3GPP RAN WG2 Meeting #117-e R2-2203542

eMeeting February 21st – March 3rd, 2022

Agenda Item: 8.10.2.1.1

Source: InterDigital

Title: Report of [AT117-e][103][NTN] MAC open issues: Second Round

Document for: Discussion, Decision

# Introduction

This document is intended address a subset of remaining MAC open issues as per the following email discussion guidelines:

**[AT117-e][NTN][103] MAC open issues (InterDigital)**

* **Updated scope:**
  + **Continue the discussion on MAC open issues**
  + **Update the MAC CR**
* **Updated intended outcome: Summary of the offline discussion with e.g.:**
  + **List of proposals for agreement (if any)**
  + **List of proposals that require online discussions**
  + **List of proposals that should not be pursued (if any)**
  + **Updated MAC CR**

Please note the following deadlines:

* Updated deadline (for companies' feedback): **Thursday 2022-02-24 1800 UTC**
* Updated deadline (for rapporteur's summary in R2-2203542): Thursday 2022-02-24 2000 UTC
* Deadline (for MAC CR in R2-2203547): Thursday 2022-03-03 1000 UTC

Please also note the following chair guidance:

* Proposals marked "for agreement" in R2-2203542 not challenged until **Friday 2022-02-25 1000 UTC** will be declared as agreed via email by the session chair (for the rest the discussion will continue offline).

# Remaining issues from [Pre117e]

## TA report with no UL-SCH resources available

Based on input to [Pre117e] Question 2a/2b, in general companies agree that connected UE should send TA report (if triggered) regardless of whether or not there is UL/DL data. However, opinions diverge as to whether this should always be the case, or conditional on the availability of UL-SCH resources.

Those which do not support triggering an SR when a TA report is triggered and no UL-SCH resources are available (or RACH if SR is triggered but there are no available PUCCH resources) note that this may cause all connected UEs under the satelite coverage to update TA simultaneously due to satellite movement, which may cause signalling storm and significant additional overhead.

Proponents note that TA reporting is important for network to adjust K-Offset and may impact subsequent UL/DL transmission if not reported. Any excessive signalling overhead can be controlled by network implementation.

**Rapporteur suggests the following compromise:** In legacy, UE triggers SR if there are no UL-SCH resources available for Regular BSR (a lower priority MAC CE than UE-specific TA MAC CE) only if *logicalChannelSR-DelayTimer* is not running. As mentioned by several companies in previous offline, perhaps we can leave this up to network implementation by introducing a similar timer for TA reporting?

For example, if there are no UL-SCH resources available and network does not want UE to trigger SR, the new timer value range may include the value “infinity” to effectively disable triggering SR for TA reporting. Alternatively if the network would like the UE to trigger SR immediately even if there are no UL-SCH resources, the timer may be disabled as in BSR case with *logicalChannelSR-DelayTimerApplied* set ot value ‘false’*.* Any additional intermediate values (less than infinity) may further help the network balance timely reception of the TA report with signalling overhead.

This may be captured in MAC specification using text similar to the BSR procedure in Section 5.4.5. The following exemplary text is provided, but can of course refined in Stage 3 (if agreed):

RRC configures the following parameters to control the TA reporting:

- *TAReportSR-DelayTimerApplied*;

- *TAReportSR-DelayTimer*;

…

For TA Report in connected mode, the MAC entity shall:

1> if the TA report is triggered due to [TAOffsetThreshold] and *TAReportSR-DelayTimerApplied* with value *true* is configured by upper layers:

2> start or restart the *TAReportSR-DelayTimer*.

1> else:

2> if running, stop the *TAReportSR-DelayTimer*.

The MAC entity shall:

1> if the UE-specific TA reporting procedure determines that at least one UE-specific TA report has been triggered and not cancelled:

2> if UL-SCH resources are available for a new transmission and the UL-SCH resources can accommodate the UE-Specific TA MAC CE plus its subheader as a result of logical channel prioritization:

3> instruct the Multiplexing and Assembly procedure to generate the UE-Specific TA MAC CE as defined in clause 6.1.3.XX.

2> if a TA Report has been triggered due to [TAOffsetThreshold] and *TAReportSR-DelayTimer* is not running:

3> if there is no UL-SCH resource available for a new transmission, or;

3> if UL-SCH resources available for a new transmission cannot accommodate the UE-Specific TA MAC CE plus its subheader as a result of logical channel prioritization:

4> trigger a Scheduling Request.

**Question 1) As a compromise, do you support introducing an *SR-DelayTimer* for TA reporting (similar to BSR procedure) which includes value ‘infinity’?**

**Note: If UL-SCH resources are not available for TA report, this solution would support the following UE behaviour based on network configuration:**

