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

**Fukuoka, Japan, 20 - 24 May, 2024**

**Source:** Huawei, HiSilicon

**Title:** Report of [Post126][305][IoT-NTN Enh] 36.331 CR (Huawei)

**Agenda Item:** 7.6.1

**Document for:** Discussion and decision

# Introduction

This document captures the outcome of the following email discussion:

* [Post126][305][IoT-NTN Enh] 36.331 CR (Huawei)

 Scope: update the RRC CR with meeting agreements

 Intended outcome: Agreed CR

 Deadline for agreed CR (in R2-2405758): short

# Discussion

The issue to be discussed in this document is the T390 stop condition for GNSS position fix during C-DRX inactive time:

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| Proposal 4: T390 is stopped after successful GNSS position fix during C-DRX inactive time. - Google could be fine but thinks we should have a single criterion for stopping T390. - QC agrees and thinks we can remove “during C-DRX inactive time”- Oppo is fine with p4 and thinks this is a special case to be treated separately. Nokia agree* Agreed (can further discuss how to capture this in the CR review)

Proposal 5: Discuss in CR review phase how to capture T390 stopping condition for the following cases: - Network-triggered GNSS position fix- Autonomous GNSS position fix- GNSS position fix during C-DRX inactive time- ZTE thinks the first 2 points have already been covered and we just need to focus on the last point. Apple agrees* In the CR review we focus on how to capture T390 stopping condition for GNSS position fix during C-DRX inactive time
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The agreed proposal during the meeting is “T390 is stopped after successful GNSS position fix during C-DRX inactive time”, however, in the current spec, for network triggered GNSS measurement, T390 is stopped once GNSS measurement MAC CE is received (instead of after successful completion of GNSS position fix):

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| T390NOTE1 | Upon GNSS validity duration expiry if *ul-TransmissionExtensionEnabled* is configured. | Upon leaving RRC\_CONNECTED, or upon reception of network triggered GNSS measurement, or upon initiating the connection re-establishment procedure. | Perform the actions as specified in 5.3.3.21. |

There are several options for implementing the T390 stop condition for GNSS position fix during C-DRX inactive time:

* **Option 1** (as in the agreed proposal): T390 is stopped after successful GNSS position fix during C-DRX inactive time;
* **Option 2** (“aligned” with NW triggered GNSS): T390 is stopped upon initiating GNSS position fix during C-DRX inactive time:
	+ **Option 2-1**: separate condition with NW triggered GNSS
	+ **Option 2-2**: common criterion for NW triggered GNSS and C-DRX based GNSS
* **Other options**, e.g. T390 is stopped after sending GNSS Validity Duration Report MAC CE (so that UE and NW can have an aligned understanding of T390 status), but this may introduce further RRC-MAC interaction

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| ***TP for Option 1***# Clause 5.5.9:NOTE: UE can also autonomously start GNSS measurements during available idle periods in RRC\_CONNECTED to keep GNSS valid and stop T390 upon indication that a new GNSS position becomes valid, and the exact time of starting GNSS measurements during available idle periods is left to UE implementation.# Clause 7.3.1:

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| T390NOTE1 | Upon GNSS validity duration expiry if *ul-TransmissionExtensionEnabled* is configured. | Upon leaving RRC\_CONNECTED, or upon reception of network triggered GNSS measurement, or upon indication that a new GNSS position becomes valid during available idle periods in RRC\_CONNECTED, or upon initiating the connection re-establishment procedure. | Perform the actions as specified in 5.3.3.21. |

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| ***TP for Option 2-1***# Clause 5.5.9:NOTE: UE can also autonomously start GNSS measurements during available idle periods in RRC\_CONNECTED to keep GNSS valid and stop T390 upon starting GNSS measurement, and the exact time of starting GNSS measurements during available idle periods is left to UE implementation.# Clause 7.3.1:

