**3GPP TSG-RAN WG4 Meeting #** **107 R4-230xxxx**

**Incheon, KR, May 22 – May 26, 2023**

**Agenda item:** 9.8.5

**Source:** Moderator (MediaTek inc.)

**Title:** Topic summary for [107][237] IoT\_NTN\_enh

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this summary (e.g. list of treated agenda items).*

This document is the topic summary for RRM requirements for R18 IoT (Internet of Things) NTN (non-terrestrial network) enhancements, including the following topics covered

* Topic#1: RRM core requirements (AI 9.8.4)

*List of candidate target of discussions for this topic.*

* 1st round: Decide on the scope, priority, options and tentative agreement to be discussed in the 2nd round. Conclude issues with strict consensus, if any.
* 2nd round: Conclude the issues identified in the 1st round.

# Topic #1: RRM core requirements (AI 9.8.4)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2307900**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307900.zip) | MediaTek inc. | Observation 1: The potential impact on RRM impact of this WI are:   * For NB-IoT, neighbour cell measurements in connected mode ((New) 8.14A.X1) * For M1, conditional HO enhancement (5.5A.2.3/4) * Other enactment   Proposal 1: NB-IoT neighbour cell measurements in connected mode, the scaling factor for multiple NGSO satellites can be introduced.  Proposal 2: For time-based NB-IoT neighbour cell measurements in connected mode, the UE shall start intra/inter frequency measurement in connected mode before the t-Service if present. The intra/inter frequency measurement requirement do not apply when the time span from when *t-Service* is broadcasted to *t-Service* is less than Ttrigger, which is the time UE complete measurements.  Proposal 3: UE is not required to update the GNSS location for Location-based connected mode measurement initiation.  Proposal 4: For location-based NB-IoT neighbour cell measurements in connected mode, a margin of 50 m should be considered for the distance threshold/radius of serving for detecting when to trigger connected mode measurements. |
| [**R4-2308315**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308315.zip) | Huawei, HiSilicon | Observation 1: The triggering methods for neighbour cell measurement in connected mode before RLF are as follows:   * Quasi-earth fixed cell:   + Legacy NRSRP based triggering   + T-service based triggering (the exact time to start measurements is up to UE implementation)   + Location based triggering: reference location + distance threshold * Earth-moving cell:   + Legacy NRSRP based triggering   + Location based triggering: reference location + distance threshold   Observation 2: The inter-frequency measurement in connected mode before RLF is “best efforts” measurement using vacant time slot, where the exact time for inter-frequency neighbour cell detection and measurement is unpredictable.  Proposal 2: For for *t-service* triggered neighbor cell measurement before RLF for NB-IoT:  Option 1: Do not define requirements for t-service triggered neighbour cell measurement.  Option 2: 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 3: 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.  Proposal 4: RAN4 should further wait for RAN2 progress before discussing exact requirements for time and [location based] CHO for eMTC.  Proposal 5: For location triggered cell reselection measurement,  - For eMTC and fixed cell, re-use the requirements from NR NTN  - 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  Observation 3: For inter-frequency neighbor cell measurement for NB-IoT, the measurement occasion shall also fulfill the condition that it is the resource where UE is not performing GNSS fix. For other measurement during connected mode, the measurement delay could be longer if GNSS fix happens during measurement period. |
| [**R4-2308360**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308360.zip) | Nokia, Nokia Shanghai Bell | [Observation 1: It has been previously agreed that the “total number of satellites” the UE shall measure is equal to two for each frequency layer, including the serving satellite.](#_Toc135062611)  [Proposal 1: RAN4 to clarify that the neighbor satellite for inter-frequency measurements that the UE shall be capable to measure in each frequency layer in NGSO scenarios are not necessary the same.](#_Toc135062612)  [Proposal 2: 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.](#_Toc135062613)  [Proposal 3: RAN4 to discuss how to define the requirements for the propagation of the referenceLocationh based on the satellite movement.](#_Toc135062614)  [Proposal 4: 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.](#_Toc135062615) |
| [**R4-2308958**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308958.zip) | CMCC | *Proposal 1: For NB-IOT NTN of quasi-earth fixed cell and earth-moving cell, RAN4 should introduce time-based 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 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.*  *Proposal 3: For NB neighbour cell measurement in connected mode, the impaction of GNSS measurement gap should be considered. The measurement occasion should also fulfill the condition that the resources are not colliding with GNSS measurement gap.*  *Proposal 4: When RLM measurement and GNSS measurement are colliding, the RLM requirements need to be extended.* |
| [**R4-2309220**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309220.zip) | Ericsson | Proposal 1: RAN4 to confirm reusing of neighbour cell measurement requirements which were agreed in the first IoT NTN WI.  Proposal 2: Introduce scaling factor for multiple NGSO satellites for NB intra-freuquency neighbour cell measurement in connected mode. FFS for inter-frequency measurements.  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.  Proposal 4: RAN4 to postpone the discussions on GNSS re-acquisition until more progress has been reached on this objective in other WGs. |

