**3GPP TSG-RAN WG2 #126 R2-24xxxxx**

**Fukuoka, Japan, May 20 – 24, 2024**

Agenda Item: 7.6.4

Source: Ericsson

Title: Summary of [AT126][303][IoT NTN Enh] MAC issues (Ericsson)

Document for: Discussion/Decision

# 1 Introduction

The rapporteur proposed these proposals as a summary to start off the discussion

**Proposal 1: RAN2 confirm that the UE shall always perform CBRA after successful GNSS measurement.**

**Proposal 2: The MAC procedure for reporting GNSS validity duration is clarified such that CBRA is always performed**

**Proposal 3: In NTNs, when the UE does CBRA in connected mode and *timeAlignmentTimer* is running, the UE shall not ignore the received Timing Alignment Command received in RAR**

The following Tdocs and proposals were included in this discussion:

[R2-2405117](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2405117%20Remaining%20issues%20on%20GNSS%20operation.docx)       Remaining issues on GNSS operation              Huawei, HiSilicon            discussion          Rel-18              IoT\_NTN\_enh-Core

Proposal 3: RACH is not triggered for the GNSS Validity Duration report if there is no UL resource available for the case of autonomous GNSS measurement in C-DRX inactive time.

-     Nokia thinks this could be left to UE implementation

-     QC is fine with p3. Google agrees.

-     Ericsson thinks the UE shall trigger RACH but it’s up to the UE when to do it

-     Apple thinks we could have a note

* Continue the discussion in [303]

[R2-2404686](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2404686%20GNSS%20extension.doc) Remaining issues on out-of-date GNSS fix   Qualcomm Incorporated         discussion   Rel-18 IoT\_NTN\_enh-Core

Proposal 1           UE resets the value of N\_TA before resuming UL operation after GNSS is fixed. Text proposal is provided above.

[R2-2404900](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2404900%20Remaining%20issues%20of%20MAC%20spec%20for%20IoT%20NTN.docx) Remaining issues of MAC spec for IoT NTN   ZTE Corporation, Sanechips  discussion   Rel-18 IoT\_NTN\_enh-Core

Proposal 1: RAN2 assume the exiting way for maintaining N\_TA after GNSS is fixed is enough, no enhancement is needed.

Proposal 2: It’s no need to enhance the process for the UE to report remaining GNSS Validity Duration after successful GNSS measurement during C-DRX.

[R2-2405198](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2405198%20NTA%20handling%20after%20GNSS%20fix%20v1.docx) NTA handling after GNSS fix     NEC   discussion       Rel-18 IoT\_NTN\_enh-Core

Proposal: reset NTA to 0 after GNSS fix

[R2-2405441](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2405441%20Further%20discussion%20on%20UE%20behaviour%20after%20successful%20GNSS%20acquistion.docx) Further discussion on UE behaviour after successful GNSS acquisition    Nokia, Nokia Shanghai Bell    discussion       Rel-18   IoT\_NTN\_enh-Core

Observation 1: The value of N\_TA is not clear after a UE has completed the GNSS measurement successfully.

Observation 2: If the UE transmits on PUSCH resources to the network after a GNSS measurement, the following PUSCH transmissions may cause interference to other UEs until the NW corrects any potential TA errors after sending multiple Timing Advance Commands MAC CE.

Observation 3: The network can correct large TA errors via the Random Access Response message.

Proposal 1: After a successful GNSS measurement /autonomous GNSS measurement, the UE shall  perform the Random Access procedure for UL synchronization using N\_TA = 0.

[R2-2405451](file:///C%3A%5CData%5C3GPP%5CExtracts%5CR2-2405451%20-%20R18%20IoT%20NTN%20GNSS%20extension.docx) R18 IoT NTN GNSS extension Ericsson   discussion       Rel-17 IoT\_NTN\_enh-Core

Observation 1      The UE shall trigger GNSS measurement reporting every time upon completing GNSS fix operation.

Observation 2      The GNSS Duration Report MAC CE shall not trigger SR; instead CBRA shall be used.

Observation 3      If the UE has a grant for new transmission, it will send the GNSS validity duration report MAC CE on that grant.

Observation 4      The current MAC spec does not always trigger CBRA to report the GNSS validity duration.

Proposal 1           Correct the MAC procedure to make it clear that a triggered GNSS validity duration report always trigger CBRA in line with the RAN2 agreements.