1. **Immediately trigger SR (if *TAReportSR-DelayTimerApplied* is set to ‘*false*’);**
2. **Never trigger SR (if *TAReportSR-DelayTimerApplied* is set to ‘*true*’ and *TAReportSR-DelayTimer is set to ‘infinity’*);**
3. **Delay triggering SR (if *TAReportSR-DelayTimerApplied* is set to ‘*true*’ and *TAReportSR-DelayTimer* is set to a value other than infinity) allowing network to balance overhead and timely reception of TA reporting**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Agree |  |
| OPPO | Disagree with introducing an SR-DelayTimer, but agree with triggering SR immediately | TA reporting is important for NW to adjust UE-specific K-offset. If it has no chance to report, it may impact the subsequent UL/DL transmission by using the old K-offset. To facilitate network’s implementation, and to reduce scheduling delay, we think triggering SR/RACH for TA reporting is the simplest way.  Regarding the concern that this may cause all connected UEs under the satelite coverage to update TA simultaneously due to satellite movement, which may cause signalling storm and significant additional overhead, note that UE triggers SR only if the UE has no available UL-SCH for TA reporting, which means not all the TA reportings would trigger SR. Besides, it is expected that NW implementation can handle this. |
| Apple | Disagree | Same view as OPPO. If all UEs are configured with the same value of the delay timer (say from a SIB), then the signalling storm problem is not avoided. So either the UEs are configured with the value using dedicated signaling or some randomization is applied. We are not sure there is time to work out all the details in time. |
| Samsung | See comment | We think signalling storm is unlikely. But fine to make it configurable as a compromise solution. |
| vivo | Disagree | We fail to see any big issues without introducing the proposed new timer. For connected UEs, NW anyway can configure different threshold values for TA reporting, which can avoid UEs to report TA MAC CE at the same time. |
| ASUSTeK | Disagree | No need to introduce the delay timer. If it should be configurable, there can simply be a Boolean parameter. |
| Huawei, HiSilicon | Disagree | Prefer to stick to the original proposal. This solution will make specs further complex. The legacy *logicalChannelSR-DelayTimer* is designed for LCH with lower priority, different from TA report which is important for scheduling. There is no need to define a new timer specifically for delaying SR triggering by TA report. The NW can alleviate the the potential overhead via other simpler ways than above, e.g. configuring a larger TA threshold. |
| Spreadtrum | Disagree | This TA report is important, so the delay timer is not needed. |
| Nokia | Disagree | We don’t see the point to report a delayed TA report to NW because the TA value report is urgent if NW decide to use the TA report to maintain the Koffset. The logic is different from the existing *logicalChannelSR-DelayTimer* where the BSR report can be delayed for some low priority LCH. If companies do think TA report is important, it should be enabled and always be reported in time.  So, we think TA report with switch ON/OFF is enough. NW can control whether UE should report TA value by configure or de-configure the TA report event. |
| Xiaomi | Disagree | It is unlikely that UE will trigger TA at the same time given UE location are different. Besides, TA threshold can be different from different UE and the percentage of UEs without PUSCH resources trigger TA at the same time would be low. |
| LG | Disagree | Agree with OPPO. |
| ZTE | See comments | It is preferred not to do over enhancements. And we share same view as Oppo that signalling storm is not an issue since it is rare that there is no available UL resource for all UEs in the same coverage. As commented by other companies before, UE koffset could be outdated when DL data arrives. Following are possible methods to deal with this situation:   1. Allow NW to request UE to report TA (i.e., by PDCCH order) 2. TA report to trigger SR 3. NW implementation to assign a larger koffset   1 is ruled out based on previous agreement on not introducing new trigger in connected mode for TA report. 2 is beneficial to keep TA up-to-date thus help fine tuning of koffset, but will lead to additional overhead and more specs impact . 3 has no specs impact, but will lead to additional transmission delay.  As a compromise, only the on&off indication is needed, UE either immediately trigger SR or not trigger SR at all. |
| CATT |  | No strong view, but we can access this solution for compromise. |
| Ericsson | Disagree | No SR triggering for TA reporting is needed. This is not a critical issue to solve, gNB implementation can handle it.  1) If UE has no data and gNB has no data, all is fine.  2) If the UE has data and no UL-SCH resources, it will trigger a BSR and an SR. SRs can be sent even without the UE having an accurate Koffset. Then the gNB becomes aware of the UEs need to communicate.  2) if gNB has data, the gNB is aware of the UEs need to communicate.  When the gNB is aware that the UE need to communicate, the gNB can estimate if the UE has a good Koffset or not.  gNB has many options if it deems the UEs Koffset as outdated, it can  a) send an UL grant with longer k2 that usual to get a TA report,  b) send an updated Koffset DL MAC CE (if gNB really wants the HARQ feedback for this MAC CE, it can use a longer k1 than normal),  c) send an PDCCH order RA request (in which case the UE must use the cell-specififc Koffset according to the RAN1 agreement)  To estimating that the TA may have changed such that the Koffset is outdated is easy. After two reports of TA, the gNB can predict how the TA will change in the following as the main factor affecting this is the satellite movement and nothing else (the time between the TA reports and the values reported allows this).  Here is an example of the propagation RTT and the TA reporting for a delta change of 1 ms. The satellite passes right above the UE and the GW is 100 km away from the UE. Only about 35 reports will be needed during the whole connection time of about 500s (in this example the UE connects when satellite appears at minimum elevation angle above horisn and is connected until satellite recede under the elevation angle). Every TA curve will have the same shape, regardless of UEs and GWs distance from each other and from the Specular Point path. |
| MediaTek | Disagree | Regardless of the introduction of a delay timer, there is no scenario where the UE needs to update the network with the full TA using TA reporting mechanism when there is NO UL/DL data. The new timer will only increase the complexity in the specifications and implementation with NO justifiable reason. Therefore we do not support the compromise proposal. |

## UE location reporting for purposes of TA report

During offline [AT116bis][101] (and again via contribution to RAN2#117e), support for UE location information for TA reporting purposes was split, with small majority preferring to not support. Based on previous agreement, if the content of the TA report in connected mode is TA pre-compensation, then MAC CE is used whereas if the content is UE location report, RRC signalling is used. Each signalling method has it’s advantages: MAC CE would be faster to transmit, however RRC signalling can be more reliable and UE location could be useful for other purposes.

However, Rapporteur notes that although TA reporting has been primarily addressed in UP discussions, reporting UE location information would ultimately be handled by RRC specification. This may require additional discussion on how to implement this functionally in RRC with very little time left in this release.

Considering the very late stage of discussion it is suggested that if UE-location for TA reporting purposes is agreed, a very simple mechanism is captured relying on NW configuration and the same TA reporting threshold (i.e., the TA offset threshold).

This may be captured in MAC specification via the following exemplary text, which can be modified in Stage 3 (if agreed):

RRC configures the following parameters to control the TA reporting:

- [*TAorLocation*]

…

The MAC entity shall:

1. if the UE-specific TA reporting procedure determines that at least one UE-specific TA report has been triggered and not cancelled:

2> if a TA Report has been triggered due to [TAOffsetThreshold] and [*TaorLocation*] with value ‘location’ is configured by upper layers:

3> notify RRC to report UE location information.

2> else

3> if UL-SCH resources are available for a new transmission and the UL-SCH resources can accommodate the UE-Specific TA MAC CE plus its subheader as a result of logical channel prioritization:`

4> instruct the Multiplexing and Assembly procedure to generate the UE-Specific TA MAC CE as defined in clause 6.1.3.XX.

**Question 2) As a compromise, do you agree to support the above mechanism to enable reporting UE-location information for TA reporting purposes in MAC?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Disagree | Procedure seems very strange, i.e., MAC instructing RRC to send a RRC message. Why not simply RRC handle the location trigger. |
| OPPO | Disagree | UE location information reporting is a RRC procedure, it should be handled by RRC specification.  We think using UE specific TA pre-compensation for TA reporting purpose is sufficient in Rel-17. Due to the very limited time left in R17, we prefer not to support UE location information for purpose of TA reporting. |
| Apple | Disagree | Same view as OPPO, no need to specify UE location information for TA purposes. |
| Samsung | Disagree | We share the view that UE location is to be specified in RRC. We are fine not to support UE location for TA or postpone UE location related discussion. |
| Vivo | Disagree | As there is very little time left in this release, we should spend time on the ctitical issues rather than introducing duplicated function. We insist not to introduce UE-location information for TA reporting purposes. |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | Agree | Similar procedures for MAC-RRC interaction exist in current MAC specs as: “…notify RRC to release PUCCH for all Serving Cells, if configured…”. |
| It Spreadtrum | Disagree | Both TA report and location report are configured by RRC, it is not needed to introduce extra interaction between MAC and RRC. |
| Nokia | Agree | We support this way-forward. The UE location reporting can be used for not only for UP (e.g. for TA reporting purpose) but also for CP (e.g. for cell id mapping), the adaption on MAC specification can base on the framework of RRC spec to simplify the specification. |
| Xiaomi | Disagree | Share the same view with QC |
| LG | Disagree | Since the UE location reporting may be transmitted using RRC message, this procedure should be captured in the RRC spec if reporting UE location is agreed. |
| ZTE | Disagree | It is more reasonable to configure and report Location report in RRC, which will be captured in RRC specs. |
| CATT | Disagree | If network need the UE location, it can directly request the UE to report the location, but this has nothing to do with TA report. |
| Ericsson | Disagree | We agree there is very little time to specify the UE location reporting.  However, there is already the new location Event D1 in the RRC spec that can be used for this purpose, only two minor changes need to be added:  The Event D1 referenceLocation1 and the reported location is the 3D location (ellipsoidPointWithAltitude), and a flag in the Event D1 configuration is added:  ***useLastReportedLocation***  When *useLastReportedLocation* is configured, referenceLocation1 is equal to the UEs last successfully reported location, if available, else the referenceLocation1 is the centre of Earth. |
| MediaTek | Disagree | There is NO technical reason to use two alternatives for exactly the same purpose. This will only introduce additional complexity for NO obvious justifiable reason. TA reporting can already achieve the desired objective. Therefore we do not support the unnecessary compromise. |

## Naming of new MAC CEs and field descriptions

In [Pre117e], the naming of the newly introduced MAC CEs and corresponding field definitions were addressed. During discussion, it was commented that RAN1 has introduced specification text in 38.211 and 38. 213 to capture the TA reporting procedure.

