**3GPP TSG RAN WG2 #124 *R2-23xxxxx***

**Chicago, USA, 13 – 17 Nov, 2023**

**Source:** Huawei, HiSilicon

**Title:** Report of [Post123bis][302][IoT-NTN Enh] 36.331 running CR (Huawei)

**Agenda Item:** 7.6.1

**Document for:** Discussion and decision

# Introduction

This document captures the outcome of the following email discussion:

* [Post123bis][302][IoT-NTN Enh] 36.331 running CR (Huawei)

Scope: running CR update and list of open issues

Intended outcome:

* + - * + Endorsed running CR
        + List of open issues to be addressed by company Tdocs

Deadline: Long

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| \*\*\* Detailed scope for all e-mail discussions on running CRs and open issues \*\*\*  1.     Update the running CR with agreements from the meeting  2.     Rapporteur to propose resolutions for straightforward open issues which can already be included in the running CR  3.     For Stage 3 running CRs, get input on stage-3 issues that require further input from companies to make a decision:   * Focus on stage-3 issues which are better handled via offline, e.g. signaling details, parameter values/ranges, NOT functionality discussion. For these issues, if any, the CR rapporteur should submit a separate report with proposals to the next meeting by the submission deadline, while input via company Tdocs should be avoided   4.     Identify the remaining open issues that need to be solved for WI completion in the next meeting:   * Company Tdocs for the next meeting should focus on these issues |

For RRC running CR review, please insert your comments (using bubble comments) to the draft CR.

In this document, please share your views on:

1. Some stage-3 issues not involving functionality change (i.e. no company Tdocs on these issues);
2. The open issue list for the next meeting (i.e. company Tdocs are welcome).
3. 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:

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email** |
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# Stage-3 issues handled offline

## Editor’s Notes

A new Clause 5.5.x on GNSS measurement triggering and reporting was added to the RRC running CR, and this Clause was referenced in the procedures related to MSG4 reception and *RRCConnectionReconfiguration* reception.

It was commented by several companies during post-123 RRC CR review that the references are not needed, so an Editor’s Note was added:

Editor’s Note: The reference to 5.5.x can be revisited and removed if deemed not needed. Same to the reference to 5.5.x in 5.3.3.4a, 5.3.5.3, 5.3.5.4 and 5.3.7.5.

Rapp clarification: Normally when an RRC configuration is provided, it needs to be clarified in the procedure text how to use this configuration. For instance, regarding legacy LTE measurements, Clause 5.5.2 on measurement configuration is referenced in *RRCConnectionReconfiguration* reception procedure; regarding R17 NB-IoT measurements in RRC\_CONNECTED, 5.5.8 is also referenced in msg4 reception procedures. Referring to 5.5.x in msg4 or Reconfiguration does not imply that the measurement behaviour is triggered right away after receiving msg4 or Reconfiguration, it is simply because the signalling for autonomous gap enabling (*gnss-AutonomousEnabled-r18*) is included in msg4 and Reconfiguration.

**Q1: Please share your views on whether the references to 5.5.x (in Section 5.3.3.4, 5.3.3.4a, 5.3.5.3, 5.3.5.4 and 5.3.7.5) should be removed:**

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| --- | --- | --- |
| **Company** | **Yes (removed)/**  **No (keep the references)** | **Comments** |
| Huawei, HiSilicon | No | Consequently, the Editor’s Note can be removed. |
| Apple | No |  |
| Samsung | Yes | The gnss-AutonomousEnabled-r18 is a part of MAC-MainConfig, so instead of adding a reference in all of these sections, we think that one single reference can be added when MAC is configured in Section 5.3.10.4. However, we may need to discuss whether MAC-MainConfig is the most suitable option, but for now we can keep it there. |
| Lenovo | No |  |
| Google | No |  |
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Regarding SIBxx acquisition based on T317/T318, the following Editor’s Note was added because some companies want to make this behaviour optional and use a note instead:

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| 5.3.18 T317 expiry  The UE shall:  1> if in RRC\_CONNECTED:  2> inform lower layers that the UL synchronisation is lost;  2> start timer T318;  2> acquire *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) as specified in 5.2.2;  2> acquire *SystemInformationBlockTypeXX* (*SystemInformationBlockTypeXX-NB* in NB-IoT) as specified in 5.2.2, if the UE determines validity duration of the neighbour satellite assistance information has expired;  Editor’s Note: FFS whether to make it an optional behaviour (i.e. up to UE to reacquire SIBxx). |

Rapp clarification: The issue lies in the wording “may” in the agreement in RAN2 #123 “*For re-acquisition of SIBXX the UE may rely on T317/T318 in connected mode*”. Some companies interpret it as an optional behaviour, but in my understanding this “may” is due to the fact that UE does not need to re-acquire SIBxx if it has not expired. We should have a clearly defined UE behaviour in the spec.

**Q2: Please share your views on whether the currently implementation of SIBxx reacquisition is ok:**

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| **Company** | **Yes (removed the Editor’s Note)/**  **No (remove the procedure and use a note instead)** | **Comments** |
| Huawei, HiSilicon | Yes |  |
| Apple | See comments | We can simply change the normative text to “may acquire SIBxx”. The reason is SIBxx validity duration may be much longer than T317 thus when T317 expires, SIBxx is and will be still valid for quite some time. |
| Samsung | Yes, remove editors note | Agree with the rapporteurs conclusion, just introducing a note and not specifying introduces network issues in how a network can schedule the SIBxx. Even though it is not an essential SIB that bars a UE, we still think that acquiring SIBxx is important, especially for instance when conditional handover is configured for eMTC.  It is not reasonable to only introduce a note when we have a clear way of specifying it. |
| Lenovo | See comments | Our understanding is that “may” means UE can choose to reacquire SIBxx upon T317 expiry or not, while the proposed text is under “UE shall”. We suggest keeping the “UE shall” part as it was, and change the note to describe the optional behavior (“may” part), e.g:  *NOTE: UE may acquire SystemInformationBlockTypeXX (SystemInformationBlockTypeXX-NB in NB-IoT) as specified in 5.2.2.* |
| Google | See comment | We are fine to make it optional by either adding a ‘may’ in front of the procedure text or replacing the procedure text with a NOTE. |
| Ericsson | Yes | If the concern is that the UE may reacquire SIBxx even though the information is still valid we can reformulate the text as follows:  “acquire *SystemInformationBlockTypeXX* (*SystemInformationBlockTypeXX-NB* in NB-IoT) as specified in 5.2.2, if the UE determines validity duration of the neighbour satellite assistance information has expired otherwise it is up to the UE to have up to date *SystemInformationBlockTypeXX* (*SystemInformationBlockTypeXX-NB* in NB-IoT) when in RRC-CONNECTED” |
| Nokia | See comments | T317 timer is started when UE acquires SIB31 with the value *SyncValidityDuration.* SIBXX is mainly introduced for idle mode cell-reselection measurement purpose. So the UE is not forced to acquire SIBXX prior to entering into connected mode ( but for SIB31 it is mandatory for UE to acquire this SIB prior to entering into connected mode) and in that case the UE will not even know the validity duration of this SIBXX. In this case no need for re-acquisition of this SIBXX at all. If the UE implementation really acquired this information prior to entering into connected mode for potential use of this for enhanced connected mode measurements, then the validity timer for this will be different from SIB31. Because UE might have acquired SIBXX at different time instances in idle mode.  **Observation 1: SIBXX acquisition cannot be linked to T317 as SIBXX acauisition in idle mode itself is optional and the time at which UE acquire this SIBXX will be different from SIB31.**  If it has to be specified there should timer started on acquiring SIBXX and on its expiry in connected mode UE can mark the SIBXX as invalid. It should be upto UE implementation to re-acquire this SIBXX in connected mode. And no timer is needed to monitor this acquisition time.  **Observation 2: If SIBXX acquisition in connected mode is to happen at the right time, UE should also start the timer TXX (with the value of T317).**  **Hence we prefer to leave SIBXX acquisition to UE implementation without any binding to T317.**  If majority companies prefers to specify some text for this acquisition of SIBXX in connected mode we propose to consider the following changes.  1> if in RRC\_CONNECTED:  2> inform lower layers that the UL synchronisation is lost;  2> start timer T318;  2> acquire *SystemInformationBlockType31* (*SystemInformationBlockType31-NB* in NB-IoT) as specified in 5.2.2;  2> may acquire *SystemInformationBlockTypeXX* (*SystemInformationBlockTypeXX-NB* in NB-IoT) if the SIBXX was acquired earlier and validity time is expired for this SIBXX., as specified in 5.2.2, if the UE determines validity duration of the neighbour satellite assistance information has expired; |
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A related issue is how to solve the case where T318 is stopped before successful acquisition of SIBxx. In R17, T318 is stopped once SIB31 is acquired. During the online discussion, it seems that some companies do not want to introduce an additional timer for SIBxx acquisition, therefore the simplest solution could be: UE stops T318 when both SIB31 and SIBxx have been acquired.

