**3GPP TSG RAN meeting #100 RP-23xxxx**

**Taipei, Netherlands, June 6-12, 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-223519 | | | | |
| **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: 65%  For information  RAN1: 85%  RAN2: 65%  RAN3: 70%  RAN4: 45% | Performance Part: 0% | Testing part: - | |

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

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

**Source:**

|  |  |  |
| --- | --- | --- |
| **Leading WG** | | RAN2 |
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| **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#112bis-e, April 17th – April 26th, 2023, Online**

**Agreements on “9.9.3 Disabling of HARQ feedback for IoT NTN”**

**Agreement**

For Option 3 DCI indication:

* Option A: when both per-HARQ process bitmap and DCI solution enabling/disabling signaling are configured
  + DCI-based overridden mechanism is DCI signaling to reverse the HARQ feedback enable/disable for the corresponding transmission from per-HARQ process RRC configuration
    - For single TB scheduled by DCI, the DCI based overridden indication is applied to one of the following options (to be down-selected):
      * Option A-1: only applied to semi-statically HARQ disabled processes
      * Option A-4: applied to both semi-statically HARQ disabled and enabled processes
    - FFS for multiple TBs scheduled by single DCI
* Option B: DCI-based HARQ enabling/disabling direct indication in case DCI solution enabling/disabling signaling is configured and per-HARQ process bitmap signaling is not configured (i.e. no bitmap is configured)
  + DCI-based mechanism is DCI signaling to directly indicate the HARQ feedback enable/disable for the corresponding transmission
    - For single TB scheduled by DCI, DCI-based direct indication is applied to the scheduled TB
    - FFS for multiple TBs scheduled by single DCI

**Agreement**

For single TB scheduled by DCI, for DCI-based direct indication, down select one of the following based on the criteria DCI overhead, PDCCH monitoring behavior, impact on scheduling flexibility, UE implementation complexity, etc

* Option 1: Indication by adding one field in DCI (e.g., 1-bit)
  + Note: Other fields in DCI are the same as legacy.
* Option 2: Indication by reusing/reinterpreting existing field in DCI
  + Option 2A: HARQ-ACK related field
    - For eMTC CE mode B, one state of “HARQ-ACK resource offset” field in DCI format 6-1B is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.
      * FFS: detailed state
    - For NBIoT, one state of “HARQ-ACK resource” field in DCI format N1 is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.
      * FFS: detailed state
  + Option 2B: MCS or repetition number field
    - Reduce 1bit of legacy MCS or repetition number field and add 1bit new field in DCI format 6-1B and N1 to indicate the HARQ feedback enabled/disabled
      * FFS: detailed for interpreting of the reduced MCS or repetition number field
  + Option 2C: HARQ-ACK related field v2
    - For eMTC CE mode B, reduce 1bit of legacy “HARQ-ACK resource offset” field and add 1bit new field in DCI format 6-1B to indicate the HARQ feedback enabled/disabled
      * FFS: detailed for interpreting of the reduced “HARQ-ACK resource offset” field
    - For NBIoT, reduce 1bit of legacy “HARQ-ACK resource” field and add 1bit new field in DCI format N1 to indicate the HARQ feedback enabled/disabled
      * FFS: detailed for interpreting of the reduced “HARQ-ACK resource” field
  + Option 2D: Other indication by reusing/reinterpreting existing field

**Agreements on “9.11.4 Improved GNSS operations for IoT NTN”**

**Agreement**

For the GNSS measurement gap aperiodically triggered with MAC CE, the duration for the GNSS measurement gap can be configured by eNB.

* The gap duration is equal to the latest reported GNSS position fix time duration for measurement when the duration for GNSS measurement gap is not included in the configuration by eNB.

**Conclusion**

From RAN1 perspective, UE is not forbidden to autonomously re-acquire GNSS position fix during inactive state of Connected DRX.

* Note: The configured DL/UL transmissions during inactive state of Connected DRX should not be impacted
* Note: details are up to RAN2

Send an LS to RAN2 for the conclusion.

**Agreement**

On when the aperiodic GNSS measurement gap starts, which is aperiodically triggered by eNB with MAC CE, the start time should be at n+ X, where n is the end of MAC CE receiving subframe/slot

* FFS: details of X, e.g. predefined value or configured value, considering HARQ feedback for the MAC CE, etc

**Agreement**

Draft LS in [R1-2304125](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304125.zip) is endorsed. Final LS is approved in [R1-2304126](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304126.zip).

**Agreement**

UE reports one GNSS position fix time duration for GNSS measurement via a N-bit field at least including [1,2] seconds as component values.

* FFS: value of N, other component value(s) of GNSS position fix time duration (e.g. N=3, with value in [3,7,13,19,25, X] seconds, and X is FFS).

FFS: whether RAN4 input is needed.

**RAN1#113, May 22nd – May 26th, 2023, Incheon, South Korea**

**Agreements on “9.9.3 Disabling of HARQ feedback for IoT NTN”**

**Working assumption**

For DCI-based direct indication in single TB scheduled by DCI,

* Indication by reusing/reinterpreting HARQ-ACK related field in DCI
  + For eMTC CE mode B, one state of “HARQ-ACK resource offset” field in DCI format 6-1B is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.
    - FFS: detailed state, and whether this state is different across different UEs
  + For NBIoT, one state of “HARQ-ACK resource” field in DCI format N1 is used for indication of HARQ feedback disabled, other states are used for indication of HARQ feedback enabled and corresponding HARQ-ACK resource.
    - FFS: detailed state, and whether this state is different across different UEs
* If reusing/reinterpreting HARQ-ACK related field in DCI is also used for DCI overriding scheme, the interpretation of the state can be different than for DCI-based direct indication.

**Agreement**

For single TB scheduled by DCI,

* Working assumption 1 DCI based overridden indication is applied to both semi-statically HARQ disabled and enabled processes
  + For DCI based overridden indication, adopt indication by reusing/reinterpreting HARQ-ACK related field in DCI
    - For eMTC CE mode B, “HARQ-ACK resource offset” field in DCI format 6-1B is used for indication of maintaining/reversing the HARQ feedback enable/disable for the corresponding transmission from per-HARQ process RRC configuration and corresponding HARQ-ACK resource in case of indication of HARQ feedback enabled.
      * HARQ feedback disabled is reversed to enabled in case of any states other than state A in “HARQ-ACK resource offset”, otherwise is maintained as disabled.
      * HARQ feedback enabled is maintained in case of any states other than state A in “HARQ-ACK resource offset”, otherwise is reversed to disabled.
        + FFS: detailed state A, and whether this state A is different across different UEs
    - For NBIoT, “HARQ-ACK resource” field in DCI format N1 is used for indication of maintaining/reversing the HARQ feedback enable/disable for the corresponding transmission from per-HARQ process RRC configuration and corresponding HARQ-ACK resource in case of indication of HARQ feedback enabled.
      * The same DCI indication functionality as eMTC is adopted.
* 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).
* Send an LS to RAN2 with the following contents:
  + RAN1 respectfully ask RAN2 for the feasibility of Working assumption 2 (taking into account potential RAN2 spec impact).