### Name of UE-specific TA MAC CE

The following is quoted from 38.211 v17.0.0 section 3.1 and 4.3.1:

|  |
| --- |
| Timing advance between downlink and uplink; see clause 4.3.1  …  Uplink frame number  for transmission from the UE shall start  before the start of the corresponding downlink frame at the UE where  - and are given by clause 4.2 of [5, TS 38.213], except for msgA transmission on PUSCH where shall be used;  - is derived from the higher-layer parameters *TACommon*, *TACommonDrift*, and *TACommonDriftVariation* if configured, otherwise ;  - is computed by the UE based on satellite-ephemeris-related higher-layers parameters if configured, otherwise . |

It was commented “UE specific” is not mentioned in the reported quantity, and can be dropped from the name. Furthermore, this MAC CE is similar to the PHR and BSR (it reports some information from the UE), and should contain “report” at the end.

Rapporteur notes the TA reporting procedure has been led by RAN1, and RAN2 specification should align with terminology used in latest version of 38.211. As suggested, the naming of the UE specific TA MAC CE can be revised to “Timing Advance Report MAC CE” to better align with RAN1 specification and existing RAN2 MAC CE naming convention.

**Question 3a) Do you agree to revise the naming of “UE-Specific MAC CE” to “Timing Advance Report MAC CE” to better align with TS 38.211?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | See comments | Prefer “UE-Specific Timing Advance Report MAC CE”. |
| OPPO | Agree |  |
| Apple | Agree |  |
| Samsung | Agree |  |
| vivo | See comments | Share same view with QC. |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | Agree | Better to aling with RAN1 and “UE-Specific” seems not needed as other UL UE specific MAC CEs (e.g. BSR, PHR) contain no “UE-Specific” in their names. |
| Spreadtrum | See comments | Agree with QC. |
| Nokia | Agree |  |
| Xiaomi | Agree |  |
| LG | Agree |  |
| ZTE | Fine with both |  |
| CATT | Agree with QC |  |
| Ericsson | Agree | We prefer to align with RAN1 spec and the other similar MAC CEs and “Timing Advance Report MAC CE” is much more descriptive. |
| MediaTek | Agree |  |

### UE-specific MAC CE field descriptions

In [Pre117e] discussion, the following RAN1 agreements were also quoted:

***Agreement***

*15 kHz is used as the reference subcarrier spacing value for the unit of TA reported in FR1.*

***Agreement***

*The reported TA is the least integer number of slots greater than or equal to the corresponding TA value.*

To align with RAN1 agreements, it was commented that the field description of the UE-Specific TA MAC CE contents be revised as follows to better reflect RAN1 agreements:

- Timing Advance: In FR1, the Timing Advance field indicates the least integer number of slots greater than or equal to the Timing Advance value (see TS 38.211 section 4.3.1). The length of the field is 14 bits.

Rapporteur again notes the TA reporting procedure has been led by RAN1, and RAN2 specification should align with terminology/agreements used in latest version of 38.211.

**Question 3b) Do you agree to revise the field description of “UE-Specific MAC CE” as follows to better align with RAN1 agreements?**

- Timing Advance: In FR1, the Timing Advance field indicates the least integer number of slots greater than or equal to the Timing Advance value (see TS 38.211 section 4.3.1). The length of the field is 14 bits.

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Agree |  |
| OPPO | Agree |  |
| Apple | Agree |  |
| Samsung | Agree |  |
| vivo | Agree |  |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | Agree |  |
| Spreadtrum | Agree |  |
| Nokia | Agree |  |
| Xiaomi | Agree |  |
| LG | Agree |  |
| ZTE | Agree with comments | RAN1 also agreed for FR1 the reference SCS is 15kHz, shall it also be reflected in the filed description? |
| CATT | Agree |  |
| Ericssson | Agree | Holy cow, I have never seen so many Agree in the NTN work item!!! |
| MediaTek | Agree |  |

### Differential UE-Specific K-Offset MAC CE name

Similar to the UE-specific TA MAC CE, the following terminology has been used in TS 38.213 v17.0.0 in section 4.2 when referring to the UE-specific Koffset:

|  |
| --- |
| For a timing advance command received on uplink slot and for a transmission other than a PUSCH scheduled by a RAR UL grant or a fallbackRAR UL grant as described in clause 8.2A or 8.3, or a PUCCH with HARQ-ACK information in response to a successRAR as described in clause 8.2A, the corresponding adjustment of the uplink transmission timing applies from the beginning of uplink slot where , is a time duration in msec of symbols corresponding to a PDSCH processing time for UE processing capability 1 when additional PDSCH DM-RS is configured, is a time duration in msec of symbols corresponding to a PUSCH preparation time for UE processing capability 1 [6, TS 38.214], is the maximum timing advance value in msec that can be provided by a TA command field of 12 bits, is the number of slots per subframe, is the subframe duration of 1 msec, and , where is provided by *Koffset* in *ServingCellConfigCommon* and is provided by a MAC CE command; otherwise, if not respectively provided,  or . |

It was commented in [Pre117] discussion that similar to UE-Specific TA MAC CE, there is no need to use “specific” in the name, and if we use “Differential Koffset” it is already differentiated from the cell-specififc Koffset, thus we can drop the “UE” in the name.

However, unlike the previously referenced text, the value does make explicit reference to the UE, and based on RAN1 LS R1-2112840 on MAC CE impacts, the RAN1 temporary name is “UESpecific\_Koffset“, with description “Provides and updates the value of UE specific K\_offset”.

**Question 3c) What is you preferred naming for the currently defined “Differential UE-Specific K-Offset MAC CE”?**

* **Option 1: Differential Koffset MAC CE**
* **Option 2: UE-Specific Koffset MAC CE**
* **Option 3: Other, please describe.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred Option** | **Additional comments** |
| Qualcomm | Option 2 |  |
| OPPO | Option 1 |  |
| Apple | Option 1 |  |
| Samsung | Option 1 or Option 3 | Prefer to keep “differential”, e.g. UE Differential K\_offset MAC CE |
| vivo | Option 2 |  |
| ASUSTeK | Option 1 |  |
| Huawei, HiSilicon | Option 1 | “UE-Specific” seems not needed as other DL UE specific MAC CEs (e.g. TA command) contain no “UE-Specific” in their names. |
| Spreadtrum | Option 2 |  |
| Nokia | Option 2 | Align with RAN1 LS is fine. |
| Xiaomi | Option 1 |  |
| LG | Option 1 |  |
| ZTE | Option1 | Or what has been suggested by Samsung. ‘differential’ needs to be kept since the value provided in this MAC CE is a differential value. |
| CATT | Option 2 | Align with RAN1. |
| Ericsson | Option 1 | In this case, it is better to align the name with the other names used in MAC, where we never say UE specific as all MAC CEs are UE specifi! |
| MediaTek | Option 1 | But, we are fine to go with the majority with regards to the naming. |

## Configuration of HARQ mode for HARQ process 0

In [Pre117e], RAN2 further discussed several previously raised technical issues regardingwhen HARQ process 0 carries PUSCH transmission scheduled by RAR or PUSCH payload of MsgA. Although most issues were resolved, a few companies still had concerns regarding increased delay for transmission of UL data, since LCHs configured with different HARQ mode cannot use the PUSCH resource depending on configuration of *allowedHARQ-mode*.

