3GPP RAN WG2 Meeting #117-e R2-220xxxx

eMeeting February 21st – March 3rd, 2022

Agenda Item: 8.10.2.1.1

Source: InterDigital

Title: [DRAFT] Summary of [Pre117-e][NTN][103] MAC open issues

Document for: Discussion, Decision

# Introduction

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

**[Pre117-e][NTN][103] MAC open issues (InterDigital)**

* **Issues 1-3, 5-11 and 13 from R2-2201900 will be handled in offline discussion**
* Issues 4, 12 and additional details of K\_Offset MAC CE will be handled by CR rapporteur directly in the running CR
* Issues 14-18 can be handled via company contributions in AI 8.10.2.1.1
* The following aspect of Issue 3: “*RAN2 to confirm support of UE location information for purposes of TA reporting*” can be handled via company contributions in AI 8.10.2.1.1
* Other MAC issues can be handled via company contributions in AI 8.10.2.1.2 and AI 8.10.2.1.3

Please note the following deadlines:

* Deadline (for companies' feedback): **Monday 2022-02-14 23:59 UTC**

# TA reporting and RACH aspects

## UE-specific TA reporting

### Enable/disable TA reporting during RACH in connected mode

In the second phase of offline [AT116bis][101], there was near consensus (18 of 19) that in general, TA reporting during RACH in connected mode is not controlled by the enable/disable indication configured in SI but depends on whether a TA update event is triggered or not.

Considering very large majority, Rapporteur suggests this proposal be agreed, and implementation details be discussed during stage-3.

**Question 1: Do you agree with the following proposal?:**

***Proposal: TA reporting during RACH in connected mode is not controlled by the enable/disable indication configured in SI, but depends on whether a TA update event is triggered or not. Specification impact, if any, can be discussed in Stage 3.***

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| **Company** | **Agree/Disagree** | **Additional comments** |
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### TA reporting triggered and no UL-SCH resources

In the final phase of offline [AT116bis][101], the following proposal was discussed and supported by 12 of 16 companies:

***Proposal: SR can be triggered if there is a TA reporting triggered and no UL-SCH resources for TA reporting. When SR is triggered but there are no available PUCCH resources, UE will trigger RACH.***

During discussion, it was noted that the drawback of SR/RACH triggering from UE is that the UE will send periodically TA report when it exceeds the threshold even when there is no data to send, which will cause much overhead especially given that all UEs within the cell will be sending this. For example, all connected UEs in an area the size of the UK (i.e. a cell size of 1000km) will end up always reporting TA (periodically). Relying on existing mechanisms will ensure that TA report is only sent when required, i.e. only when there is DL or UL data (i.e. when TA is actually needed).

Companies supportive of this proposal counter this concern by noting that the reporting interval is up to NW implementation e.g., by setting the offset threshold/UE-specific K\_Offset. Proper NW configuration, for example, configuration of a relatively large UE-specific K\_Offset, would result in less frequent TA report, thus less overhead.

**Question 2a: Should connected UE send TA report (if triggered) only if there is UL/DL data?**

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| **Company** | **Yes/No** | **Additional comments** |
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**Question 2b: If the above proposal is agreed, can NW configuration address any possible excessive TA reporting? If “No” please describe system impact(s) which preclude this option.**

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| **Company** | **Yes/No** | **Additional comments** |
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### UE location information for TA reporting purposes

During offline [AT116bis][101], UE location information for TA reporting purposes was discussed over several rounds. Based on final round outcome, company opinion was split:

* **8** do not support UE location information for TA reporting purpose in connected mode;
* **6** do support; and
* 1 suggests to postpone.

However, several aspects of UE location information for TA reporting purpose have more consensus. Considering limited time remaining Rapporteur suggests the topics below be addressed in this email discussion with the condition “*If UE reporting location information for TA reporting purpose in connected mode is supported*” which shall be addressed via contribution to RAN2#117e (as captured in the Appendix via Open issue 19).