**Q3: Do you agree with “UE stops T318 when both SIB31 and SIBxx have been acquired”:**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | Yes |  |
| Apple | No | With the proposal, there comes a situation where UE cannot acquire SIBxx during T318 then T318 would expire, which leads to RLF. We don’t think this is what RAN2 agreed. If to go this way, RAN2 should explicitly agree on it. |
| Samsung | Yes | This allows the network to flexibly schedule the SIBxx along with SIB31, otherwise, the SIBxx always have to be scheduled before SIB31, and given that we would expect that SIBxx does not have to broadcast SIB31 as often, this brings about difficulties for the network.  As for what Apple mentions, the above can be solved by not triggering RLF when T318 expires if SIB31 has been obtained, which is easy to implement in the spec. |
| Lenovo | No | We share Apple’s view that no agreement has been made on this. |
| Google | No | We share the view with Apple that acquiring SIBxx will become a mandatory feature (which is not preferred), if T318 keeps running when UE fails to acquire SIBxx. |
| Ericsson | Yes | RAN2 can discuss further whether SIBxx can be considered essential for the case above, i.e., RLF may be reasonable assuming that it may not be possible for the UE to perform neighbour cell measurements if it is not possible for the UE to have up to date SIBxx. On the other hand, one may question the scenario where UE can acquire SIB31, but not SIBxx assuming that the network provides a suitable configuration for T318 and the scheduling of SIB31 and SIBxx.  Yet another option is to capture in the spec that RLF is not triggered when T318 expires but SIB31 has been obtained. |
| Nokia | No | T317 stop should not be impacted by SIBXX acquisition. Because it may lead to this timer to expire if there are some issues in acquiring SIBXX which is not relevant for uplink synchronisation. So better don’t modify the stop behaviour for T317 based on SIBXX.  T317 can be just used to trigger re-acquisition of SIBXX if it is realy needed. We also need to note that if SIBXX is not acquired in connected mode there will be no impact to the connected mode measurements. UE can continue its measurements using Rel-17 behaviour. |
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## Parameter values

The maximum number of neighbour satellites for which satellite assistance information is provided in SIBxx is still FFS.

maxSat-r18 INTEGER ::= ffsValue -- Maximum number of neighbour satellites

Rapp clarification: For BL UEs and UEs in CE, the maximum SIB and SI message size is 936 bits. For NB-IoT, the maximum SIB and SI message size is 680 bits. Based on rough calculation, the satellite assistance information (including ephemeris, common TA parameters, epochTime, Koffset and Kmac) is around 260 bits. Considering t-ServiceStartNeigh may also be put in SIBxx (as it is agreed to be per satellite) and further extensions, the maximum number of satellites for which assistance information can be provided in one SI is 3 for eMTC and 2 for NB-IoT if all optional fields are included. Based on this, we can use 4 as the maximum number for simplicity (in case some optional fields are not present).