However, it is noted that a large majority of companies still think this can be handled by NW implementation (reflecting a similar outcome in [AT116bis-e] discussion where the same topic was raised), and no new technical arguments were raised as compared to previous discussion. Rapporteur therefore suggests for the sake of progress that the previous proposal be agreed.

**Question 4) Can companies accept the following proposal for the sake of progress:**

***Proposal: When HARQ process 0 carries PUSCH transmission scheduled by RAR or PUSCH payload of MsgA, configuration of HARQ mode and allowedHARQ-DRX-LCP is up to NW implementation, and UE always follows it (no specification impact).***

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Agree |  |
| OPPO | Agree |  |
| Apple | Agree |  |
| Samsung | Agree |  |
| vivo | Agree |  |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | Agree | We can accept this proposal for the sake of progress. |
| Spreadtrum | Agree |  |
| Nokia | Agree |  |
| Xiaomi | Agree | We can compromise |
| LG | Option 1 |  |
| ZTE | Agree with comments | For the sake of progress we can accept the majority’s view. However we still think the simplest solution is to specify that allowedHARQ-mode doesn’t applied to grant scheduled by MsgB/RAR. |
| CATT | Agree |  |
| Ericsson | Disagree | We think it is much better to allow all LCHs in Msg3/MsgA, that is allowedHARQ-mode do not apply to Msg3/MsgA.  Reason is that there may be quite a long inactive time before the UE sends and Msg3 /MsgA, and thus small data of some LCHs (that triggered a SR) may be delayed for an extra RTT until the Msg3/MsgA is decoded in the gNB and the BSR included can be acted on.  However, we may consider gNB config of this too. |
| MediaTek | Agree |  |

## Implementation of HARQ RTT Timer extension

In [Pre117-e], implementation if HARQ RTT Timer extension in the running MAC CR was discussed. The main concern raised was that current text may be interpreted as changing an RRC configured field. MAC specification Rapporteur agrees that this interpretation should be avoided, and proposes 2 possible implementations:

**Implementation 1) Clarification of current running CR text:**

1. if this Serving Cell is part of a non-terrestrial network:

2> if this Serving cell is configured with *downlinkHARQ-FeedbackDisabled* and DL HARQ feedback is enabled for a HARQ process:

3> set duration of MAC DRX timer *drx-HARQ-RTT-TimerDL* ~~length~~ for the corresponding HARQ process to RRC configured value *drx-HARQ-RTT-TimerDL* included in *DRX-Config* plus UE-gNB RTT.

2> else:

3> set duration of MAC DRX timer *drx-HARQ-RTT-TimerDL* ~~length~~ for the corresponding HARQ process to RRC configured value *drx-HARQ-RTT-TimerDL* included in *DRX-Config*.

2> if this Serving Cell is configured with *uplinkHARQ-Mode* and a HARQ process is configured as HARQ Mode A:

3> set duration of MAC DRX timer *drx-HARQ-RTT-TimerUL* ~~length~~ for the corresponding HARQ process to RRC configured value *drx-HARQ-RTT-TimerUL* included in *DRX-Config* plus UE-gNB RTT.

2> else:

3> set duration of MAC DRX timer *drx-HARQ-RTT-TimerUL* ~~length~~ for the corresponding HARQ process to RRC configured value *drx-HARQ-RTT-TimerUL* included in *DRX-Config*.

**Implementation 2) Introduction of helper variables**

The following UE variables are used for the DRX operation:

- *HARQ\_RTT\_TIMER\_DL* (per downlink HARQ process, except for the broadcast process).

- *HARQ\_RTT\_TIMER\_UL* (per uplink HARQ process).

When DRX is configured, the MAC entity shall:

1. if this Serving cell is configured with *downlinkHARQ-FeedbackDisabled* and DL HARQ feedback is enabled for a HARQ process:

2> set *HARQ\_RTT\_TIMER\_DL* for the corresponding HARQ process to *drx-HARQ-RTT-TimerDL* plus UE-gNB RTT.

1. else:
2. set *HARQ\_RTT\_Timer\_DL* for the corresponding HARQ process to *drx-HARQ-RTT-TimerDL*
3. if this Serving Cell is configured with *uplinkHARQ-Mode* and a HARQ process is configured as HARQ Mode A:
4. set *HARQ\_RTT\_Timer\_UL* for the corresponding HARQ process to *drx-HARQ-RTT-TimerUL* plus UE-gNB RTT.
5. else:
6. set *HARQ\_RTT\_Timer\_UL* for the corresponding HARQ process to *drx-HARQ-RTT-TimerUL*

Rapporteur notes that Implementation 2 is simple, unambiguous, and clear. Although legacy instances of *drx-HARQ-RTT-TimerUL/DL* will be replaced with new helper variables, the UE behaviour remains the same as in legacy. It is therefore suggested that unless there are serious technical concerns, RAN2 procedes with Implementation 2.

**Question 5) Do you agree that HARQ RTT Timer extension will be implemented in MAC CR as per Implementation 2?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Disagree | We prefer not to touch the legacy parts. In implementation 2, “else” part is not necessary. |
| OPPO | Disagree | Share the same view as Qualcomm. |
| Apple | Agree | We think the revised wording is clear and does not impact legacy implementations |
| Samsung | Disagree | It will cause more changes |
| vivo | Agree |  |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | Disagree | Prefer the current implementation in MAC running CR. We haven’t fully discussed, not to mention agreed with the helper variables. |
| Spreadtrum | Agree |  |
| Nokia | Agree |  |
| Xiaomi | Disagree | The same view as QC |
| LG | Disagree | Same view as QC |
| ZTE | Agree | It is more clear also more future proofing if different offset/RTT length could be introduced for other purpose/scenarios. But we are also fine with current implementation. |
| CATT | Disagree |  |
| Ericsson | Agree | It is better to not make it ambiguous if an RRC parameter can be changed by the UE.  The else part in implementation 2 is needed to avoid error cases when the *downlinkHARQ-FeedbackDisabled* or *uplinkHARQ-Mode* are reconfigured. |
| MediaTek | Disagree | We prefer not to introduce “helper” variables, but the text in the running CR can be clarified if necessary. |

# Remaining issues from [AT117e]

## Additional details of ra-ContentionResolutionTimer

In [AT117e], additional details of the *ra-ContentionResolutionTimer* were discussed, where it was proposed that upon receiving PDCCH indicating Msg3 retransmission, UE starts *ra-ContentionResolutionTimer* after the end of the Msg3 retransmission plus UE-gNB RTT. Although this received majority support, in subsequent discussion there were serious concerns raised about impact to blind Msg3 retransmission (a legacy function) and resulting impact to coverage. The following is captured in chair notes as a possible way forward:

* Further discuss offline to see whether it's possible to make it configurable

Rapporteur thinks the above compromise is reasonable, and suggests that the former proposal be considered a configurable option.