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| T390NOTE1 | Upon GNSS validity duration expiry if *ul-TransmissionExtensionEnabled* is configured. | Upon leaving RRC\_CONNECTED, or upon reception of network triggered GNSS measurement, or upon initiating GNSS measurement during available idle periods in RRC\_CONNECTED, or upon initiating the connection re-establishment procedure. | Perform the actions as specified in 5.3.3.21. |

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| ***TP for Option 2-2***# Clause 5.5.9:The UE shall:1> if an indication to perform GNSS measurement is received from lower layers:2> perform GNSS measurement using the measurement gap with a gap length indicated by lower layers, as specified in TS 36.213 [23];1> if *gnss-AutonomousEnabled* is configured:2> perform GNSS measurement using an autonomous gap starting from T390 expiry if *ul-TransmissionExtensionEnabled* is configured, otherwise starting from GNSS validity duration expiry, with a gap length indicated by lower layers or equal to the latest reported time duration required for the UE to acquire a GNSS position if not indicated by lower layers;NOTE: UE can also autonomously start GNSS measurements during available idle periods in RRC\_CONNECTED to keep GNSS valid, and the exact time of starting GNSS measurements during available idle periods is left to UE implementation.1> upon starting GNSS measurement:2> stop timer T318, if running;2> stop timer T390, if running;# Clause 7.3.1:

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| T390NOTE1 | Upon GNSS validity duration expiry if *ul-TransmissionExtensionEnabled* is configured. | Upon leaving RRC\_CONNECTED, or upon performing GNSS measurement. | Perform the actions as specified in 5.3.3.21. |

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**Q1: Please indicate your preferred option:**

* **Option 1** (as in the agreed proposal): T390 is stopped after successful GNSS position fix during C-DRX inactive time;
* **Option 2** (“aligned” with NW triggered GNSS): T390 is stopped upon initiating GNSS position fix during C-DRX inactive time:
	+ **Option 2-1**: separate condition with NW triggered GNSS
	+ **Option 2-2**: common criterion for NW triggered GNSS and C-DRX based GNSS
* **Other options**, e.g. T390 is stopped after sending GNSS Validity Duration Report MAC CE etc.

