232 Measurement information to assist cell search after a coverage gap Ericsson

**RAN2#124, November 13th – November 17th, 2023, Chicago, USA**

Submitted TDocs to AI 7.6.1

* R2-2311716 LS on Rel-18 RAN1 UE features list for LTE after RAN1#114bis (R1-2310634; contact: NTT DOCOMO, AT&T) RAN1
* R2-2311891 Introduction of IoT NTN enhancements Huawei, HiSilicon
* R2-2311892 Report of [Post123bis][302][IoT-NTN Enh] 36.331 running CR (Huawei) Huawei, HiSilicon
* R2-2312116 Stage-3 running CR for TS 36.321 for Rel-18 IoT-NTN MediaTek Inc.
* R2-2312281 Introduction of Rel-18 IoT NTN UE capabilities Qualcomm Incorporated
* R2-2312282 Rapporteur input to open issues on the introduction of Rel-18 IoT NTN UE capabilities Qualcomm Incorporated
* R2-2313301 Introduction of IoT NTN enhancements Ericsson
* R2-2313304 Stage 2 open issues Ericsson
* R2-2313320 Introduction of IoT-NTN Enhancements Nokia Solutions & Networks (I)
* R2-2313321 Report of [Post123bis][304][IoT-NTN Enh] 36.304 running CR (Nokia) Nokia Solutions & Networks (I)

Submitted TDocs to AI 7.6.2.1

* R2-2311838 Remaining Issues on HARQ Enhancement for IoT NTN vivo
* R2-2311958 Discussion on HARQ enhancement for IoT NTN OPPO
* R2-2312114 Remaining Issues on HARQ Enhancements in IoT-NTN MediaTek Inc.
* R2-2312244 Remaining issues of HARQ enhancements ZTE Corporation, Sanechips
* R2-2312283 Open issues on HARQ enhancements Qualcomm Incorporated
* R2-2312700 Remaining issues on HARQ enhancements for IoT NTN Nokia, Nokia Shanghai Bell
* R2-2312714 Remaining issues on HARQ enhancement Huawei, Turkcell, HiSilicon
* R2-2312722 Discussion on HARQ enhancement open issues Xiaomi
* R2-2313300 R18 IoT NTN HARQ enhancements Ericsson
* R2-2313317 Discussion on HARQ enhancements in IoT NTN CATT

Submitted TDocs to AI 7.6.2.2

* R2-2311839 Remaining Issues on GNSS Operation for IoT NTN vivo
* R2-2311962 Discussion on GNSS operation for IoT NTN OPPO
* R2-2311963 DRAFT LS on GNSS validity duration OPPO
* R2-2312046 Leftover issues on the GNSS operation enhancements Google Inc.
* R2-2312054 Discussion on GNSS operation enhancements CATT
* R2-2312115 Remaining GNSS Enhancement Issues in IoT-NTN MediaTek Inc.
* R2-2312246 Remaining issues of GNSS enhancements ZTE Corporation, Sanechips
* R2-2312286 Open issues on GNSS fix in RRC\_CONNECTED Qualcomm Incorporated
* R2-2312353 Leftover issues in improved GNSS operation Apple
* R2-2312458 Views on timer handling during GNSS measurement gap Lenovo
* R2-2312608 GNSS operation enhancement NEC
* R2-2312673 Discussion on GNSS enhancement for IoT-NTN CMCC
* R2-2312701 Remaining issues on GNSS operation enhancement for IoT NTN Nokia, Nokia Shanghai Bell
* R2-2312715 Remaining issues on GNSS measurement Huawei, Turkcell, HiSilicon
* R2-2312721 Discussion on GNSS operation enhancement open issues Xiaomi
* R2-2312879 GNSS acquisition and reporting for IoT NTN Interdigital, Inc.
* R2-2313010 GNSS measurement procedures in connected mode Samsung R&D Institute UK
* R2-2313299 R18 IoT NTN GNSS operation enhancements Ericsson