**Question 6a) Do companies agree to the following compromise proposal:**

**Proposal: *If configured by network,* UE stops *ra-ContentionResolutionTimer* upon receiving PDCCH indicating Msg3 retransmission and then starts ra-ContentionResolutionTimer after the end of the Msg3 retransmission plus UE-gNB RTT.**

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | disagree | The maximum contention resolution timer length is just 64 subframes so there may not be enough time left.  Probably following is the easiest fix in the specification.  1> if Msg3 is transmitted on a non-terrestrial network:  2> stop the *ra-ContentionResolutionTimer*, if running.  2> start the *ra-ContentionResolutionTimer* and restart the *ra-ContentionResolutionTimer* at each HARQ retransmission in the first symbol after the end of the Msg3 transmission plus the UE estimate of UE-gNB RTT.  1> else:  2> start the *ra-ContentionResolutionTimer* and restart the *ra-ContentionResolutionTimer* at each HARQ retransmission in the first symbol after the end of the Msg3 transmission; |
| OPPO | Agree | Although we don’t think blind scheduled Msg3 retransmission is a typical NW implementation given that Msg3 repetition transmission can be used for coverage enhancement, we can accepet this compromise proposal. |
| Samsung | Disagree | prefer Qualcomm suggestion. |
| vivo | Disgree | If the blind Msg3 retransmission really needs to be considered in this release, we prefer the solution that discussed in the previous meeting, i.e., UE ignor the expiry of ra-ContentionResolutionTimer during the delay of the restart of the ra-ContentionResolutionTimer by UE-gNB RTT.  Otherwise, we prefer to leave the coverage enhancements (e.g. to support MSG3 blind retransmission) in the Rel-18. |
| ASUSTeK | Agree | About the TP provided by Qualcomm:   * the timing to stop the timer should be when the UL grant is received; * since the timer would be stopped, restart is not needed.   Then the TP could be modified as below:  Once Msg3 is transmitted the MAC entity shall:  1> if Msg3 is transmitted on a non-terrestrial network /\*and be configured\*/:  2> if an uplink grant for this Serving Cell has been received on the PDCCH for the MAC entity's Temporary C-RNTI:  3> stop the *ra-ContentionResolutionTimer*.  2> start the *ra-ContentionResolutionTimer* at each HARQ (re)transmission in the first symbol after the end of the Msg3 transmission plus the UE estimate of UE-gNB RTT.  1> else:  2> start the ra-ContentionResolutionTimer and restart the ra-ContentionResolutionTimer at each HARQ retransmission in the first symbol after the end of the Msg3 transmission; |
| Huawei, HiSilicon | Disagree | If it is configurable, we have to define two sets of UE behavious, i.e., one for the configured case (as per Q6a) and one for the not configured case (as per Q6b). This actually makes it more complex. We prefer to keep the original proposal. |
| Spreadtrum | Disagree | Same comments as vivo. |
| Nokia | Agree with comment | We do think Msg3 blind retransmission is a legacy function which should be supported in NTN for coverage enhancement. To move forward, we accept the compromise to support configurable option (i.e. UE support both blind Msg3 retx enabled and disabled, it is up to NW to configure which option is to be used).  For how to caputure the stop of CR timer once UE receive the Msg3 retx grant, it is Stage-3 details. We think proposal from ASUSTek is well aligned with the proposal but we are open to discuss that later. |
| Xiaomi | Disagree | Same view as vivo that UE simply ignore the expiry of ra-ContentionResolutionTimer during the delay of the restart of the ra-ContentionResolutionTimer by UE-gNB RTT. |
| LG | Agree |  |
| ZTE | Agree | Blind Msg3 retransmission is a possible behavior since in legacy  and it is preferred to keep it as a scheduling option for NW in NTN as well |
| CATT | Disagree | If RTT is used to offset the start of CR timer, the issue about the CR timer expires after the MSG3 retransmission will be happened. We do not need two split methods based on the network configuration.  On the other hand, the operation of “*If ra-ContentionResolutionTimer expires during the UE-gNB RTT after Msg3 retransmission, (to wait for new CR timer restart) the* *UE does not consider the Contention Resolution unsuccessful*” has not considered the bilnd retransmission scheduled by network after MSG3 initial transmission.  Maybe we can consider another method that, reserving the legacy specification (i.e. start or restart CR timer immediately after MSG3 (re)transmission) for supporting the network blind scheduling. Meanwhile, and restarting the ra-ContentionResolutionTimer at the time of the end of the Msg3 transmission plus the UE-gNB RTT, for monitoring PDCCH scheduling. A note can be added like: The UE does not consider the Contention Resolution unsuccessful upon the expiry of the CR timer the one starts/restarts after Msg3 (re)transmission. This method not only does not limit the network scheduling, but also can correctly monitor PDCCH.  We need to confirm the support of blind Msg3 retransmission, firstly. |
| Ericsson | Agree with Nokia |  |
| MediaTek | Agree |  |

If the proposal in Question 6a is agreed, then RAN2 must agree on UE behaviour when UE is not configured with the above behaviour. One possible option raised was that If *ra-ContentionResolutionTimer* expires during the UE-gNB RTT after Msg3 retransmission, (to wait for new CR timer restart) the UE does not consider the Contention Resolution unsuccessful.

**Question 6b) If “Agree” to Question 6a, what is the preferred UE behaviour when configuration is not present?**

* **Option 1: If *ra-ContentionResolutionTimer* expires during the UE-gNB RTT after Msg3 retransmission, (to wait for new CR timer restart) the UE does not consider the Contention Resolution unsuccessful.**
* **Option 2: Other, please describe.**

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| --- | --- | --- |
| **Company** | **Preferred Option** | **Additional comments** |
| OPPO | Option 2 | Based on RAN1 running CR, the common K offset is always used for Msg3 scheduling, which may lead to larger time interval between PDCCH reception and Msg3 retransmission compared with TN case. Therefore, ra-ContentionResolutionTimer may also expires between PDCCH reception and Msg3 retransmission, similar as the case that ra-ContentionResolutionTimer expires during the UE-gNB RTT after Msg3 retransmission, if ra-ContentionResolutionTimer expires between PDCCH reception and Msg3 retransmission, UE should not consider the Contention Resolution unsuccessful since UE knows it would start ra-ContentionResolutionTimer later.  Based on above, we suggest the following proposal:  **If *ra-ContentionResolutionTimer* expires after UE receives PDCCH indicating Msg3 retransmission, (to wait for new CR timer restart) the UE does not consider the Contention Resolution unsuccessful.** |
| ASUSTeK | Option 1 | About the proposal from OPPO, the condition may be confusing. It looks like that once Msg3 is retransmitted, the UE never considers Contention Resolution unsuccessful. |
| Nokia | Option 1 or Option2 with comments | To support blind Msg3 retransmission, we are open to discuss how to capture the intended UE behaviour.  In general, we understand the correct UE behavior is that, if there is a future CR timer which will be run by UE later, UE should not declare CR failure when it waits for the timer running to resolve the Contention Resolution.  OPPO’s proposal covers the UL grant indicating Msg3 retransmission which will restart a futher CR timer later. We are fine with the intention. As indicated by ASUSTeK, the proposal itself seems cover the case of next CR timer expire after the granted MSG3 retransmission as well.  We can work further on the workding to clarify. Here is our attempt:  **If *ra-ContentionResolutionTimer* expires and no PDCCH addressed to TC-RNTI indicating uplink grant for a MSG3 retransmission is received after the start of the ra-ContentionResolutionTimer, the UE considers the Contention Resolution not successful** |
| LG | Option 1 |  |
| ZTE | Option 1 | The UE-gNB RTT starts after the end of Msg3 retransmission not the PDCCH scheduling Msg3 retransmission therefore the Koffset will not affect this interval. |
| Ericsson | Option 1 | Agree with Nokia |
| MediaTek | Option 2 (follow the legacy mechanism for CR timer expiry) | If the network selects not to follow the mechanism in Q6a, it can send the blind Msg3 retransmission grant within ra-ContentionResolutionTimer. In this case, we can follow the legacy mechanism when the ra-ContentionResolutionTimer expires, i.e. the UE discards the TC-RNTI and considers the contention resolution not successful. |
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## **OI 14:** Additional details for *drx-HARQ-RTT-TimerDL/UL*

In open issues discussion from [AT116bis-e], OI14 raises the issue there may need to be further clarification on UE DRX behaviour, as when PDCCH indicates a UL/DL transmission legacy specification doesn’t consider the case where *drx-HARQ-RTT-TimerUL/DL* for the corresponding HARQ process has already been running.