#### **Topic 1:** Whether both UE location and/or UE specific TA information are needed in parallel for the purposes of TA reporting

In final round of offline [AT116bis][101], the following proposal was discussed and supported by 6 of 8 responding companies:

***Proposal: UE can be configured to report only the UE location or the UE specific TA information IF reporting UE location information for TA reporting purpose in connected mode can be agreed.***

Companies which do not agree have raised the following technical issue:

**Technical issue 1)** Limit to NW configuration

Two companies note that this proposal would limit NW configuration possibilities for the network, and that if both TA report and UE location can be reported, let the network decide if it shall configure one of them or both or none (allowing optimization based on resource situation, services, subscriptions etc.).

To counter this argument, It is noted by other companies that there is no need to report both the UE specific pre-compensation and the UE location information to NW in parallel since they are derived from the same inputs.

**Question 3: Companies are invited to comment on the above technical issue or provide additional comments regarding the above proposal.**

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| **Company** | **Additional comments** |
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#### **Topic 2:** Definition of event trigger for location reporting (e.g. if it re-uses the same event trigger or different trigger)

In final round of offline [AT116bis][101] there was consensus that if reporting UE location information for TA reporting purpose in connected mode can be agreed, it shall reuse the TA-based trigger event. Rapporteur suggests that the same proposal be agreed.

**Question 4: Do you agree with the following proposal?:**

***Proposal: Reuse the TA-based trigger event if reporting UE location information for TA reporting purpose in connected mode can be agreed.***

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| **Company** | **Agree/Disagree** | **Additional comments** |
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#### **Topic 3:** connected mode UE failing to acquire an accurate UE location to be used in the calculation of the full TA.

In final round of offline [AT116bis][101], the following proposal was discussed and supported by 14 of 16 companies:

***Proposal: RAN2 do not address the issue on connected mode UE failing to acquire an accurate UE location to be used in the calculation of the full TA.***

The main concern from companies which do not agree (and also recognized by some companies who do) is that if UE cannot fix GNSS, then its TA would not be valid and it should not perform any UL transmission. Rapporteur suggests RAN2 can capture the above concern, however considering the very large majority support do not address this issue in RAN2 specification.

**Question 5: Do you agree with the following proposal?:**

***Proposal: RAN2 understanding: UE failing to acquire an accurate UE location to be used in the calculation of the full TA should not perform any UL transmission until GNSS is fixed. No RAN2 specification impact.***

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| **Company** | **Agree/Disagree** | **Additional comments** |
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## Details of new MAC CEs

### Details of UE-specific K\_Offset and TA reporting MAC CEs

Rel-17 NTN has introduced two new MAC CEs, captured in the current version of the MAC CR [2] as follows:

#### 6.1.3.XX UE-Specific TA MAC CE

The UE-Specific TA MAC CE is identified by MAC subheader with LCID as specified in Table 6.2.1-2. It has a fixed size and consists of two octets defined as follows (Figure 6.1.3.X-X):

- UE-specific TA: This field contains the UE estimate of the full UE-specific TA (i.e., T\_TA as defined in the UE’s TA formula). The length of the field is 16 bits

#### 6.1.3.XX Differential UE-Specific K\_Offset MAC CE

The Differential UE-Specific K\_Offset MAC CE is identified by a MAC subheader with eLCID as specified in Table 6.2.1-2b. It has a fixed size and consists of a single octet defined as follows (Figure 6.1.3.X-X):

- Differential UE-Specific K\_Offset: This field contains the differential UE-specific K\_Offset, The length of the field is 8 bits.

RAN2 to confirm details of new MAC CEs, including the structure and name of both MAC CEs.

**Question 6a: Do you agree UE-specific MAC CE consists of only one field with length 16 bits, which contains the UE estimate of full UE-specific TA (i.e., T\_TA as defined in the UE’s TA formula)?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
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**Question 6b: Do you agree Differential UE-Specific K\_Offset MAC CE consists of only one field with length 8 bits, which contains the Differential UE-Specific K\_Offset?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
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**Question 6c: Do you agree with the following names: 1) UE-specific TA MAC CE; and 2) Differential UE-Specific K\_Offset MAC CE?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
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## RA windows and timers

### Extension of *ra-ReponseWindow* and *msgB-ResponseWindow*

In current version of NTN MAC CR Section 5.1.1 [2], there are the following Editor’s Notes regarding *ra-ResponseWindow* and *msgB-ReponseWindow* extension:

Editor’s note: *Agreement:* If the start of *ra-ResponseWindow* is accurately compensated by UE-gNB RTT, *ra-ResponseWindow* is not extended in LEO/GEO. RAN2 to confirm *ra-ResponseWindow* is not extended for NTN.