Submitted TDocs to AI 7.6.3.1

* R2-2311959 Discussion on mobility enhancement for IoT NTN OPPO
* R2-2312055 Discussion on leftover issues of mobility enhancements CATT
* R2-2312247 Remaining issues of mobility enhancements ZTE Corporation, Sanechips
* R2-2312285 Open issues on measurement and Mobility enhancements Qualcomm Incorporated
* R2-2312355 Neighbour cell measurements before RLF for eMTC-NTN Apple
* R2-2312764 Discussion on the remaining issues for the mobility enhancements Xiaomi
* R2-2312860 Further analysis on open issues for IoT-NTN Mobility Enhancements Nokia, Nokia Shanghai Bell
* R2-2312880 Fast RLF and re-establishment in the discontinuous coverage scenario Interdigital, Inc.
* R2-2313011 Enhancements for neighbour cell measurements Samsung R&D Institute UK
* R2-2313078 Remaining issues on mobility enhancements Huawei, HiSilicon, Turkcell
* R2-2313228 Neighbour cell measurements in IoT NTN Ericsson
* R2-2313229 Discussion on triggering RA for RRC connection re-establishment in IoT NTN Ericsson

Submitted TDocs to AI 7.6.3.2

* R2-2311840 Discussion on CHO Enhancement for IoT NTN vivo
* R2-2312354 Leftover issues for mobility enhancement in IoT NTN Apple
* R2-2312459 Views on providing NB-IoT UE location information Lenovo
* R2-2312878 CHO enhancement for earth-moving cells Interdigital, Inc.
* R2-2313012 On other mobility enhancements for IoT NTN Samsung R&D Institute UK

Submitted TDocs to AI 7.6.4

* R2-2311841 Discussion on Discontinuous Coverage vivo
* R2-2312048 Leftover issues on the discontinuous coverage Google Inc.
* R2-2312056 Discussion on open issues for discontinuous coverage CATT
* R2-2312199 Considerations on Supporting Discontinuous Coverage NEC
* R2-2312248 Paging window alignment in discontinuous coverage ZTE Corporation, Sanechips
* R2-2312284 UE Autonomous release in discontinuous coverage Qualcomm Incorporated
* R2-2312460 Views on some remaining issues for discontinuous coverage Lenovo
* R2-2312631 Discussion on enhancement to discontinuous coverage for IoT NTN Transsion Holdings
* R2-2312716 Remaining issues on discontinuous coverage Huawei, Turkcell, HiSilicon
* R2-2312723 Discussion on Discontinuous coverage open issues Xiaomi
* R2-2312861 Discussion on remaining issues discontinuous coverage Enhancements Nokia, Nokia Shanghai Bell
* R2-2312881 RRC Release in discontinuous coverage Interdigital, Inc.
* R2-2313296 Enhancements to Discontinuous Coverage SHARP Corporation
* R2-2313397 Enhancements to discontinuous coverage Samsung

## 4.3 RAN3

**RAN3#121, Toulouse, France, 21st - 25th August 2023**

* R3-234059, Further discussion on discontinuous coverage issue for IoT NTN, ZTE
* R3-234200, (TP for BL CR IoT NTN TS36.423) Correction for Time based CHO, CATT, Ericsson, Nokia, Nokia Shanghai Bell, ZTE, Huawei
* R3-234219, (TP to BL CRs, 36.300, 36.423) Alignment with NR NTN, Huawei, Ericsson
* R3-234017, (TP for BL CR 36.300 and 36.413) on support X2-CHO and S1-HO with time-based trigger condition, Nokia, Nokia Shanghai Bell
* R3-234105, Time-Based HO and IoT NTN - Stage 2 Impacts, Ericsson, CATT, ESA, Huawei
* R3-234106, Time-Based HO for IoT NTN - S1AP Impacts, Ericsson, Huawei, CATT, ESA
* R3-234107, Time Margin for CHO in IoT NTN - X2AP Impact, Ericsson, Inmarsat, ESA