**Agreement**

The draft LS in R1-2306205 is endorsed. Final LS in R1-2306245.

**Agreement**

For the RRC configuration of DCI solution enabling/disabling of HARQ feedback for NB-IoT and LTE-MTC in CE Mode B, the RRC configuration is UE-specific.

**Agreement**

for NB-IoT and LTE-MTC in CE Mode B, if multiple TBs is configured, for DCI-based HARQ enabling/disabling direct indication in multiple TBs scheduled by single DCI, the same indication is applied to all scheduled TBs, i.e. HARQ is enabled or disabled for all TBs.

**Agreement**

Adopt the response below to RAN2’s question 3:

Understanding 2 is the correct understanding.

**Agreement**

For a NB-IoT UE operating with two HARQ processes, for an UL HARQ process with HARQ mode B, the minimum time between the end of NPUSCH transmission and the start of NPDCCH monitoring for the same HARQ process is 1 ms.

* Note: this implies a RAN1 specification change in Rel-18

**Agreement**

For the response to RAN2’s question 1a: provide the agreement above.

**Agreement**

Adopt the response below to RAN2’s question 1b:

* For an UL HARQ process with HARQ mode B for eMTC UEs, the minimum time between the end of PUSCH transmission and the start of MPDCCH monitoring for the same HARQ process is 1 ms for Type B half-duplex FDD operation, and there is no minimum time restriction between the end of PUSCH transmission and the start of MPDCCH monitoring for full-duplex FDD operation.

**Agreement**

Adopt the response below to RAN2’s question 2:

* Whether/how to support case 1, case 2 and/or case 3 for UL multiple TB scheduling for eMTC and NB-IoT is transparent to RAN1 and can be left to RAN2 decision.

**Agreement**

For a NB-IoT UE operating with one HARQ process, for an UL HARQ process with HARQ mode B, the minimum time between the end of NPUSCH transmission and the start of NPDCCH monitoring is 1 ms.

* Note: this implies a RAN1 specification change in Rel-18

**Agreement**

For the response to RAN2’s question 1a: provide the agreement above.

**Agreement**

The draft LS in R1-2306134 is endorsed with the following changes:

* Add the agreement on NB-IoT UE operating with one HARQ process to the list of RAN1 agreements listed in the LS
* Change “kindly” to “respectfully” in the action

Final LS in R1-2306182.

**Agreements on “9.11.4 Improved GNSS operations for IoT NTN”**

**Agreement**

From RAN1 perspective, at least for the case when frequency error and timing error are within frequency and timing error requirements with legacy closed loop time correction, UL transmission can be allowed in a duration X after original GNSS validity duration expires without GNSS re-acquisition.

RAN1 will decide further details of the above.

**Agreement**

UE reports one GNSS position fix time duration for GNSS measurement via a 4-bit field with component values [1,2,3,4,5,6,7,13,19,25,31]

* FFS: other component values

**Agreement**

The UE is not required to transmit or receive any channel / signal within the aperiodic GNSS measurement gap duration before the UE reacquires GNSS successfully.

FFS: UE’s behavior within the duration after UE reacquires GNSS successfully to the end of the gap if the UE reacquires GNSS successfully before the end of the gap.

**Agreement**

For the aperiodic GNSS measurement gap triggered by eNB with MAC CE, down select one of the alternatives for the start time of the gap:

* Alt 1: should be at n+ X, where n is the end of MAC CE receiving subframe/slot and X>= 12ms for NB-IoT, X>= 3ms for eMTC
  + Note: X is one value regardless of HARQ feedback enabled or disabled for the MAC CE
  + FFS: details, e.g. X is predefined value or configured value
* Alt 2: 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 and X1>= 12ms for NB-IoT, X1>= 3ms for eMTC, or 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
  + FFS: details, e.g. X1 and X2 are predefined value or configured value, including whether X1 and X2 can be the same
* Alt3: should be at p+ X, where p is the end of HARQ feedback transmission subframe/slot, where HARQ feedback for the MAC CE is always enabled
  + FFS: details, e.g. X is predefined value or configured value

**Agreement**

For NB-IoT and eMTC, at least for the case where the network configuration does not include a periodicity (if supported), for autonomous GNSS re-acquisition, the UE may re-acquire GNSS autonomously during GNSS measurement timer, the start time of the autonomous GNSS measurement timer is based on the original GNSS validity duration.

* FFS: additional delay and details of delay (if any), e.g. delay can be zero or can be equal to/larger than the duration X where UL transmission can be allowed after original GNSS validity duration expires without GNSS re-acquisition.
* Note1: Autonomous GNSS re-acquisition mechanism is enabled or disabled by network.
* Note2: The length of GNSS measurement timer can be configured by network and the length of GNSS measurement timer is equal to the latest reported GNSS position fix time duration for measurement when the length of GNSS measurement timer is not configured
* Note3: The autonomous GNSS re-acquisition can be periodic in certain conditions without further spec impact

#### Remaining Open issues

Objective 1 (IoT-NTN Performance Enhancements in Rel-18 to address remaining issues from Rel-17):

- Details of disabling of HARQ feedback to mitigate impact of HARQ stalling on UE data rates.

- Details of improved GNSS operations for a new position fix for UE pre-compensation during long connection times and for reduced power consumption.

## 2.2 RAN2

#### 2.2.1 Agreements

**RAN2#121bis-e, April 17th – April 26th, 2023, Online**

**Agreements on “8.6.2 Performance Enhancements”**

Agreements:

* RAN2#121’s agreement is revised to “For NB-IoT NTN with single HARQ process when the HARQ feedback is disabled, the UE will start/restart drx-inactivity timer in the subframe containing the last repetition of the corresponding PDSCH reception plus 12 subframes plus deltaPDCCH” (Can further check in the NB-IoT session if anything needs to be done for legacy NB-IoT as well, as some timers don’t take deltaPDCCH into account)
* Wait for RAN1’s decision on the RRC signalling of enabling DCI-based solution to indicate HARQ feedback enabled/disabled, and the signalling granularity, e.g. per UE or per HARQ process
* On DCI indication overriding RRC configuration for the HARQ feedback enabled/disabled, wait for RAN1’s progress on DCI-based solution before discussing related DRX impact in RAN2.
* On DL multiple TB scheduling, wait for RAN1’s progress before discussing related DRX impact in RAN2.
* P4 in R2-2302557 is not agreed, i.e. no special handling for single HARQ process for eMTC.
* For eMTC NTN, a parameter harq-FeedbackEnablingforSPSactive could be configured for a UE. If harq-FeedbackEnablingforSPSactive is configured to enable HARQ feedback, UE reports ACK/NACK for the first SPS PDSCH after activation, regardless of if HARQ feedback is enabled or disabled corresponding to the first SPS PDSCH after activation.
* For a NB-IoT UE configured with a single HARQ process in HARQ mode B, send LS to RAN1 and ask for the “processing time for starting drx-InactivityTimer (i.e. start to monitor NPDCCH)”. (can further check the detailed wording of the question)
* Network implementation resolves the issue of ambiguity on start of DRX inactivity timer after the PUSCH transmission by not scheduling the NPDCCH back-to-back during the ambiguity period (i.e., Koffset – UE’s TA)
* Send LS to RAN1 to check for UL multiple TB scheduling, which UL HARQ mode combination(s) are to be supported.
* In the LS to RAN1, we don’t include a question on whether RAN1 intends to introduce the DCI-based solution for the UL HARQ mode
* UL transmission using SPS can be configured with HARQ mode B
* P1 in R2-2303713 is not agreed, i.e. do not enhance the LCP restriction based on uplinkHARQ-Mode for different RLC PDU types
* Send LS to RAN1 informing RAN2’s agreements and also including potential questions to be checked with RAN1
* Add one more question in the LS to check with RAN1 which of the below understandings is correct for the RAN1 agreement.
  + Understanding 1: For a DL HARQ process with disabled HARQ feedback in NB-IoT, UE is not required to monitor NPDCCH for the same HARQ process in a period of Y=12(ms) from the end of reception of the NPDSCH.
  + Understanding 2: For a DL HARQ process with disabled HARQ feedback in NB-IoT, UE is not required to monitor NPDCCH for all the HARQ processes in a period of Y=12(ms) from the end of reception of the NPDSCH.
* RAN2 further discuss whether UL transmission using PUR can be configured with HARQ mode B.
* There is no need for UE to provide GNSS position fix time duration in Msg3.
* RLM is suspended during the GNSS measurement gap while the UE is measuring GNSS
* UE can stay in RRC\_CONNECTED state when current GNSS position becomes out-of-date if the UE enters a GNSS measurement gap. FFS whether the new GNSS measurement shall be started before, upon or after the current GNSS validity duration expiry
* For a UEs that cannot acquire system information and GNSS position at the same time, acquisition of SIB31 may be postponed until GNSS measurement is completed if the UE cannot complete acquisition of SIB31 before the start of GNSS measurement gap
* For the NB-IoT CP solution, UE will report the GNSS validity duration by using a MAC CE
* RAN2 can discuss UE autonomously reacquire GNSS during inactive state of C-DRX based on RAN1’s input in the next RAN2 meeting

Working Assumption:

* GNSS validity duration UE reported after GNSS measurement is the remaining validity duration

**Agreements on “8.6.3 Mobility Enhancements”**

Agreements:

* New SIBxx is introduced to broadcast the neighbor cell/satellite information.
* Common TA parameters are broadcast as assistance information for neighbor cell measurements.
* Kmac is broadcast as neighbor cell assistance information.
* For moving cell, the UE can derive the trajectory of serving cell with rough accuracy based on serving satellite ephemeris and epochTime, with the assumption that the serving cell reference location broadcast by the network is the one at Epoch time (like in NR-NTN).
* Introduce satellite ID for the satellite in a list in new SIB-xx. FFS on the details of the new IE
* For eMTC NTN, for fixed cell, location-based measurement initiation can also be used in RRC\_IDLE for cell re-selection purposes (like in NR-NTN)
* For eMTC NTN, for moving cell, location-based measurement initiation can also be used in RRC\_IDLE for cell re-selection purposes (like in NR-NTN). FFS whether to consider solution that does not require UE to update the GNSS for this same as in connected mode
* SIB3 is extended to include the reference location and distanceThresh

**Agreements on “8.6.4 Enhancements to discontinuous coverage”**

Agreements:

* RAN2 will not introduce any enhancement to allow a UE in RRC Connected to stay in RRC\_CONNECTED during/after a coverage gap (e.g. suspend RLM/RLF, activation time in RRC Reconfiguration, CHO enhancement)
* RAN2 to introduce enhancement to RRC Release using one of the following options (FFS which one):
  + Explicit RRC Release using a new RRC Release cause
  + UE Autonomous release (e.g. timer based or upon detection of coverage gap).

**RAN2#122, May 22nd – May 26th, 2023, Incheon, Korea**

**Agreements on “7.6.2 Performance Enhancements”**

Agreements:

* Confirm the working assumption that GNSS validity duration UE reports is the remaining validity duration.
* The UE triggers GNSS measurement reporting every time upon completing the GNSS fix operation.
* When network triggers GNSS measurement initiation is up to network implementation.
* Add a note to state some AS operations are suspended when UE is performing GNSS measurement during GNSS measurement gap.
* GNSS fix time duration should be reported in 1) and 2):
  + RRCConnectionReestablishmentComplete and RRCConnectionReestablishmentComplete-NB
  + RRCConnectionReconfigurationComplete for HO case
  + (FFS whether there are some scenarios where this is not needed or whether there has to be some explicit NW indication to do so)

Working Assumptions:

* An UL MAC CE for GNSS validity duration reporting is used for NB-IoT user plane solution and eMTC UE as well, in addition to previously agreed NB-IoT control plane solution
* A new DL MAC CE is introduced to trigger connected UE to perform GNSS measurement.

**Agreements on “7.6.3 Mobility Enhancements”**

Agreements:

* Extend the neighbour cell information in existing SIBs (not SIB31) to include satellite ID
* The system Information modification procedure is not triggered for an update of new SIB on neighbor-cell assistance information.
* For NB-IoT, SIBxx is not an essential SIB. UE does not need to consider the cell barred if it is unable to acquire the SIB when scheduled. FFS for eMTC
* In RRC IDLE, how to (re-)acquire neighbour cell assistance information is up to UE’s implementation.
* The satellite ID in the new SIB is an integer of X bits wherein X depends on the maximum number of satellites to be considered for mobility.
* The satellite ID is defined as Radio resource control information element to be used in other configurations.
* If a parameter in the common TA parameters is absent, then the value of the parameter is assumed zero.
* If Kmac is absent, then the value of Kmac for the neighbor satellite in the list is assumed zero. FFS on further optimization on signaling, e.g., signalling explicit value 0 of Kmac.
* Reference location and distanceThresh in SIB31. A change of reference location does not trigger SI modification. A UE does not need to get a new reference location as long as ephemeris and Epoch time are valid (in Connected mode the UE relies on T317)
* For earth-fixed cells, introduce t-ServiceStart for neighbor cells. If UE is aware of the t-ServiceStart of the neighbour cell then may be used (up to UE implementation) to determine when to start measurements of that neighbor cell
* If the serving cell t-service expires, stop T310 (if running) and start T311 (i.e. perform cell search and re-establishment without attempting to recover on the current cell for the duration of T310). FFS on discontinuous coverage
* The distance between the UE and a second reference location (e.g. within a neighbour cell) is not taken into account.
* R18 location and time based trigger for measurements (for connected mode and for idle) apply to both NB-IoT and eMTC.