Editor’s note: *Agreement:* If the start of *msgB-ResponseWindow* is accurately compensated by UE-gNB RTT, *msgB-ResponseWindow* is not extended in LEO/GEO. RAN2 to confirm *msgB-ResponseWindow* is not extended for NTN.

Considering RAN1 has not identified any need for extension, RAN2 may confirm that *ra-ResponseWindow* and *msgB-ReponseWindow* extension is not necessary.

**Question 7: Do you agree *ra-ResponseWindow* and *msgB-ReponseWindow* are not extended in NTN?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
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### Remaining details of *ra-ContentionResolutionTimer*

During offline [AT116bis][101], *ra-ContentionResolutionTimer* behaviour was discussed over multiple rounds. Final round outcome resulted in the following proposal, which was acceptable to 10/13 companies:

***Proposal: 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.***

The primary concern of disagreeing companies is the limitation placed on MSG3 blind retransmission, noting if the above proposal is adopted the UE is not required to monitor PDCCH and may miss the blind retransmission of MSG3 between the moment when UE stops *ra-ContentionResolutionTimer* and the moment the UE (re)starts *ra-ContentionResolutionTimer*. This may impact cell coverage, which is a key issue given the large cell sizes of non-terrestrial networks.

Rapporteur notes that a large majority support the above proposal, and there is not consensus MSG3 blind retransmission is needed. It is suggested that the above proposal be adopted for Rel-17, and impact to coverage and possible enhancement to support MSG3 blind retransmission be considered in the Rel-18 NTN coverage enhancement study item.

**Question 8: Do you agree with the following compromise proposal?:**

***Proposal: 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. Impact to coverage and possible enhancements (e.g. to support MSG3 blind retransmission) can be considered in the Rel-18 NTN coverage enhancement SI.***

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| **Company** | **Agree/Disagree** | **Additional comments** |
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# Other MAC Aspects

## LCP

### DRX and LCP parameter names

Based on comment to offline [AT116bis][107], several companies note that naming/descriptions of *allowedHARQ-DRX-LCP,* *uplinkHARQ-DRX-LCP-Mode* and HARQ DRX-LCP modes should be revised for further clarity in the specification.

**Question 9a: What is your preferred parameter naming?**

* **Option 1: *uplinkHARQ-mode*, *allowedHARQ-mode, and HARQ mode A/B***
* **Option 2: *uplinkHARQ-DRX-mode, allowedHARQ-DRX-mode, and HARQ-DRX mode A/B***

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| **Company** | **Preferred option?** | **Additional comments** |
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**Question 9b: Companies are invited to provide a revised/updated description of any of the above- listed parameters.**

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| **Company** | **Comments** |
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### HARQ mode for PUSCH transmission scheduled by RAR

During offline [AT116bis][107], HARQ mode for PUSCH transmission scheduled by RAR was discussed over multiple rounds. Final round outcome resulted in the following proposal, which was acceptable to 9/12 companies:

***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).***

During discussion, the following technical concerns were raised regarding the proposed solution:

**Technical Issue 1)** we need to clarify whether the configuration of “No HARQ state” is per HARQ process or per UE?

* *Rapporteur understanding is that based on agreement in RAN2#116e [6]: “if uplinkHARQ-DRX-LCP-Mode-r17 is configured, a HARQ process may be mapped to either ‘HARQ mode A’ or ‘HARQ mode B’.” either all HARQ processes are configured as “no HARQ state” or as “HARQ mode A/B”. This implies that “no HARQ state” is configured per UE.*

**Technical Issue 2)** if network configure HARQ process #0 with no HARQ state, dynamic scheduling may not be able to use this HARQ process since DRX RTT timer can not be extended by RTT.