**Q4: Do you agree with setting *maxSat-r18* as 4?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | Yes |  |
| Apple | Yes |  |
| Samsung | Yes |  |
| Lenovo | Yes |  |
| Google | Yes |  |
| Ericsson | Yes |  |
| Nokia | Yes but | This number can also be flexible depending on the actual parameters included for each satellite as all the parameters are not mandatory in the SIB. We are OK to keep this static if majority companies prefers fixed value. |
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The value range of Satellite Id is also FFS.

The IE *SatelliteId* is used to identify the satellite assistance information of neighbour satellites.

***SatelliteId* information element**

-- ASN1START

SatelliteId-r18 ::= INTEGER (1.. ffsValue)

-- ASN1STOP

In R17, the satellite id in SIB32 has a value range from 0 to 255.

Rapp’s preference is to have the same value range as R17 (allowing 256 values), either “INTEGER (1..256)” or “INTEGER (0..255)”

**Q5: Please indicate your preference on the value range of *SatelliteId-r18*.**

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| **Company** | **Value range** | **Comments** |
| Huawei, HiSilicon | INTEGER (1..256) |  |
| Apple | INTEGER (1..256) |  |
| Samsung | INTEGER (0..255) | If we want to have satellite IDs consistent with SIB32, then we need to have the same values. But we need to discuss this further, i.e what is the implication of this, but at least a start is to have the same values. |
| Lenovo | INTEGER (0..255) | We tend to have the same value as in SIB32 but can further discuss this. |
| Google | INTEGER (1..256) |  |
| Ericsson | Same as SIB32 |  |
| Nokia | INTEGER (1..256) |  |
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# Open issue list

* **GNSS**

**Issue 1-1: How to determine GNSS invalid (considering duration X and Y), this affects 1) condition for entering RRC\_IDLE, and 2) the start of autonomous gap**

Rapp clarification: This is related to the following agreement in RAN2 #123.

Editor’s Note: *Agreement*: If there is neither network aperiodically trigger nor network configuration of UE autonomously GNSS measurement, UE moves to RRC\_IDLE after GNSS becomes invalid. It’s FFS how to decide GNSS valid or invalid considering duration X and Y.

Options listed during the RAN2 #123bis offline discussion [1]:

* Option 1: It is up to RAN1 whether/how to decide GNSS validity duration considering X and Y.
* Option 2: Even if duration X is provided, the remaining GNSS validity duration keeps unchanged.
* Option 3: UE considers the GNSS position as outdated and goes to RRC\_IDLE, upon the expiry of X on top of the expiry of the GNSS validity duration.

Whether X is added to the GNSS validity duration also impacts how we capture the start of autonomous gap for GNSS measurement: whether the autonomous gap starts right after GNSS validity duration expiry or starts after duration X on top of GNSS validity duration expiry, as indicated in the following Editor’s Note:

Editor’s Note: FFS the start of autonomous gaps, e.g. “after X expires on top of GNSS validity duration expiry” or X is included within the GNSS validity duration. The exact X (and Y) is pending on RAN1 further discussion.

* **Mobility**

**Issue 2-1: Regarding RLF based measurement enhancements for eMTC UEs in RRC\_CONNECTED, which frequencies to measure (frequencies in *MeasObject*s, or frequencies in SIB, or both)**

Rapp clarification: RAN2 agreed to apply the RLF enhancements (time/location-based measurement initiation) to eMTC UEs as well. However, in the legacy spec, eMTC UEs are already capable of performing Connected mode measurements based on *MeasObject*s, it is unclear for the moment which frequencies to measure if time/location-based measurement initiation configuration is present in the SIB: whether the UE only measures frequencies in *MeasObject*s, or frequencies in SIB, or both.

For NB-IoT, I think it is straightforward to follow the R17 NB-IoT in TN that it is up to UE implementation which cells/carriers to be measured (agreements in RAN2 #115-e: “*Provision of information regarding which cells/carriers to be considered is not supported. It is up to UE implementation to choose and prioritize carrier/cell list for measurement.*”). But it would be good if a formal agreement is made also on NB-IoT.