#### 2.2.2 Remaining Open issues

Objective 1 (IoT-NTN Performance Enhancements in Rel-18 to address remaining issues from Rel-17):

* Any further details on disabling HARQ feedback in DL for both NB-IoT and eMTC based NTN.
* Any further details on HARQ mode A and HARQ mode B for UL HARQ operation in IoT NTN.
* Further details on RAN2 aspects on GNSS enhancements.

Objective 2 (Mobility enhancements):

* Any further details on neighbor cell measurements.
* Any further remaining details on CHO enhancements for eMTC-based NTN.

Objective 3 (Further enhancement to discontinuous coverage):

* RAN2 aspects on further enhancements in discontinuous coverage.

## 2.2 RAN3

#### 2.3.1 Agreements

**RAN3#119bis-e, April 17th – April 26th, 2023, Online**

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

* The Uu cell ID is used as the target cell ID in both S1 and X2 handover signalling.
* There is no need to consider the 5GC for discontinuous coverage issue in Rel-18 IoT NTN WI.
* Regarding the duplicated issues, IoT NTN shall wait for the corresponding progress in NR NTN.

**RAN3#120, May 22nd – May 26th, 2023, Incheon**

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

* Uu Cell ID is used to be exchanged via X2 Setup and eNB Configuration Update procedure.

#### 2.3.2 Remaining Open issues

* Align with the progress of NR NTN, if any.
* The potential issues of discontinuous coverage captured by the final TR from SA2.

## 2.4 RAN4

#### 2.4.1 Agreements:

**RAN4#106bis-e, Online, April 17 – April 26, 2023**

Issue 1-2: Scaling factor for multiple NGSO satellites

* include scaling factor for multiple NGSO satellites for RRC Idle measurement requirements (Tdetect, Tevaluate, Tmeasure)
* FFS the need to introduce scaling factor for multiple NGSO satellites for NB neighbour cell measurement in connected mode
  + Intra-frequency
  + Inter-frequency

Issue 2: Requirements which not applicable due to lack of neighbor cell ephemeris

The requirements which not applicable due to lack of neighbor cell ephemeris in R17 could be applied in R18, the requirements defined during R17 can be the starting point for further discussion.

Issue 3-1: Neighbor cell measurements in connected mode, time-based

* For quasi-earth fixed cell for NB-IoT, RAN4 to discuss whether to define requirements for *t-service* triggered neighbor cell measurement before RLF. FFS the following options:
  + Option 1: The NB-IoT UE shall start the intra/inter-frequency measurements at least before time T1 before start of t-Service, where T1 is the time required to perform one measurement.
  + Option 2: RAN4 to define time-based connected mode measurement initiation condition in core spec. The details such as exact measurement starting time should wait further progress of RAN2.
  + Option 3: not to define.
  + Other options are not precluded.

Issue 3-2: Neighbor cell measurements in connected mode, location-based

* For quasi-earth fixed cell and earth-moving cell for NB-IoT, RAN4 to define location-based connected mode measurement initiation condition in core spec. The details such as exact measurement starting time should wait further progress of RAN2

Issue 4: For eMTC, CHO requirements

* Define RRM requirements for time-based and location-based CHO for both normal and enhanced coverage for eMTC. For the specific delay requirement development, wait further progress of RAN2.
  + Note: the enhanced coverage is legacy function

**RAN4#107, Incheon, KR, May 22 – May 26, 2023**

Issue 1-1: Measurement capabilities on number of NGSO satellites

* Agreements
  + Clarify that the sets of neighbor satellites for inter-frequency measurements that the UE shall be capable to measure in each frequency layer in NGSO scenarios are not necessary the same

Issue 1-2: Scaling factor for multiple NGSO satellites

* Agreements
  + Introduce scaling factor for multiple NGSO satellites for NB intra-frequency neighbor cell measurement in connected mode. FFS for inter-frequency measurements.

Issue 2-2: Requirements applicability for time-based neighbor cell measurements

* Agreements
  + UE shall be able to detect, measure, and evaluate neighbour cells before *t-Service* is reached, and the relaxed neighbor cell measurement is only allowed when the relaxed monitoring criteria defined in clause 5.2.4.12 [1] are fulfilled and the time span to before *t-Servic* is longer than Ttrigger

Issue 3: Location-based cell reselection

* For location triggered cell reselection measurement,
  + For eMTC and fixed cell, re-use the requirements from NR NTN as a starting point
  + For eMTC and moving cell, wait for further progress in Rel-18 NR NTN WI
  + FFS whether the requirements are also applicable to NB-IoT pending on further RAN2 agreement

Issue 4-1: Neighbor cell measurements in connected mode, time-based

Continue discussion on the following proposals:

* Proposal 1: For for *t-service* triggered neighbor cell measurement before RLF for NB-IoT:
  + Option 1a: Do not define requirements for t-service triggered neighbour cell measurement. (Huawei)
  + Option 1b: The UE shall be able to measure only intra-frequency neighbour cell before t-service provided that the time span from the SI broadcasting t-service to t-service is longer than Tidentify\_intra, and when to start the detection, measurement and evaluation on neighbour cells is up to UE implementation.
* Proposal 2a: Support neighbor cell measurements initiated before t-service before RLF and wait for RAN2 definition on the indication of the “start time” of neighbor satellite to decide the point in time where the measurements are initiated.
* Proposal 2b: For NB-IOT NTN of quasi-earth fixed cell and earth-moving cell, RAN4 should introduce time-based connected mode measurement initiation in core spec according to RAN2’s design. The exact time to start measurements in connected mode before t-Service can be left to UE implementation.
* Proposal 3: The NB-IoT UE shall start the intra/inter-frequency measurements at least before time T1 before start of t-Service, where T1 is the time required to perform one measurement.