## 4.4 RAN4

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

RRM

* R4-2317395 WF on R18 IoT NTN RRM requirements Moderator (MediaTek)
* R4-2317223 Topic summary for [108bis][231] IoT\_NTN\_enh Moderator (MediaTek inc.)
* R4-2315176 Discussion on RRM core requirements for IOT NTN enhancement CMCC
* R4-2315253 Discussion on RRM requirements for IoT NTN enhancement MediaTek inc.
* R4-2315631 Discussion on RRM requirements for IoT NTN enhancement Huawei, HiSilicon
* R4-2316261 Discussion on mobility requirements for IoT NTN enhancements Nokia, Nokia Shanghai Bell
* R4-2316351 Discussions on RRM requirements for IoT NTN enhancements Ericsson
* R4-2315254 Introduction of location based cell re-selection requirement for IoT NTN enhancement for UE category NB-IoT MediaTek inc.
* R4-2315632 Draft CR on RRM impact of GNSS re-acquisition for NB-IoT Huawei, HiSilicon
* R4-2316066 draftCR on IDLE mode requirements for eMTC over NTN Huawei, HiSilicon
* R4-2316262 DraftCR on NB-IoT Neighbor Cell Measurements in RRC\_Connected (36.133) Nokia, Nokia Shanghai Bell
* R4-2316263 DraftCR on eMTC Connected Mode Measurements (36.133) Nokia, Nokia Shanghai Bell

**RAN4#109, November 13th – November 17th, 2023, Chicago, USA**

RRM

* R4-2321646 Big CR to TS 38.133 on RRM requirements for IoT NTN enhancements MediaTek
* R4-2321577 WF on R18 IoT NTN RRM requirements Moderator (MediaTek)
* R4-2321339 Ad-hoc minutes on IoT\_NTN\_enh WI MediaTek
* R4-2318075 Work Plan on RRM performance part for IoT NTN enhancements MediaTek
* R4-2318191 Topic summary for [109][235] IoT\_NTN\_enh Moderator (MediaTek)
* R4-2318073 Discussion on RRM core requirements for IoT NTN enhancement MediaTek inc.
* R4-2318074 CR on cell re-selection requirement for IoT NTN enhancement for UE category NB-IoT MediaTek inc.
* R4-2318912 Discussion on RRM core requirements for IOT NTN enhancement CMCC
* R4-2318913 Draft CR to TS 36.133: Conditional HO for Cat-M1 for IOT-NTN CMCC
* R4-2319352 Discussion on RRM requirements for IoT NTN enhancement Huawei, HiSilicon
* R4-2319353 Draft CR on RRM impact of GNSS re-acquisition for NB-IoT Huawei, HiSilicon
* R4-2320015 draftCR on IDLE mode requirements for eMTC over NTN Huawei, HiSilicon
* R4-2320140 Discussions on RRM requirements for IoT NTN enhancements Ericsson
* R4-2320141 IoT NTN RRM requirements during GNSS reacquisition Ericsson
* R4-2320142 IoT NTN RRC re-establishment requirements during discontinuous coverage Ericsson
* R4-2320741 Discussion on open issues for IoT NTN enh Nokia, Nokia Shanghai Bell
* R4-2320742 DraftCR to 36.133 on Connected Mode Mobility for IoT NTN Nokia, Nokia Shanghai Bell
* R4-2320743 DraftCR to 36.133 on Connected Mode Mobility for Emtc NTN Nokia, Nokia Shanghai Bell
* R4-2318075 Work Plan on RRM performance part for IoT NTN enhancements MediaTek inc.
* R4-2318076 Discussion on RRM performance requirements for IoT NTN enhancement MediaTek inc.
* R4-2319354 Discussion on performance requirements for IoT NTN enhancement Huawei, HiSilicon
* R4-2320143 Discussions on RRM performance requirements for IoT NTN enhancements Ericsson
* R4-2320744 Performance Considerations for IoT NTN enhancements Nokia, Nokia Shanghai Bell

Demod

* R4-2321145 WF on [109][332] IoT\_NTN\_Demod Moderator (MediaTek)
* R4-2318224 Topic summary for [109][332] IoT\_NTN\_Demod Moderator (MediaTek)
* R4-2318232 Discussion on IoT NTN Nokia, Nokia Shanghai Bell
* R4-2318666 Workplan on demodulation requirements for IoT-NTN enhancement MediaTek inc.
* R4-2318667 Discussion on UE requirements for IoT-NTN enhancement MediaTek inc.
* R4-2318734 Discussion on the performance requirements for IoT NTN enhancements Qualcomm India Pvt Ltd
* R4-2319749 Discussion on demodulation requirements for IoT-NTN enhancements Ericsson
* R4-2319847 View on SAN demodulation requirement for Rel-18 IoT over NTN Samsung
* R4-2320229 Discussion on demodulation performance requirements for IoT NTN enhancement Huawei,HiSilicon

# 5 Others

***END***