Rapporteur understanding is that this open issue comes from different interpretations on how *drx-HARQ-RTT-TimerDL* and *drx-HARQ-RTT-TimerUL* are defined in legacy specification, and whether a UE may expect a PDCCH indicating a UL/DL transmission while *drx-HARQ-RTT-TimerUL/DL* is running for the corresponding HARQ process.

Regarding this issue, RAN2 Vice Chair has already captured the following guidance in chair notes from RAN2#115e:

*- VC thinks that if further clarification is needed on the legacy behaviour this will have to be discussed in the main room as part of the maintenance session.*

Rapporteur therefore suggests that based on Chair guidance, this issue is not further discussed in this session and if further clarification on DRX behaviour is necessary, it may be brought up in the main session as part of maintenance.

**Question 7) Do you agree that, as per chair guidance “*further clarification on UE DRX behaviour when PDCCH indicates a UL/DL transmission where drx-HARQ-RTT-TimerUL/DL for the corresponding HARQ process has already been running*” is not treated in this session?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Agree |  |
| OPPO | Disagree | There may be no issue in legacy since drx-HARQ-RTT-TimerUL/DL is short and typicaly UE would not receive PDCCH indicating UL/DL retransmission for the HARQ process during *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process. However, *drx-HARQ-RTT-TimerUL* is extended in NTN. In RAN2#113bis-e, we have made the following agreement:   1. RAN2 confirms that in NTN if the UE is in DRX Active Time for any reason, the UE should monitor the PDCCH regardless of whether drx-HARQ-RTT-TimerUL or drx-HARQ-RTT-TimerDL is running or not. No specification change is needed.   Based on the agreement, as long as the UE is in DRX active time during drx-HARQ-RTT-TimerUL/DL for a HARQ process (e.g. due to the running of *drx-InactivityTimer*, or drx-RetransmissionTimerUL/DL for other HARQ processes), network could still schedule the UL/DL retransmission for the HARQ process during *drx-HARQ-RTT-TimerUL/DL* for the corresponding HARQ process. So we think we need to discuss the UE behaviour in the case when PDCCH indicates a UL/DL transmission where drx-HARQ-RTT-TimerUL/DL for the corresponding HARQ process has already been running.  A simple solution is that UE stops the *drx-HARQ-RTT-TimerUL/DL* if PDCCH indicates a UL/DL transmission for the corresponding HARQ process during the running of *drx-HARQ-RTT-TimerUL/DL* for the corresponding HARQ process. |
| Samsung | Agree |  |
| vivo | Agree |  |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon | Agree |  |
| Spreadtrum | Agree |  |
| Nokia | Agree |  |
| Xiaomi | Agree |  |
| LG | Agree | This is kind of the optimization and this is controversial. In addition, the NTN can work well without this optimization. |
| ZTE | Agree |  |
| CATT | Agree |  |
| Ericsson | Agree |  |
| MediaTek | Disagree | This issue seems particularly applicable to NTN environments, therefore should be discussed in NR NTN WI maintenance, if postponed. |

## **OI 16:** Details of DRX behaviour for SR and CFRA

### Details of DRX behaviour for SR

Open Issue 16 discusses the case that a when UE sends an SR, the UE enters Active time to monitor for a response after an offset time has elapsed. This aspect was addressed via contribution, where company input may be generally classified into support for introducing an offset or not.

For those which did not support an offset, the primary concern raised was that this may be non-trivial to introduce in the specification. For example, since SR may be retransmitted, if introducing an offset to SR triggered DRX Active Time, does it mean for each SR (re)transmission, the UE enters DRX Active Time after an offset time has elapsed, or the offset is only applied to the first transmission of the SR? If the offset is applied for each SR (re)transmission, will the RTT duration after SR retransmssion cancel the Active Time starting from the end of the RTT duration after first SR transmission?

Proponents of introducing an offset clarify that UE will enter Active Time at the first SR transmission + an offset. The active time will continue until no pending SR, and the SR retransmission has no impact on the active time. Rapporteur would like to check if, with this clarification, the following proposal is agreeable.

**Question 8a) Do you agree that in NTN, the UE enters Active Time at the first SR transmission + an offset? The Active Time will continue until no pending SR, and the SR retransmission has no impact on the Active Time.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Agree | This should be clear that UE will keep maintaining active time due to other reasons like DRX timers.  Active time delay only due to SR should be same as how the RAR window is delayed. But SR retransmission is confusing term, may be we can use subsequent SR transmissions. |
| OPPO | Disagree | Unlike extention of *drx-HARQ-RTT-TimerUL*(*DL),* which is an essential feature for NTN since without this feature, *drx-RetransmissionTimerUL*(DL) needs to be extended, the enhancement to SR triggered DRX Active Time is more like an optimization because in this case DRX Active Time is not controlled by any timer. Due to the limited time left, we prefer not to consider this non-essential enhancement. |
| Samsung | Agree |  |
| vivo | Agree |  |
| ASUSTeK | Agree |  |
| Huawei, HiSilicon |  | Although there we see some benefit, this is a just enhancement. If we cannot reach consensus, prefer not to have it in this release. |
| Spreadtrum | Agree | Since gNB does not schedule UE before receiving SR, UE could enter active state after an offset. |
| Nokia | Disagree the proposal but agree to add offset. | We don’t think the offset should only be applied to the first SR transmission. Instead, it should be applied to every SR transmission. (i.e. *Offset should be applied to delay the start of the DRX active time after UE sending an SR*).  We think the key point here is that, the offset to postpone the UE enter Active time (after an SR sending) should have no impact to the running of UE’s existing active time (i.e., no impact to the NW DL scheduling which can be covered by current running timers after UE sending an SR.) |
| Xiaomi | Agree |  |
| LG |  | This is kind of the optimization and this is controversial. In addition, the NTN can work well without this optimization. Thus, we prefer not to discuss it in this release. |
| ZTE | Agree |  |
| Ericsson | Agree |  |
| MediaTek | Agree |  |

Form [AT117e] discussion, in SR case there was near consensus that the offset is defined as the UE-gNB RTT.

**Question 8b) If “Agree” to Question 8a), do you agree the offset is defined as UE-gNB RTT?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Agree |  |
| Samsung | Agree |  |
| vivo | Agree |  |
| ASUSTeK | Agree |  |
| Spreadtrum | Agree |  |
| Nokia | Agree |  |
| Xiaomi | Agree |  |
| ZTE | Agree |  |
| Ericsson | Agree |  |
| MediaTek | Agree |  |
|  |  |  |
|  |  |  |

### Details of DRX behaviour for CFRA

For discussion on UE entering DRX Active time an offset time after sending Msg3 in response to RAR message during CFRA, companies concerns were slightly different.