Issue 4-2: Neighbor cell measurements in connected mode, location-based

Continue discussion on the following proposals:

* Proposal 1: For location-based triggering, add the corresponding criteria (reference location and distance threshold) and the same requirements as NRSRP based triggering can apply, and the details should wait for more progress in RAN2. (Huawei)
* Proposal 2: For eMTC NTN of quasi-earth fixed cell and earth-moving cell, RAN4 should introduce location-based IDLE mode measurement initiation condition in core spec according to RAN2’s design. The measurement initiation mechanism for NR-NTN could be reused. (CMCC)
* Proposal 3: For earth-moving cell, RAN4 to discuss how to define the requirements for the propagation of the referenceLocationh based on the satellite movement. (Nokia)

Issue 6-1: GNSS re-acquisition, impact on RLM

* Agreements
  + Capture in specification that when a UE is measuring the GNSS in a GNSS-MG RLM monitoring is suspended. FFS on the impact on RLM requirements.

#### 2.4.2 Remaining Open issues:

Core Part

Define UE RRM requirements for the introduced mobility enhancement features, including eMTC CHO, neighbour cell measurements in connected mode, location-based cell reselection.

Performance Part

The work on Performance part has not started yet.

## 2.5 RAN5

#### 2.5.1 Agreements

#### 2.5.2 Remaining Open issues

#### 2.5.3 Remaining Open issues with cross-WG dependencies

## 2.6 RAN6

#### 2.6.1 Agreements

#### 2.6.2 Remaining Open issues

## 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#112bis-e, April 17th – April 26th, 2023, Online**

Submitted TDocs to AI 9.9.3

* R1-2302366 Discussion on disabling of HARQ feedback for IoT NTN Huawei, HiSilicon
* R1-2302566 Discussion on disabling of HARQ feedback for IoT NTN OPPO
* R1-2302617 Discussion on disabling of HARQ feedback for IoT NTN Spreadtrum Communications
* R1-2302721 Discussion on remaining issues of disabling of HARQ feedback for IoT NTN CATT
* R1-2302837 Disabling of HARQ feedback for NB-IoT/eMTC over NTN Nokia, Nokia Shanghai Bell
* R1-2302859 Discussion on disabling of HARQ feedback for IoT-NTN Sony
* R1-2303000 Discussion on the HARQ operation for IoT NTN xiaomi
* R1-2303020 On disabling HARQ feedback for IoT NTN Ericsson
* R1-2303146 Disabling of HARQ feedback for IoT NTN Samsung
* R1-2303175 Disabling of HARQ feedback for IoT NTN Nordic Semiconductor ASA
* R1-2303251 Discussion on disabling of HARQ feedback for IoT NTN CMCC
* R1-2303296 Discussion on disabling of HARQ feedback for IoT-NTN ZTE
* R1-2303357 Disabling of HARQ for IoT NTN MediaTek Inc.
* R1-2303419 On disabling HARQ feedback for IoT-NTN Mavenir
* R1-2303501 On HARQ Feedback Disabling for IoT NTN Apple
* R1-2303542 Disabling of HARQ feedback for IoT NTN InterDigital, Inc.
* R1-2303608 Disabling HARQ Feedback for IoT-NTN Qualcomm Incorporated
* R1-2303627 Disabling of HARQ feedback for IoT NTN Lenovo
* R1-2303642 Views on Disabling of HARQ feedback for IoT NTN Sharp
* R1-2303685 Disabling of HARQ feedback for IoT NTN NEC
* R1-2303998 FLS#1 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)
* R1-2303999 FLS#2 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)

Submitted TDocs to AI 9.9.4

* R1-2302367 Discussion on improved GNSS operations for IoT NTN Huawei, HiSilicon
* R1-2302567 Discussion on improved GNSS operations for IoT NTN OPPO
* R1-2302618 Discussion on improved GNSS operations for IoT NTN Spreadtrum Communications
* R1-2302722 Discussion on remaining issues of improved GNSS operations for IoT NTN CATT
* R1-2302749 On Improved GNSS Operations for IoT NTN NEC
* R1-2302838 Enhancements for long connections in NB-IoT/eMTC over NTN Nokia, Nokia Shanghai Bell
* R1-2303001 Discussion on the improved GNSS operation for IoT NTN xiaomi
* R1-2303147 Improved GNSS operations for IoT NTN Samsung
* R1-2303176 Improved GNSS operations for IoT NTN Nordic Semiconductor ASA
* R1-2303252 Discussion on improved GNSS operations for IoT NTN CMCC
* R1-2303297 Discussion on improved GNSS operation for IoT-NTN ZTE
* R1-2303358 Improved GNSS operations for IoT NTN MediaTek Inc.
* R1-2303432 On improved GNSS operation in IoT NTN Ericsson Limited
* R1-2303502 On improved GNSS operations for IoT NTN Apple
* R1-2303543 Improved GNSS operations for IoT NTN InterDigital, Inc.
* R1-2303609 Improved GNSS Operations for IoT-NTN Qualcomm Incorporated
* R1-2303628 Improved GNSS operations for IoT NTN Lenovo
* R1-2303911 Feature lead summary#1 of AI 9.9.4 on improved GNSS operations Moderator (MediaTek)
* R1-2303912 Feature lead summary#2 of AI 9.9.4 on improved GNSS operations Moderator (MediaTek)
* R1-2304125 [Draft] LS on GNSS position fix during inactive state of Connected DRX for improved GNSS operations Moderator (MediaTek)
* R1-2304073 Feature lead summary#3 of AI 9.9.4 on improved GNSS operations Moderator (MediaTek)

**RAN1#113, May 22nd – May 26th, 2023, Incheon, South Korea**

Submitted TDocs to AI 9.9.3

* R1-2304574 Discussion on disabling of HARQ feedback for IoT NTN Spreadtrum Communications
* R1-2304634 Discussion on disabling of HARQ feedback for IoT NTN Huawei, HiSilicon
* R1-2304687 Disabling of HARQ feedback for NB-IoT/eMTC over NTN Nokia, Nokia Shanghai Bell
* R1-2304753 Discussion on remaining issues of disabling of HARQ feedback for IoT NTN CATT
* R1-2304781 Disabling of HARQ feedback for IoT NTN InterDigital, Inc.
* R1-2304851 Disabling of HARQ feedback for IoT NTN Lenovo
* R1-2304918 Discussion on the HARQ operation for IoT NTN xiaomi
* R1-2304984 Disabling of HARQ feedback for IoT NTN NEC
* R1-2305049 Discussion on disabling of HARQ feedback for IoT-NTN Sony
* R1-2305110 Discussion on disabling of HARQ feedback for IoT NTN CMCC
* R1-2305184 On disabling HARQ feedback for IoT NTN Ericsson
* R1-2305261 HARQ Feedback Disabling for IoT NTN Apple
* R1-2305354 Disabling HARQ Feedback for IoT-NTN Qualcomm Incorporated
* R1-2305438 Discussion on disabling of HARQ feedback for IoT NTN OPPO
* R1-2305531 Disabling of HARQ feedback for IoT NTN Samsung
* R1-2305558 Discussion on disabling of HARQ feedback for IoT-NTN ZTE
* R1-2305650 Disabling of HARQ for IoT NTN MediaTek Inc.
* R1-2305849 Views on Disabling of HARQ feedback for IoT NTN Sharp
* R1-2305909 Disabling of HARQ feedback for IoT NTN Nordic Semiconductor ASA
* R1-2306020 FLS#1 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)
* R1-2306021 FLS#2 on disabling of HARQ feedback for IoT NTN Moderator (Lenovo)
* R1-2306205 [Draft] LS on NPDCCH monitoring restriction for NB-IoT NTN Moderator (Lenovo)
* R1-2304324 LS on HARQ Enhancements RAN2, OPPO

Discussion on response LS to be handled in agenda item 9.9. To be moderated by Zuomin (OPPO).