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### RRM core requirements

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

Background:

RAN4 #105 agreement in WI LTE\_NBIoT\_eMTC\_NTN\_req:

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

* + The minimum of the UE capability on the total number of the NGSO satellites across the layers is [2].
  + For NB in IDLE and M1 in both IDLE and CONNCTED, the UE shall be capable of monitoring
    - for intra-frequency carrier, the number of target satellites UE needs to monitor is [2] including serving LEO satellite.
    - for inter-frequency carrier, the number of target satellites UE needs to monitor per carrier is [2] if one of the target satellites include the UE serving satellite; the number of target satellites UE needs to monitor is [1] otherwise.

Proposals:

* Proposal 1: RAN4 to clarify that the neighbor satellite for inter-frequency measurements that the UE shall be capable to measure in each frequency layer in NGSO scenarios are not necessary the same. (Nokia)

Recommended WF: Is proposal 1 agreeable?

#### Issue 1-2: Scaling factor for multiple NGSO satellites

Proposals:

* Proposal 1: NB-IoT neighbour cell measurements in connected mode, the scaling factor for multiple NGSO satellites can be introduced. (MTK)
* Proposal 1a: Introduce scaling factor for multiple NGSO satellites for NB intra-freuquency neighbour cell measurement in connected mode. FFS for inter-frequency measurements. (Ericsson)

Recommended WF: Is Proposal 1a agreeable? FFS for inter-frequency measurements.

#### Issue 2-1: Requirements appliacability

Proposals:

* Proposal 1: RAN4 to confirm reusing of neighbour cell measurement requirements which were agreed in the first IoT NTN WI (Ericsson)

Recommended WF: Is proposal 1 agreeable?

#### Issue 2-2: Requirements appliacability for time-based neighbour cell measurements

Proposals:

* Proposal 1: Clarify that UE shall be able to detect, measure, and evaluate neighbour cells before *t-Service* is reached, and the relaxed neighbour 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 (Huawei)
* Proposal 1a: For time-based NB-IoT neighbour cell measurements in connected mode, the UE shall start intra/inter frequency measurement in connected mode before the *t-Service* if present. The intra/inter frequency measurement requirement do not apply when the time span from when *t-Service* is broadcasted to *t-Service* is less than Ttrigger, which is the time UE completes measurements (MTK)

Recommended WF: Are proposal 1 and 1a agreeable?

#### Issue 3: Location-based cell reselection

Proposals:

* Proposal 1: For location triggered cell reselection measurement, (Huawei)
  + For eMTC and fixed cell, re-use the requirements from NR NTN
  + 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

Recommended WF: Is proposal 1 agreeable?

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

Background:

RAN4 #106-bis agreement

* For quasi-earth fixed cell for NB-IoT, RAN4 to discuss whether to define requirements for *t-service* triggered neighbour 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.

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. (Huawei)
* 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. (Nokia)
* 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. (CMCC)
* 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. (Ericsson)

Recommended WF: Discuss proposals.

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

Background:

RAN4 #106-bis agreement

* 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

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)

Recommended WF: Discuss proposals.

#### Issue 5: For eMTC, CHO requirements

Proposals:

* Proposal 1: RAN4 should further wait for RAN2 progress before discussing exact requirements for time and [location based] CHO for eMTC. (Huawei)

Recommended WF:

* No agreement in this meeting.

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

Proposals:

* Proposal 1: 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. (Nokia)
* Proposal 1a: When RLM measurement and GNSS measurement are colliding, the RLM requirements need to be extended. (CMCC)

Recommended WF: Is Proposal 1 agreeable?

#### Issue 6-2: GNSS re-acquisition, other impact

Proposals:

* Proposal 1: For NB neighbour cell measurement in connected mode, the impaction of GNSS measurement gap should be considered. The measurement occasion should also fulfill the condition that the resources are not colliding with GNSS measurement gap. (CMCC)
* Proposal 2: UE is not required to update the GNSS location for Location-based connected mode measurement initiation. (MTK)
* Proposal 3: For location-based NB-IoT neighbour cell measurements in connected mode, a margin of 50 m should be considered for the distance threshold/radius of serving for detecting when to trigger connected mode measurements. (MTK)
* Proposal 4: RAN4 to postpone the discussions on GNSS re-acquisition until more progress has been reached on this objective in other WGs. (Ericsson)

Recommended WF: Discuss proposals.