Those which did not agree note that during CFRA, network can identify the UE via Msg1, so after sending RAR, UE has acquired its TA and network may be able to schedule the subsequent transmission for the UE any time it wants (e.g. before or after receiving Msg3, depending on network implementation). To avoid missing any scheduling, UE should enter DRX Active Time after receiving RAR as legacy.

Proponents of an offset note that Msg3 is the ACK message of RAR.The network will therefore typically will not schedule UE before receiving the Msg3, and it is reasonable that UE delays to enters DRX active time.

As a compromise, some mention that it can be configurable whether the UE shall apply the offset or not. The network is then in full control if it want to send Msg3 retransmissions or not and may select that based on the UEs services or subscription or other reasons. Rapporteur thinks that this is a reasonable way forward.

**Question 9) Do you agree that in NTN, UE enters DRX Active time a network configurable offset time after sending Msg3 in response to RAR message during CFRA?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Disagree | There is nothing to do for CFRA. This is wrong to say Msg3 for CFRA.  The UE must be in fully connected mode after receiving RAR in CFRA. So simply follow the current DRX state.  But ok to look at handover case if CFRA is supported in handover. |
| OPPO | Disagree | We don’t think this is an esstial issue, and prefer to follow legacy DRX behaviour after msg3 for CFRA. |
| Samsung | Disagree | UE enters DRX Active Time after receiving RAR as legacy. |
| vivo | Disagree | CFRA can be triggered by PDCCH order, RRC with reconfigurationwithsync and in the BFR case. For the first two cases, NW shall determine that the TA command included in the RAR is used by UE and then can correctly schedule the UE. That means NW will not schedule the NW before receiving the msg3. Thus, it is reasonable that the offset time equals to the UE-gNB RTT, which does not need to be configurable.  For the BFR CFRA Case, there’s no RAR message and Msg.3 in response to it. Thuswe fail to see a need for such a configurable offset time, and UE behaviour should follow the legacy operation.  In summary, we think the new UE behaviour that UE delays to enter the active time during CFRA is only applied to the PDCCH order and RRC with reconfigurationwithsync cases, and the offset time is equal to UE-gNB RTT. |
| ASUSTeK | Disagree |  |
| Huawei, HiSilicon | Disagree | Prefer not to make the issue further complex for a non critical enhancement. It is better UE enters Active Timer immediately. |
| Spreadtrum | Disagree | It is not needed to consider the msg3 in CFRA. |
| Nokia | Agree | OK for the compromised solution to move forward. |
| Xiaomi | Disagree |  |
| LG | Disagree | This is kind of the optimization and this is controversial. In addition, the NTN can work well without this optimization. Thus, we prefer not to discuss it in this release. |
| ZTE | Agree with comments | First, the active time is described as below,  “a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the Random Access Preamble not selected by the MAC entity among the contention-based Random Access Preamble (as described in clauses 5.1.4 and 5.1.4a).”  it is naturally not for CF-BFR as the RA is completed based on reception of PDCCH scheduled by C-RNTI in dedicated SS. But for other CFRA cases, after RAR has successfully received UE has already implemented TAC indicated in RAR. Since it is CFRA, also NW can predict( e.g., based on the channel state) the successful rate of reception of RAR at UE side, it is possible for NW to perform an early scheduling in case delay-sensitive data arrives. Therefore there is no need to always wait for UE-gNB RTT.  To balance with power saving and flexible NW scheduling, it is preferred to have a configurable offset with zero as an option.  However,we are also fine with no enhancements if it is majority view. |
| CATT | Disagree | For CFRA, there is no MSG3 in RA procedure. And the network may schedule the UE after RAR in any time, we should not restrict the NW implemention.  On the other hand, the UE enters active time after successful reception of a RAR for CFRA not after sending the message followed RAR. |
| Ericsson | Partly agree | The offset shall be UE-gNB RTT, but it shall be configurable, in the CFRA config, to apply the offset or not. In that way any wanted behaviour is controlled by the gNB , as in legacy or some power saving if gNB waits the Msg3/MsgA for confirmation before scheduling the UE again. |
| MediaTek | Disagree | This is a non-critical optimization, we prefer keep the legacy behaviour. |

## **OI 17:** UL synchronization failure

In Open issues discussion, RAN2 discussed how to handle UL synchronization failure due to the validity timer expiry. Although discussion was inconclusive in previous meetings, it has been noted that in IoT-NTN a similar issue was discussed, and it was agreed: *“when SI used for UL synch (pre-compensation) is no longer valid, the UE autonomously tunes away and re-acquires the required SI, and then comes back.”*

However, several companies mention that an IoT UE cannot read SIB in connected mode, which is not usually the case in NR. Applying IoT-NTN agreement in NR would cause the UE to wait until validity timer expiry and then interrupt connection to perform SI update. Considering UE knows when validity time expires, UE can instead re-aquire SIB prior to validity timer expiry to avoid unnecessary periodic interruption.

Rapporteur would first like to reach a general understanding on how the UE behaves while validity timer is running, which may impact the frequency of the timer expiring and the possibly UE behaviour upon timer expiry (e.g., if this is a rare event a simple solution may be defined).

**Question 10a) What is your understanding of *general* behaviour for connected UE when approaching validity timer expiry?**

* **Option 1: UE does not reaquire SIB until validity timer expires;**
* **Option 2: UE reaquires SIB prior to validity timer expiry (when possible);**
* **Option 3: Other, please describe.**

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| --- | --- | --- |
| **Company** | **Preferred Option** | **Additional comments** |
| Qualcomm | Option 3 | In general this should be UE imeplementation. But the UE should try to acquire th SIB before validity timer expires.  But this may not be guaranteed. There may be some other reason why option 2 may not be possible such as to finish on going transmission, SIB not scheduled in the same bandwidth part, SIB epoch time is after validity timer expiry, or there is DL channel problem. |
| Intel | option 2 | UE implementation should start reaquiring SIB early enough prior to validity timer expiry. |
| OPPO | Option 3 | Share the same view as Qualcomm |
| Apple | Option 2 |  |
| Samsung | Option 2 | UE should by implementation reaquire SIB before expiry to keep UL synchronized. It would be too late and risky if UE reaquires SIB until validity timer expiry. |
| Vivo | Option 3 | Agree with QC that this should be UE implementation. |
| ASUSTeK | Option 1 | We can follow revious agreement that: “UE acquires the updated SIBX when the timer expires.” |
| Huawei, HiSilicon | Option 2 | Even if validity timer expires due to that UE cannot reaquire the SIB, it can be up to UE implementation to re-acquire the SIB and nothing special has to be done. |
| Spreadtrum | Option 2 | The expiring of validity timer may lead uplink transmission interruption. |
| Nokia | Option 2 | The validity timer indicates the maximum time duration in which the UE can apply the satellite ephemeris without having acquired new satellite ephemeris and Common TA related information. We think UE should attempt to re-acquire the SIB before the validity timer expirty. |
| Xiaomi | Option 2 |  |
| LG | Option 2 | The smart UE implementation should acquire the SIB before the validity timer expires. |
| ZTE | Option 2 |  |
| CATT | Option 1 | The following agreement is made in RAN2 #116bis-e meeting:  *The ntnUlSyncValidityDuration applies to the whole SIBX. UE acquires the updated SIBX when the timer expires. FFS whether to also include it in the LS to RAN1. FFS if this applies only to Connected mode or to idle mode UE as well*  And further in RAN2 #117-e meeting, the following agreement is achieved:  *ntnUlSyncValidityDuration applies both to connected mode and idle mode*  The above agreements consider the expiry time of validity timer is the SIBX updated bound, therefore, the UE does not reacquire SIBX until validity timer expires. |
| Ericsson | Option 2 | This shall be the normal behviour, anything else is an exception and shall happen only rarely. |
| MediaTek | Option 2 | After the validity timer expires, the data used for UL sync will become invalid, therefore the UE should aim to refresh the data before the timer expiry. |