* R1-2305316 Discussion on NTN IOT HARQ enhancements Qualcomm Incorporated
* R1-2305400 Discussion on questions of HARQ enhancement in IoT NTN from RAN2 LS Nokia, Nokia Shanghai Bell
* R1-2305938 Discussion on the LS of HARQ enhancement for IoT NTN Huawei, HiSilicon
* R1-2304850 Draft reply LS to RAN2 on HARQ Enhancements Lenovo
* R1-2305224 Draft Reply LS on HARQ Enhanements Apple
* R1-2305225 Discussion on RAN2 LS on HARQ Enhancements Apple
* R1-2305444 Discussion RAN2 LS on HARQ Enhancements OPPO
* R1-2305445 Draft reply LS on HARQ Enhancements OPPO
* R1-2305563 Discussion on LS on HARQ Enhancements ZTE
* R1-2305564 Draft Reply LS on the HARQ enhancement ZTE
* R1-2305915 [Draft] Reply to RAN2 LS on HARQ Enhancements Nordic Semiconductor ASA
* R1-2306106 Summary of discussion on LS on HARQ enhancements Moderator (OPPO)
* R1-2306179 Summary#2 of discussion on LS on HARQ enhancements Moderator (OPPO)
* R1-2306134 Draft Reply LS on HARQ Enhancements RAN1, OPPO
* R1-2306182 Reply LS on HARQ Enhancements RAN1, OPPO

Submitted TDocs to AI 9.9.4

* R1-2304575 Discussion on improved GNSS operations for IoT NTN Spreadtrum Communications
* R1-2304635 Discussion on improved GNSS operations for IoT NTN Huawei, HiSilicon
* R1-2304688 Enhancements for long connections in NB-IoT/eMTC over NTN Nokia, Nokia Shanghai Bell
* R1-2304754 Discussion on remaining issues of improved GNSS operations for IoT NTN CATT
* R1-2304782 Improved GNSS operations for IoT NTN InterDigital, Inc.
* R1-2304852 Improved GNSS operations for IoT NTN Lenovo
* R1-2304919 Discussion on the improved GNSS operation for IoT NTN xiaomi
* R1-2305069 On Improved GNSS Operations for IoT NTN NEC
* R1-2305111 Discussion on improved GNSS operations for IoT NTN CMCC
* R1-2305262 On improved GNSS operations for IoT NTN Apple
* R1-2305286 Remaining issues on improved GNSS operations for IoT NTN Sharp
* R1-2305355 Improved GNSS Operations for IoT-NTN Qualcomm Incorporated
* R1-2305439 Discussion on improved GNSS operations for IoT NTN OPPO
* R1-2305532 Improved GNSS operations for IoT NTN Samsung
* R1-2305559 Discussion on improved GNSS operation for IoT-NTN ZTE
* R1-2305651 Improved GNSS operations for IoT NTN MediaTek Inc.
* R1-2305910 Improved GNSS operations for IoT NTN Nordic Semiconductor ASA
* R1-2305916 On improved GNSS operation in IoT NTN Ericsson
* R1-2305998 Feature lead summary#1 of AI 9.9.4 on improved GNSS operations Moderator (MediaTek)
* R1-2305999 Feature lead summary#2 of AI 9.9.4 on improved GNSS operations Moderator (MediaTek)
* R1-2306202 Feature lead summary#3 of AI 9.9.4 on improved GNSS operations Moderator (MediaTek)

## 4.2 RAN2

**RAN2#121bis-e, April 17th – April 26th, 2023, Online**

Submitted TDocs to AI 7.6.1

* R2-2303097 36331 running CR for IOT NTN Huawei, HiSilicon
* R2-2303838 Running CR for R18 IoT NTN Ericsson
* R2-2303950 Stage-3 running CR for TS 36.321 for Rel-18 IoT-NTN MediaTek Inc..

Submitted TDocs to AI 7.6.2.1

* R2-2302533 Discussion on HARQ enhancement for IoT NTN OPPO
* R2-2302534 Draft LS to RAN1 on HARQ enhancement for IoT NTN OPPO
* R2-2302557 Discussion on the HARQ enhancements in IoT NTN CATT
* R2-2302672 On Disabling HARQ Feedback in IoT-NTN MediaTek Inc.
* R2-2302819 Further discussion on HARQ enhancements ZTE Corporation, Sanechips
* R2-2303041 Enhancement for UL and DL HARQ processes Qualcomm Incorporated
* R2-2303517 Discussion on the HARQ enhancement for IoT-NTN CMCC
* R2-2303644 Discussion on Timing Advance Report MAC CE transmission in eMTC NTN Nokia, Nokia Shanghai Bell, Huawei, HiSilicon
* R2-2303713 Disabling HARQ feedback for IoT-NTN Interdigital, Inc.
* R2-2303837 R18 IoT NTN HARQ enhancements Ericsson
* R2-2303964 Discussion on HARQ enhancements Huawei, HiSilicon
* R2-2304030 Discussion on HARQ enhancement Xiaomi
* R2-2304032 LS on NPDCCH monitoring for HARQ mode B Xiaomi
* R2-232470 Discussion on HARQ enhancement for IoT NTN OPPO

Submitted TDocs to AI 7.6.2.2

* R2-2302543 Discussion on GNSS operation for IoT NTN OPPO
* R2-2302558 Discussion on GNSS operation in connected mode CATT
* R2-2302673 GNSS operation enhancements MediaTek Inc.
* R2-2302820 Procedure of GNSS reacquisition ZTE Corporation, Sanechips
* R2-2303044 GNSS fix in RRC\_CONNECTED Qualcomm Incorporated
* R2-2303250 On GNSS position fix in RRC\_CONNECTED for IoT NTN Lenovo
* R2-2303297 Discussion on the GNSS Validity Reporting in Connected State Google Inc.
* R2-2303330 GNSS fix in connected mode NEC
* R2-2303404 Improved GNSS Operation Apple
* R2-2303518 Discussion on GNSS enhancement for IoT-NTN CMCC
* R2-2303645 Discussion on enhancements on GNSS operation for IoT NTN Nokia, Nokia Shanghai Bell
* R2-2303714 GNSS acquisition and reporting for IoT NTN Interdigital, Inc.
* R2-2303836 R18 IoT NTN GNSS operation enhancements Ericsson
* R2-2303965 Discussion on GNSS operation enhancements Huawei, HiSilicon
* R2-2304017 On improved GNSS operation for IoT NTN Samsung R&D Institute UK
* R2-2304029 Discussion on GNSS operation enhancement Xiaomi
* R2-2304183 GNSS acquisition and reporting for IoT NTN InterDigital, Europe, Ltd.