**Issue 2-2: Whether time/location based CHO can be configured simultaneously for the same target cell**

Rapp clarification: In NR NTN, it was agreed in RAN2 #117 that “*Joint time-based and location-based CHO execution triggering for the same candidate cell is not supported in Rel-17 NTN.*” No online/offline discussion has been conducted so far for IoT NTN.

**Issue 2-3: Whether to allow joint configuration among time/location/RSRP-based measurements in RRC Idle/Connected, and if allowed, the intended UE behaviour**

Rapp clarification: In R17 NR NTN, the joint configuration of time and location based measurement initiation was discussed. Even though no clear conclusion was given, according to the TS 38.304, the procedures for time-based and location-based are defined independently and there is no restriction in the spec that they cannot be configured jointly. Therefore, the understanding is that, time-based and location based measurement initiation can be configured jointly, and if configured simultaneously, the UE starts measurement when either of the condition is satisfied. No online/offline discussion has been conducted so far for IoT NTN.

* **Discontinuous coverage**

**Issue 3-1: Whether to capture a note in RRC about “UE may directly go to RRC\_IDLE after RLF is triggered, if there is not enough time for the UE to finish the procedure of RRC re-establishment due to the discontinuous coverage”**

Rapp clarification: This is currently captured as an Editor’s Note in Clause 5.3.11.3:

Editor’s Note: *Agreement*: RAN2 understands that UE may directly go to RRC\_IDLE after RLF is triggered, if there is not enough time for the UE to finish the procedure of RRC re-establishment due to the discontinuous coverage (FFS whether this needs to be captured in the specs, e.g. a NOTE)

**Q6: Companies are welcome to provide comments on the open issues identified above (detailed technical discussion can be provided in company Tdoc to the next meeting, here we focus on whether the open issue list is reasonable/justified).**

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| **Company** | **Open issue** | **Comments** |
| Apple | Issue 1-1 | We prefer Option 3. The key question is during the extension duration X, whether UE still considers its location as valid, and whether location based other features (such as EventD1) can be enabled.  Our understanding is during extension duration X, UE should be able to receive DL signal. According to Rel-17 RAN4 discussion, for DL, UE needs to perform compensations to frequency and timing based on its location. That is why even in RRC idle state, UE also needs to maintain its GNSS location. Thus, we believe during X, UE’s location accuracy remains in a certain level, which may be relaxed a bit.  But we do feel some confirmation from RAN1/RAN4 would be much helpful. |
| Apple | Issue 2-1 | We have been raising this question with contributions for several meetings. RAN2 should discuss on several points:  1) Frequencies UE to measure: If RRC connected UE performs measurement on frequencies configured in both MeasObject(s) and SIB(s), RAN4 involvement is needed to evaluate the impact to RRM performance. We prefer to only measure MeasObject(s).  2) Whether UE triggers Measurement Report: According to running CR, this new feature is added into normal measurement section, where the reporting would be triggered. The question then becomes whether we merge RLF based RRM into normal RRM. |
| Apple | Issue 2-3 | We prefer to have independent configurations. |
| Apple | Issue 3-1 | Let’s make it up UE implementation. It’s not likely to capture it as normative text. We are fine to not capturing anything. |
| Samsung | Issue 3-1 | We think that companies should really consider the issue of Issue 3-1, and we were hoping that we could reach a conclusion on this in this e-mail discussion.  Describing the action of directly going to RRC idle after RLF only via a Stage 2 note is **highly problematic**. Please consider the procedures in section 5.3.11.3 for triggering RLF. If we describe it via Stage 2 then there are the following issues:  1) Which code, i.e ‘Other’ or ‘RRC Connection Failure’ to use when moving from RRC connected to RRC idle? This affects idle mode procedures.  2) For the procedures in 5.3.12, which are the procedures that are followed when leaving RRC idle, what happens with all running timers?  All this can be solved by properly specifying it as we have in our TP in R2-2310919  Some companies asked how to determine that there is not enough time for the UE to finish the procedures, and we think that this part shall be left to UE implementation. |
| Google | Issue 1-1 | We prefer Option 3 for Issue 1-1, as it doesn’t make much sense to keep the UE in the connected state when the UE is not allowed to perform any UL transmission. |
| Google | Issue 3-1 | As it is beneficial for UE power saving, we prefer to keep the NOTE (with some modifications shown below) in the clause 5.3.11.3, to guide the UE implementation.  *NOTE 2: UE may perform the actions upon leaving RRC\_CONNECTED (with release cause 'RRC connection failure') after RLF is detected, if there is not enough time for the UE to finish the procedure of RRC re-establishment due to the discontinuous coverage* |
| Ericsson | Issue 2-1 | Similar to what was specified for Rel-17 NB-IoT, it is up to UE implementation which frequencies are to be measured. If an eMTC UE in connected mode is performing measurements on frequencies configured in MeasObject(s), there should not be any need to perform measurements on those particular frequencies unless the UE considers those measurements stale prior to a potential RLF. If network has configured MeasObject(s), the UE may as well decide to skip performing measurements for any other frequency, e.g., provided in SIB(s) assuming that it is not very likely to re-establish an RRC connection to a cell operating in one of those frequencies prior to a potential RLF.  The intention with this feature was not to trigger any reporting, similar to what was specified in Rel-17 NB-IoT. The eMTC UE should only report for what is configured by the network via MeasObject(s). |
| Ericsson | Issue 3-1 | We think that it would be beneficial to have a discussion on the impact of such UE behaviour from spec standpoint. |
| Nokia | Issue 2-3 | Independent configuration is sufficient. |
|  | Issue 3-1 | The agreement in previous meeting is only about NOTE or without any NOTE. Specification changes for this case was not agreed. **FFS whether this needs to be captured in the specs, e.g. a NOTE. So if some changes needed the discussion should be only about the wording for NOTE.**  We prefer no spec changes and leave it to UE implementation. There are multiple procedures and transactions may be pending at UE and we need not specify action for them.  For similar situation in MUSIM leave indication, whether UE should go to IDLE or trigger RLF after sending MUSIM leave indication, RAN2 agreed to make no specification changes. So we prefer to follow the same. |