In the event validity timer does expire (e.g. if Option 1 is the preferred UE behaviour or if UE is configured with a BWP without a common search space and cannot reaquire SIB), then UE behaviour still needs to be defined. In general, contributions to RAN2#117e note the following potential behaviours:1) Be considered out of sync (possibly requiring RACH); 2) Re-aquire SI (with or without flushing HARQ buffers); or 3) trigger RLF (immediately or subject to a timer).

**Question 10b) Upon validity timer expiry, what is your preferred UE behaviour?**

|  |  |
| --- | --- |
| **Company** | **Preferred UE behaviour?** |
| Qualcomm | Wait for a recovery period. The ephemeris epoch time may be after validity expiry time. So the UE should not trigger RLF immediately. If the UE is still not able to acquire the SIB or start validity timer until the recovery period, there must be something wrong.  To fix this issue, the UE should trigger RLF. |
| Intel | 2) Re-aquire SI (without flushing HARQ buffers). If UE fails to re-aquire SI, it may be due to low RSRP which can lead to RLF later according to current spec. |
| OPPO | First re-aquire SI and then trigger RACH.  Different from the case of TAT expiry, the validity timer expiry at the UE is not known to the network. That means even if the UE releases the all resources autonomously, since the network will not be aware of this, these resources would not be used by other UEs. So in our view, upon expiry of validity timer, UE only needs to suspend the resource configuration and stop UL transmission rather than release these resource configuration.  In order to recover UL synchronization, the UE needs to firstly acquire the serving satellite ephemeris data and common TA parameters from SIB, and then trigger a RACH. If the UE is not configured with searchSpaceSIB1 or searchSpaceOtherSystemInformation on the active BWP, the UE should switch to initialDownlinkBWP to acquire the serving satellite ephemeris data and common TA parameters. |
| Apple | 2) Re-aquire SI (without flushing HARQ buffers); |
| Samsung | Upon validity timer expires, UL synchronization is failed. UE shall not perform any uplink transmission, UE shall re-acquire SI without HARQ buffer flushing. Flushing HARQ buffers is triggered if TAT expires as legacy. RACH is triggered as legacy, RLF is triggered as legacy if UE fails to reacquire SI due to radio link issue. |
| Vivo | Upon validity timer expiry, UE considered that it is out of sync. For UL sync recovery, UE follows the legacy RACH trigger, i.e., new RACH trigger is not introduced. |
| ASUSTeK | 2) Re-aquire SI  The validity timer for a SIB indicates the time when to need update of the SIB. |
| Huawei, HiSilicon | 2) Re-aquire SI (without flushing HARQ buffers) |
| Spreadtrum | Agree with OPPO. |
| Nokia | First of all, we think option 3 (triggering RLF) is not good. When the validity timer expires, it is only the UL synchronization that is unavailable, but the DL synchronization is kept. If the UE trigger RLF, the UE should perform cell selection and the whole RRC Reestablishment procedure again to achieve UL synchronization which will have unnecessary signalling and power consumption.  For Option1, it is not clear what’s the exact UE behaviour. UE should anyway re-acquire SI for UL sync recovery. So, Option1 should include Option2 (for SI re-acquire).  We tend to agree UE should trigger RACH. Without RACH procedure, we are not sure whether UE can send PUSCH/PUCCH correctly with a valid TA based on UE’s self-estimation. (E.g. when the validity timer expired, the previously acquired ephemeris/Common TA parameters are considered to be outdated. UE should re-acquire SIB for new ephemeris and common TA parameters, then UE re-estimate the TA for UL compensation based on the new information. It means the previous UE estimated TA and closed TA adjustment (via TA MAC CE) are not valid anymore). To maintain the TA between UE and eNB, we think UE should trigger RACH at least for new TA alignment and then NW can adjust that in RAR. Please note the maximum TA adjustment in RAR can be up to 2ms while the adjustment for TAC MAC CE in RRC Connected mode is only 0.017ms. RAR is needed for quick TA adjustment.  For whether UE should flush HARQ buffer or not, it is a separate issue. We are open for the solution but slightly prefer to keep it simple to just follow TAT timer expiry handling (i.e. flush buffer) to have less specification impact.  So, we have below new proposal:  **Proposal: Upon UL synchronization failure due to the validity timer expiry, RACH procedure should be used to recover from UL synchronization loss failure after UE re-acquires the SIB for new assistance info. FFS whether UE should flush buffer and release UL resource.** |
| Xiaomi | UE should follow the legacy behaviour when loss UL sync, i.e. flush HARQ buffer, release PUCCH resources, etc. And then re-acquire SIBxx. RACH can only be initiated after SIBxx is acquired is initiated when necessary. |
| LG | Since the UE already knows when the validity timer will expire, the UE can re-acquire the NTN assistance information. Considering this, there is no case where the validity timer expires except that the UE does not receive the SIB due to the bad radio conditions. In other words, if the expiry of the validity timer happen, the UE should search a new cell as soon as possible. Thus, the UE should perform the RLF procedure when the validity timer expires. |
| ZTE | When validityTimer expires UE shall re-acquire SI which in our understanding has already been agreed in CP session per the agreements below, no need to re-open the discussion.   |  | | --- | | RAN2#116bis-e  The ntnUlSyncValidityDuration applies to the whole SIBX. UE acquires the updated SIBX when the timer expires. FFS whether to also include it in the LS to RAN1. FFS if this applies only to Connected mode or to idle mode UE as well  RAN2#117-e  ntnUlSyncValidityDuration applies both to connected mode and idle mode |   The uncertain part is whether to further define UE behavior in such condition, and we prefer to have UE behavior clearly specified to prevent NW from unknowing the state of UE.  Since UE cannot maintain the correct TA when SIB is out of date it shall stop UL transmission and attempt to regain uplink synchronization, which is similar to recovery from out-of-synccan thus existing TAT expiry procedure can be reused to minimize specs impact. But if companies think maintaining HARQ buffer and keep UL resource can avoid waste of resource then this part can be further discussed. |
| CATT | Just to reacquire the SIBX.  Since UL synchronisation can be controlled by TAT and RLF can be controlled by T310, any other UE’s behaviour is unnecessary upon validity timer expiry. |
| Ericsson | UE shall refrain form all UL transmissions and trigger RLF |
| MediaTek | Option 1) and 2), but: UE suspends uplink transmission, considers UL out of sync, and re-acquires SI (without flushing HARQ buffers). However, if there is no UL/DL data, UE does not have to trigger RACH. |

# Conclusions

<To be generated pending company input>

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