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| **Company** | **Yes/No** | **Comments** |
| Nokia | See comments. | We think the key point is that: different from NW triggered GNSS, it is up to UE implementation to decide when the UE triggers the GNSS position fix during C-DRX inactive time, the NW has no idea whether the T390 will be stopped by UE no matter for Option2 (timer stop upon UE initiating GNSS measurement) or Option1 (timer stop after a successful GNSS position fix). Please note, if the T390 is stopped in UE while it keeps running in NW, the cell will assume UE performing autonomous GNSS measurement or going to RRC idle upon the timer expiry in NW. This will cause either the RRC state mismatch between UE and NW or waste of UE scheduling opportunity (as NW assumes UE in GNSS measurement gap while UE is not). In our understanding, RAN2 agreement “T390 is stopped after successful GNSS position fix during C-DRX inactive time” is correct but not accurate enough. If UE stops the timer, UE should anyway inform NW. Therefore, we think the Option below mentioned by Rapporteur is reasonable.*“ T390 is stopped after sending GNSS Validity Duration Report MAC CE”* |
| Apple |  | Initially we were thinking the stop condition of T390 can be unified to “initiating GNSS position fix”.For UE self triggered GNSS position fix during C-DRX inactive duration, we understand the concern from network vendors that mismatch between UE and network may occur if UE stops T390 upon initiating GNSS position fix. For example, if UE could not complete GNSS position fix during original T390 (when UE autonomous gap is not configured), network would consider UE turns into RRC idle state but UE itself is still in RRC connected state. Thus, we have a sympathy on Option 1 and Other Option. And Other Option (T390 is stopped after sending GNSS Validity Duration Report MAC CE) makes more sense in terms of achieving alignment between UE and network.Regarding how to capture this, we think the change should be limited to informative texts (e.g, no change to procedure). |
| Samsung | Option 1 | When to perform the GNSS measurement is up to UE implementation and we hope that a reasonable implementation would perform the GNSS position fix well ahead of time. But the GNSS position fix during C-DRX may “fail” – we have not defined what “failure” means in this case and we do not think that it is needed. The point is that since the GNSS position fix during C-DRX only has action when it is successful, we think that it shall be stopped upon successful GNSS position fix. We do not see what is the difference between stopping T390 after successful GNSS position fix or after sending the GNSS validity duration. If there is a gap in between stopping of T390 and sending the GNSS validity duration MAC CE, we do not see much of an issue. Fine to go with Option 1 or Other option according to majority view on this though.  |
| Qualcomm | Option 2-2 + Option 1 | Procedural text in Option 2-2 is not for GNSS fix during C-DRX inactive, we prefer this for other case of GNSS fix. For GNSS fix during C-DRX inactive, we should add a note clarifying UE may stop T390 after GNSS fix is complete as in option 1. Same as what we are doing for CBRA trigger after GNSS fix.In option 1, after GNSS fix, anyway UE will send GNSS validity duration report and eventually UE and network will be in sync. |
| Google | Option 2-2 | Agree with Nokia that the issue of Option 2-2 is that when UE fails the GNSS measurement in the c-DRX inactive period, T390 was stopped by the UE but is still running at the NW side. But we do not think this is a big issue as the UE will still remain in the connected state when T390 is stopped. The NW will eventually release the UE upon the expiry of the T390 at the network side (as the NW will not receive the GNSS validity duration MAC CE from the UE).  |
| ZTE | Option 1 | For NW-triggered GNSS measurement, we think it makes sense that T390 is stopped upon reception of network trigger for GNSS measurement. This aligns UE process with NW as we can assume that NW also stops T390 when it sends out the NW trigger. This also helps to avoid the additional requirement for UE to handle T390 expiration during GNSS measurement.However, for GNSS measurement during C-DRX, we think it may be not suitable for UE to (early) stop T390, e.g., upon initiating GNSS position fix during C-DRX, the main considerations are as following:* As mentioned by Nokia, if UE early starts GNSS, e.g., before expiration of T390, NW cannot know this and keep running of T390. NW will have some processes when T390 expires in its side, e.g., to release the UE if NO autonomous GNSS measurement is configured). If UE stops T390 early (e.g., when it starts GNSS), the UE can no longer be aware of the NW status and the possible NW processes. One possible risk is that when UE finishes GNSS measurement and sends report to NW, NW may already release the UE.
* Meanwhile, if UE keeps running of T390, UE can take suitable following processes. For example, if UE can finish GNSS before expiration of T390, UE can know that NW still maintain the UE and can send report to NW. On the other hand, if T390 expires during the GNSS measurement, UE can know that NW may release the UE. Then UE can also choose to stop the on-going GNSS measurement and back to idle.

