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**

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| **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. |
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## 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?**

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| **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. |
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## 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:

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| 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?**

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| **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. |
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### 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.

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| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Agree |  |
| OPPO | Agree |  |
| Apple | Agree |  |
| Samsung | Agree |  |
| vivo | Agree |  |
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### 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:

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| 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.**

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| **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 |  |
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## 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).***

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| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Agree |  |
| OPPO | Agree |  |
| Apple | Agree |  |
| Samsung | Agree |  |
| vivo | Agree |  |
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## 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*

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

2> set *HARQ\_RTT\_Timer\_UL* for the corresponding HARQ process to *drx-HARQ-RTT-TimerUL* plus UE-gNB RTT.

2> else:

3> 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?**

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| **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 |  |
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# 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. |
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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.** |
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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?**

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| **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 |  |
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## **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.**

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| **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 |  |
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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?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| Qualcomm | Agree |  |
| Samsung | Agree |  |
| vivo | Agree |  |
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### 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?**

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| **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. |
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## **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. |
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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?**

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| **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. |
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# Conclusions

<To be generated pending company input>

# References

1. [R2-2202302](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202302.zip) Discussion on MAC open issues Huawei, HiSilicon
2. [R2-2202303](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202303.zip) Discussion on remaining MAC issues Huawei, HiSilicon
3. [R2-2202420](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202420.zip) Remaining issues on HARQ process in NTN Spreadtrum Communications
4. [R2-2202421](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202421.zip) MAC operation about the validity timer expiry Spreadtrum Communications
5. [R2-2202546](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202546.zip) UL synchronization and validity timer expiry Apple
6. [R2-2202547](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202547.zip) UE location and TA reporting Apple
7. [R2-2202563](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202563.zip) UL synchronization failure in RRC\_CONNECTED Qualcomm Incorporated
8. [R2-2202613](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202613.zip) Considerations on MAC open issues CMCC
9. [R2-2202773](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202773.zip) Remaining MAC Open Issues for NR NTN vivo
10. [R2-2202972](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202972.zip) Consideration on MAC open issues ZTE Corporation, Sanechips
11. [R2-2202999](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2202999.zip) Discussion on MAC open issues in NTN OPPO
12. [R2-2203076](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203076.zip) Discussion on Left Open Issues of Other MAC Aspects CATT
13. [R2-2203151](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203151.zip) Discussion on TA reporting ITL
14. [R2-2203165](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203165.zip) Discussion on open issues for MAC aspects LG Electronics Inc.
15. [R2-2203194](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203194.zip) Remaining MAC issues of NR NTN Xiaomi
16. [R2-2203203](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203203.zip) CG enhancements in NTN Sony
17. [R2-2203256](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203256.zip) On left open issues for MAC aspects Nokia, Nokia Shanghai Bell
18. [R2-2203257](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203257.zip) Discussion on Validity timer expiry and restart Nokia, Nokia Shanghai Bell
19. [R2-2203298](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203298.zip) Open issues on MAC aspects Samsung Research America
20. [R2-2203423](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203423.zip) Remaining MAC open issues in NTN InterDigital
21. [R2-2203482](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203482.zip) Remaining MAC issues in NTNs Ericsson
22. [R2-2201739](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Inbox/R2-2201739.zip) Summary of [AT116bis-e][107][NTN] Other MAC issues (InterDigital)
23. [R2-2201849](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Inbox/R2-2201849.zip) Summary of [AT116bis-e][107][NTN] Other MAC issues Phase 2 (InterDigital)
24. [R2-2201900](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Inbox/R2-2201900.zip) Summary of [Post116bis-e][109][NTN] MAC running CR and list of open issues (InterDigital)
25. [R2-2203424](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203424.zip) Report of [Pre117-e][103][NTN] MAC open issues (InterDigital)
26. [R2-2203160](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203160.zip) Report of [Pre117-e][011][IoT-NTN] User plane Open Issues Input (OPPO)
27. R2-2203532 Report of [AT117-e][103] MAC open issues (InterDigital)