Submitted TDocs to AI 7.6.3.1

* R2-2300144 Enhancements for neighbour cell measurements Huawei, HiSilicon, Turkcell
* R2-2300162 Discussion on measurement enhancement for IoT NTN OPPO
* R2-2300205 Enhancements for Neighbor Cell Measurements CATT
* R2-2300264 Enhancements on neighbour cell measurement MediaTek Inc.
* R2-2300366 Discussion on neighbour cell measurements in IoT NTN Intel Corporation
* R2-2300581 Neighbour cell measurements before RLF Interdigital, Inc.
* R2-2300750 Neighbour cell measurements before RLF for NB-IoT Apple
* R2-2300891 Neighbour satellite and coverage information signalling Qualcomm Incorporated
* R2-2300980 CONNECTED neighbour cell measurement for NB-IoT in NTN Lenovo
* R2-2301012 Enhancements for neighbor cell measurements NEC
* R2-2301054 Further discussion on neighbor cell measurement ZTE Corporation, Sanechips
* R2-2301187 Consideration on enhancements for the neighbour cell measurement Xiaomi
* R2-2301253 Discussion on enhancements for neighbour cell measurements CMCC
* R2-2301494 On enhancements for neighbour cell measurements Samsung Electronics Benelux BV
* R2-2301602 Discussion on Enhancements for neighbour cell measurements Transsion Holdings
* R2-2301624 Discussion on Enhancements for neighbour cell measurements Transsion Holdings
* R2-2301693 Discussion on neighbour cell measurements before RLF Ericsson

Submitted TDocs to AI 7.6.3.2

* R2-2303252 IDLE mobility for moving cells in IoT NTN Lenovo
* R2-2303405 Mobility enhancement in IoT NTN Apple
* R2-2304018 On IoT NTN CHO and other mobility enhancements Samsung R&D Institute UK

Submitted TDocs to AI 7.6.4

* R2-2302560 Discussion on enhancements to discontinuous coverage CATT
* R2-2302822 RAN2 enhancements for discontinuous coverage ZTE Corporation, Sanechips
* R2-2303042 RRC release procedure in discontinuous coverage Qualcomm Incorporated
* R2-2303052 Enhancements to discontinuous coverage Samsung R&D Institute UK
* R2-2303111 Considerations on Supporting Discontinuous Coverage NEC Europe Ltd
* R2-2303193 On RAN impacts for Discontineous coverage enhancements Nokia, Nokia Shanghai Bell
* R2-2303253 On mobility and power saving issues for discontinuous coverage Lenovo
* R2-2303407 Support on discontinuous coverage in IoT NTN Apple
* R2-2303437 Enhancements to discontinuous coverage Xiaomi
* R2-2303476 Discussion on enhancement to discontinuous coverage for IoT NTN Transsion Holdings
* R2-2303520 Discussion on the discontinuous coverage for IoT-NTN CMCC
* R2-2303576 Discussion on power saving enhancements for supporting discontinuous coverage Spreadtrum Communications
* R2-2303716 IoT-NTN discontinuous coverage enhancements Interdigital, Inc.
* R2-2303735 Enhancements to discontinuous coverage Ericsson
* R2-2303963 Discussion on discontinuous coverage Huawei, HiSilicon
* R2-2304081 Discussion on the UE Unreachability Periods Google Inc.
* R2-2304160 Discussion on Enhancements related to discontinuous coverage Rakuten Mobile, Inc

**RAN2#122, May 22nd – May 26th, 2023, Incheon, Korea**

Submitted TDocs to AI 7.6.1

* R2-2304612 LS on GNSS position fix during inactive state of Connected DRX for improved GNSS operations (R1-2304126; contact: MediaTek) RAN1
* R2-2304737 36.321 (MAC) Running CR for IoT-NTN Mediatek Inc.
* R2-2305199 Running CR for TS 36.306 for Rel-18 IoT NTN Qualcomm Incorporated
* R2-2306065 36331 running CR for IOT NTN Huawei, HiSilicon
* R2-2306265 Running CR for R18 IoT NTN Ericsson

Subm R2-2304731 On Disabling HARQ Feedback in IoT-NTN Mediatek Inc.

* R2-2304740 Discussion on HARQ enhancement for IoT NTN OPPO
* R2-2304813 Discussion on HARQ mode for PUR Huawei, HiSilicon
* R2-2304893 Discussion on the HARQ enhancements in IoT NTN CATT
* R2-2305168 Remaining Issues on Disabling HARQ feedback for IoT-NTN Interdigital, Inc.
* R2-2305200 UL HARQ process enhancement Qualcomm Incorporated
* R2-2305609 Discussion on the HARQ enhancement for IoT-NTN CMCC
* R2-2305727 Discussion on HARQ enhancement Xiaomi
* R2-2305758 On HARQ enhancements for IoT NTN Nokia, Nokia Shanghai Bell
* R2-2305956 Further discussion on HARQ enhancements ZTE Corporation, Sanechips
* R2-2306264 R18 IoT NTN HARQ enhancements Ericssonitted TDocs to AI 7.6.2.1

Submitted TDocs to AI 7.6.2.2

* R2-2304732 GNSS Operation Enhancements in IoT-NTN MediaTek Inc.
* R2-2304751 Discussion on GNSS operation for IoT NTN OPPO
* R2-2304814 Discussion on GNSS operation enhancements Huawei, HiSilicon
* R2-2304894 Discussion on GNSS operation in connected mode CATT
* R2-2305151 GNSS fix in connected mode NEC
* R2-2305169 GNSS acquisition and reporting for IoT NTN Interdigital, Inc.
* R2-2305203 GNSS fix in RRC\_CONNECTED Qualcomm Incorporated
* R2-2305610 Discussion on GNSS enhancement for IoT-NTN CMCC
* R2-2305711 Further considerations on GNSS operations in RRC\_CONNECTED for IoT NTN Lenovo
* R2-2305726 Discussion on GNSS operation enhancement Xiaomi
* R2-2305759 GNSS operation enhancements for IoT NTN Nokia, Nokia Shanghai Bell
* R2-2305894 Issues for the GNSS Validity Reporting Google Inc.
* R2-2305957 Further discussion on GNSS reacquisition ZTE Corporation, Sanechips
* R2-2305992 GNSS operation enhancements SHARP Corporation
* R2-2306166 Improved GNSS Operation Apple
* R2-2306263 R18 IoT NTN GNSS operation enhancements Ericsson