Therefore, we also think it’s more suitable to keep T390 running when UE starts GNSS measurement during C-DRX. UE only needs to stop T390 when it successfully finishes the GNSS measurement and finds T390 still running. For the case that T390 expires in middle of the GNSS measurement during C-DRX, whether UE will continue or stop GNSS measurement can be left to UE implementation.We also agree with Samsung that there is no much difference between stopping T390 after successful GNSS position fix or after sending the GNSS validity duration. So it’s fine to stick to the existing agreement. |
| Nokia2 | “Other option” (T390 is stopped after sending GNSS Validity Duration Report MAC CE) | Agree with ZTE and others that it is not suitable for UE to stop T390 upon initiating GNSS position fix during C-DRX inactive time because it will cause unreasonable misalignment between UE and NW. On option1 (stopping T390 upon successful GNSS measurement) and other option (stopping T390 after sending the GNSS validity duration), we agree with Apple that “other option” makes more sense. After a successful GNSS position fix, UE has to trigger CBRA and then using Msg3/5 to send GNSS validity duration to NW. Considering the available RO occasions and channel repetitions to be used in IoT NTN, the gap between GNSS position fix and MAC CE reporting can be up to several seconds. Since the misalignment between UE and NW may happen within “the gap”, this kind of “gap” should be avoided as well. Therefore, if the motivation of Option1 is to avoid misalignment between UE and NW, the “other option” (instead of Option1) should be used.  |
| MediatTek | Option 1 | We should stick to RAN2 agreement (i.e. option 1) unless there is critical issue.For option 2, if the T390 is stopped upon initiating GNSS position fix during C-DRX inactive time, and if the UE fails to acquire GNSS position, the UE behaviour is not specified. Going to idle seems not necessary; for starting T390 again, why not just go along with option 1 instead? Note that UE may try to acquire GNSS position during the DRX inactive time. Because the inactive time of C-DRX is limited, the GNSS measurement cannot be guaranteed to succeed. The **failure case can be frequent**. Therefore, stopping the T390 upon initiating GNSS measurement is NOT appropriate.For option 1, if the T390 is stopped after a successful GNSS position fix during C-DRX inactive time, the only question is “what’s the expected UE behaviour if the T390 expires during the GNSS measurement”. In this case, we think whether the UE continues the GNSS measurement can be left to UE implementation. It is not a big issue. In our assumption, the UE should be able to continue GNSS measurement using autonomous gap (if autonomous gap is configured). We can consider to add a NOTE to clarify this behavior (if needed), such as: 36.331 5.5.91> if gnss-AutonomousEnabled is configured:2> perform GNSS measurement using an autonomous gap starting from T390 expiry if ulTransmissionExtensionEnabled is configured, otherwise starting from GNSS validity duration expiry, with a gap length indicated by lower layers or equal to the latest reported time duration required for the UE to acquire a GNSS position if not indicated by lower layers;NOTE1: UE can also autonomously start GNSS measurements during available idle periods in RRC\_CONNECTED to keep GNSS valid, and the exact time of starting GNSS measurements during available idle periods is left to UE implementationNOTE2: When the UE autonomous GNSS measurement is started and a GNSS measurement during the available idle period is in progress, there is no need to stop the current on-going GNSS measurement. But the autonomous gap can be used.We can continue to discuss in next meeting if further clarification is needed. But for now, we don’t see strong motivation to revert RAN2 agreement. |
| OPPO | Option1 | Agree with ZTE |
| Huawei, HiSilicon | Option 1 or “Other option” (T390 is stopped after sending GNSS Validity Duration Report MAC CE) | We agree with Nokia/Apple that stopping T390 after sending GNSS validity duration MAC CE can avoid RRC state mismatch: if T390 happens to expire between “GNSS position fix completion” and “GNSS validity duration report MAC CE is sent”, and autonomous gap is not enabled, NW assumes UE goes to RRC\_IDLE (due to no RO before T390 expiry for the UE to trigger CBRA to inform NW of GNSS completion) while the UE remains in RRC\_CONNECTED.We can also accept majority view of keeping the RAN2#126 agreement (Option1) considering the above scenario might not be very common (e.g. UEs that rely on C-DRX inactive for GNSS position fix can perform this behaviour earlier than GNSS expiry, so that T390 won’t be running when GNSS position fix is completed during C-DRX inactive). |

**Summary:**

Option 1: Samsung, QC, ZTE, MTK, OPPO, HW, Apple (less preferred)

Option 2-2: QC, Google

Other (T390 stopped after sending GNSS validity duration report MAC CE): Nokia, HW, Apple (preferred)

Samsung and ZTE think the time gap between successful GNSS position fix completion and sending GNSS validity duration MAC CE is not large and no issue is caused.

MTK mentioned that the issue of “T390 expiry during GNSS measurement” can be left to UE implementation and further clarification can be discussed in the next meeting if needed.

Since majority of companies prefer to stick to the RAN2#126 agreement (Option1), the rapp CR will be updated based on the TP for Option 1 provided in this document.

# Conclusion

Rapp CR will be updated based on Option1.

1. Contact Information

To make it easier to find the contact delegate for potential follow-up questions, delegates are encouraged to provide their contact information in the following table:

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| --- | --- | --- |
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