* Continue in offline [303]

Proposal 2           Consider the MAC text proposal in section 3.1

Observation 5      The network use NTA to compensate for errors due to estimation of UE and satellite’s position/common TA.

Observation 6      Setting NTA=0 after GNSS reacquisition is not optimal as the NTA value, configured by the network, may compensated for more than the UE position error.

Observation 7      Alt A, C and D do not provide optimal performance.

Observation 8      The UE can calculate the timing error due to inaccurate UE position by comparing the values of N"TA,adjUE"  based on its previous GNSS position and its new GNSS position after GNSS reacquisition, i.e., Terror\_UE\_position=N"TA,adjUE"-N"TA,adj[OLD]UE" .

Proposal 3           After a new GNSS position fix, set NTA=NTA\_old-Terror\_UE\_position where Terror\_UE\_position=N"TA,adj UE"-N"TA,adj[OLD]UE"  is the timing error due to inaccurate UE position and is calculated from N"TA,adj [OLD]UE"  based on the previous GNSS position and N"TA,adjUE"  based on the new GNSS position.

Proposal 4           Consider the MAC text proposal in section 3.2.

# 2 Discussion

During the f2f offline Wednesday at 15.00 to 15.30, the following was acceptable for all participants (Ericsson, Nokia, Qualcomm, Apple and MediaTek).

1. When the MAC entity receives a trigger to send the GNSS validity duration report, the UE shall stop the timeAlignmentTimer of the pTAG
2. The proposal implies the UE do not need to drop configured UL and DL resources, and the UE must initiate CBRA to reacquire uplink time alignment.
3. In RAN1 spec, UE always use N\_TA equal to zero when doing CBRA.
4. When timeAlignmentTimer is not running, the UE will always apply the Timing Advance Command received in RAR.
5. In MAC 5.4.10, add a NOTE that during inactive time of C-DRX, it is up to UE implementation when to stop timeAlignmentTimer and initiate CBRA
6. Consider this MAC text proposal for 5.4.10:

### 5.4.10 GNSS validity duration reporting

For a NB-IoT UE, a BL UE or a UE in enhanced coverage in a non-terrestrial network, an indication may be sent by upper layer to report the remaining GNSS measurement validity duration.

If the MAC entity receives an indication from upper layers to report the remaining GNSS measurement validity duration:

- stop the *timeAlignmentTimer* associated with the pTAG.

- initiate a Random Access procedure (see clause 5.1).

If the GNSS validity duration reporting procedure has been triggered and not cancelled:

- if the MAC entity has UL resources allocated for new transmission for this TTI, and;

- if the allocated UL resources can accommodate the GNSS Validity Duration Report MAC control element plus its subheader, as a result of logical channel prioritization:

- instruct the Multiplexing and Assembly procedure to generate the GNSS Validity Duration Report MAC control element as defined in clause 6.1.3.23.

All triggered GNSS validity duration reports shall be cancelled when a GNSS Validity Duration Report MAC control element is included in a MAC PDU for transmission.

NOTE: In RRC\_CONNECTED Mode when the UE is not in Active Time, it is up to UE implementation when to stop the *timeAlignmentTimer* and initiate Random Access.

1. Besides the initiation of Random Access, this method to trigger the inclusion of a MAC CE is exactly how PHR MAC CEs and TAR MAC CEs are included for transmission.

# 3 Conclusion

In the previous sections we made the following observations:

[Observation 1 The proposal implies the UE do not need to drop configured UL and DL resources, and the UE must initiate CBRA to reacquire uplink time alignment.](#_Toc167265593)

[Observation 2 In RAN1 spec, UE always use N\_TA equal to zero when doing CBRA.](#_Toc167265594)

[Observation 3 When timeAlignmentTimer is not running, the UE will always apply the Timing Advance Command received in RAR.](#_Toc167265595)

[Observation 4 Besides the initiation of Random Access, this method to trigger the inclusion of a MAC CE is exactly how PHR MAC CEs and TAR MAC CEs are included for transmission.](#_Toc167265596)

Based on the discussion in the previous sections we propose the following:

[Proposal 1 When the MAC entity receives a trigger to send the GNSS validity duration report, the UE shall stop the timeAlignmentTimer of the pTAG](#_Toc167265536)

[Proposal 2 In MAC 5.4.10, add a NOTE that during inactive time of C-DRX, it is up to UE implementation when to stop timeAlignmentTimer and initiate CBRA](#_Toc167265537)

[Proposal 3 Consider this MAC text proposal for 5.4.10:](#_Toc167265538)