Submitted TDocs to AI 7.6.3.1

* R2-2304733 On Enhancing Neighbor Cell Measurements in IoT-NTN MediaTek Inc.
* R2-2304741 Discussion on measurement triggering enhancement for IoT NTN OPPO
* R2-2304742 Discussion on neighbour cell assistance information for IoT NTN OPPO
* R2-2304895 Discussion on the mobility enhancements for IoT NTN UE CATT
* R2-2305170 Neighbour cell measurements before RLF and CHO enhancements Interdigital, Inc.
* R2-2305202 Satellite and coverage information signalling Qualcomm Incorporated
* R2-2305611 Discussion on mobility enhancements for IoT-NTN CMCC
* R2-2305671 Discussion on the neighbour cell measurement for RRC Connected UE Xiaomi
* R2-2305712 On location-based neighbour cell measurement in RRC\_CONNECTED in IoT NTN Lenovo
* R2-2305862 Further analysis on mobility enhancements for IoT-NTN Nokia, Nokia Shanghai Bell
* R2-2305958 Further discussion on neighbor satellite assistance information and new triggers for neighbor cell measurement ZTE Corporation, Sanechips
* R2-2306066 Enhancements for neighbour cell measurements Huawei, HiSilicon, Turkcell
* R2-2306168 Neighbour cell measurements before RLF for NB-IoT Apple
* R2-2306254 Neighbour cell measurements before RLF Ericsson

Submitted TDocs to AI 7.6.3.2

* R2-2305713 On new SIB for neighbour cell information in IoT NTN
* R2-2306169 Mobility enhancement in IoT NTN

Submitted TDocs to AI 7.6.4

* R2-2304812 Discussion on discontinuous coverage Huawei, HiSilicon
* R2-2304896 Discussion on enhancements to discontinuous coverage CATT
* R2-2305171 IoT-NTN discontinuous coverage enhancements Interdigital, Inc.
* R2-2305172 <draft> LS on PTW modification due to UE unreachability Interdigital, Inc.
* R2-2305201 RRC release procedure in discontinuous coverage Qualcomm Incorporated
* R2-2305307 Considerations on Supporting Discontinuous Coverage NEC Europe Ltd
* R2-2305372 Discussion on enhancement to discontinuous coverage for IoT NTN Transsion Holdings
* R2-2305560 Discussion on power saving enhancements for supporting discontinuous coverage Spreadtrum Communications
* R2-2305612 Discussion on the discontinuous coverage for IoT-NTN CMCC
* R2-2305672 Enhancements to discontinuous coverage Xiaomi
* R2-2305714 Further considerations on discontinuous coverage Lenovo
* R2-2305785 Enhancements to discontinuous coverage Samsung Shenzhen
* R2-2305863 On RAN impacts for Discontineous coverage enhancements Nokia, Nokia Shanghai Bell
* R2-2305959 RAN2 enhancements for discontinuous coverage ZTE Corporation, Sanechips
* R2-2306167 Support on discontinuous coverage in IoT NTN Apple

## 4.3 RAN3

**RAN3#119bis-e, April 17th – 26th, 2023, e-meeting**

* R3-231225 TP for BL CR 36.300 on NTN Handover Cell ID Nokia, Nokia Shanghai Bell, Qualcomm Incorporated, ZTE, Deutsche Telekom, Verizon Wireless, NEC, Huawei, CATT
* R3-231454 Time Margin for CHO in IoT NTN Ericsson, Inmarsat, ESA
* R3-231455 Time-Based HO and IoT NTN Ericsson, CATT, ESA, Huawei
* R3-231456 Time-Based HO for IoT NTN – S1AP Impacts Ericsson, Huawei, CATT, ESA
* R3-231457 Which Core Network for Rel-18 IoT NTN? Ercisson LM
* R3-231478 (TP for BL CR 36.300) on data forwarding in X2-CHO with time-based trigger condition Nokia, Nokia Shanghai Bell
* R3-231597 (TP for BL CR 36.413&38.413) Further discussion on UE context release issue Huawei
* R3-231677 Discussion on the support of discontinuous coverage CATT
* R3-231692 Further discussion on discontinuous coverage issue for IoT NTN ZTE

**RAN3#120, May 22nd – 26th, 2023, Incheon**

* R3-232675 Discussion on time based CHO in X2 CATT
* R3-232932 (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
* R3-232941 Time Margin for CHO in IoT NTN - X2AP Impact Ericsson, Inmarsat, ESA
* R3-232942 Time-Based HO and IoT NTN – Stage 2 Impacts Ericsson, CATT, ESA, Huawei
* R3-232943 Time-Based HO for IoT NTN – S1AP Impacts Ericsson, Huawei, CATT, ESA
* R3-232997 Altitude correction for the NTN TRP Huawei
* R3-233090 Further discussion on remaining issues for IoT NTN ZTE

## 4.4 RAN4

**RAN4#106bis-e, Online, April 17 – April 26, 2023**

* R4-2306387, WF on RRM requirements for IoT NTN enhancements, MediaTek.
* R4-2306262, Topic summary for [106-bis-e][231] IoT\_NTN\_enh, Moderator (MediaTek).
* R4-2304502, Discussion on Mobility Aspects and other core requirements for IoT NTN, Nokia, Nokia Shanghai Bell.
* R4-2304651, Discussion on RRM core requirements for IOT NTN enhancement, CMCC.
* R4-2304823, Discussion on RRM requirements for IoT NTN enhancement, MediaTek inc.
* R4-2305263, Discussion on RRM requirements for IoT NTN enhancement, Huawei, HiSilicon.
* R4-2305733, Discussions on RRM requirements for IoT NTN enhancements, Ericsson.

**RAN4#107, Incheon, KR, May 22 – May 26, 2023**

* R4-2310099, WF on IoT NTN enhancements RRM requirements, MediaTek.
* R4-2309982, Topic summary for [107][237] IoT\_NTN\_enh, Moderator (MediaTek).
* R4-2307900, Discussion on RRM requirements for IoT NTN enhancement, MediaTek inc.
* R4-2308315, Discussion on RRM requirements for IoT NTN enhancement, Huawei, HiSilicon.
* R4-2308360, Core Requirements for mobility in IoT/eMTC for NTN, Nokia, Nokia Shanghai Bell.
* R4-2308958, Discussion on RRM core requirements for IOT NTN enhancement, CMCC.
* R4-2309220, Discussions on RRM requirements for IoT NTN enhancements, Ericsson.

# 5 Others

***END***