**Q7: Do you think anything essential for WI completion is missed? Please elaborate on the missing issues if any.**

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| **Company** | **Open issue** | **Comments** |
| Apple | Uniqueness of satellite ID in different SIB(s) | We raised the question up during online discussion in Xiamen and it was discussed via offline email in Incheon as well.  The question we want to clarify is the satellite ID carried in multiple SIB(s) from the same cell should be cell specific unique at least. For example, the same satellite ID carried in SIB3/SIB32/SIBxx should refer to the same satellite. |
| Xiaomi | The UE behavior when serving cell t-service expires for discontinuous coverage case | In RAN2 #122meeting, we have the following FFS:   |  | | --- | | Agreements:  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 UE behavior needs to be discussed for discontinuous coverage. |
| Xiaomi | The behavior of T317/T318 during measurement gap | In RAN2 #123bis, we have the following FFS:   1. The following update in NOTE in Stage 2 running CR is agreed ((FFS whether to suspend T317, T318 during measurement gap):   NOTE: The AS operations (e.g. RLM related timers, dataInactivityTimer, CHO execution, neighbour cell measurement, RACH, SR, and BSR) are suspended when UE is performing GNSS measurement ~~during GNSS measurement gap~~  We should discuss the behavior of T317/T318 during measurement gap. |
| Lenovo | The UE behavior when serving cell t-service expires for discontinuous coverage case (same as Xiaomi) | We raised this issue before and it is still an FFS. |
| Google | The UE behavior when serving cell t-service expires for discontinuous coverage case (same as Xiaomi) | Agree with Xiaomi and Lenovo that this FFS needs to be addressed. Our view is that the UE shall not start T311 (or stop T311 if T311 is running), when the UE foresees a discontinuous coverage after t-service expires. |
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# Conclusion

To be completed

# Reference

1. R2-2311273, Report from Break-out session on NR-NTN and IoT-NTN, Vice Chairman (ZTE Corporation)
2. R2-2311321, Summary of [AT123bis][309][IoT-NTN Enh] GNSS Enhancements (Mediatek)