* *Rapporteur understanding is that if a UE is not configured with uplinkHARQ-DRX-LCP-Mode-r17 or allowedHARQ-DRX-LCP, the LCH mapping rules do not apply.* *In this case legacy LCP operation applies and there should be no issue. Note: dynamic scheduling may rely on e.g., the UE being in Active time for other reasons if DRX timers prematurely expire.*

**Technical Issue 3):** if network configure HARQ process #0 with HARQ state, it means the LCHs configured with other HARQ state can not use it even if the RACH is triggered by them due to data arrival. It will greatly increase the delay.

* *Rapporteur understanding is that based on RAN2#116bis-e discussion outcome, majority think that this can be handled by NW implementation without specification impact.*

**Question 10a: Companies are invited to comment on the above technical issues or provide additional comments regarding the above proposal.**

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In the RRC open issues email discussion [Pre117][NTN][101], Open issue 19 describes the following:

***Open issue 19:*** *HARQ type for SRBs or RRC message may need to be clarified to guarantee the reliability.*

*The open issue is about the LCP procedure in MAC, where it is decided to enable configuring either HARQ mode A or Mode B or none (any HARQ mode is fine) for each LCH, and then only allow data from that LCH to be transmitted on a HARQ process configured with that HARQ mode. Then the question is about do we need to enable configuring a HARQ mode also for SRBs. This open issue is moved to [Pre117-e][NTN][103] MAC open issues.*

**Question 10b: Companies are invited to comment on the above issue (e.g., whether configuration of HARQ mode and *allowedHARQ-DRX-LCP* is applied also for SRBs?)**

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## Miscellaneous timers

### Details of HARQ RTT Timer extention

In Rel-17 NTN, HARQ RTT timer behaviour is modified based on configuration of *downlinkHARQ-FeedbackDisabled* and *uplinkHARQ-DRX-LCP-Mode*. As an example, how the UE sets *drx-HARQ-RTT-TimerDL* length in NTN is captured in the NTN MAC running CR as follows:

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 *drx-HARQ-RTT-TimerDL* length for the corresponding HARQ process to *drx-HARQ-RTT-TimerDL* included in *DRX-Config* plus UE-gNB RTT.

2> else:

3> set *drx-HARQ-RTT-TimerDL* length for the corresponding HARQ process to *drx-HARQ-RTT-TimerDL* included in *DRX-Config*.

During CR review in [Post116bis-e][109], two comments have been raised regarding current CR implementation of setting HARQ RTT timer behaviour:

**Comment 1)** The use of additional helper variables to set timer length

One company comments that when the drx HARQ RTT timers are extended for some HARQ processes and not extended for some HARQ process (in UL respectively DL), the description in MAC spec section 5.7 becomes messy as it in legacy always refer to the RRC parameters (*drx-HARQ-RTT-TimerDL/UL*) while the timer values will depend on the HARQ process ID.

They note to avoid ambiguity of what the UE shall do with received RRC parameters it is proposed to introduce two helper variables *HARQ\_RTT\_TIMER\_DL* and *HARQ\_RTT\_TIMER\_UL* to replace *drx-HARQ-RTT-TimerDL/UL* in all procedural text (companies are encouraged to refer to R2-2201629 for further discussion and an example text proposal).

**Question 11: What is your preferred method of implementing HARQ RTT timer extension?**

* **Option 1: Current implementation is sufficient**
* **Option 2: Introduce new helper variables *HARQ\_RTT\_TIMER\_DL* and *HARQ\_RTT\_TIMER\_UL* to replace existing instances of *drx-HARQ-RTT-TimerUL/DL.***

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| **Company** | **Preferred option?** | **Additional comments** |
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**Comment 2)** The location of specification text setting the timer length

Considering agreement that uplinkHARQ-DRX-LCP-Mode also applies to CG, a unified procedure to modify RTT timer length was introduced in latest MAC running CR to simplify specification. one company comments that DRX RTT timer length cannot be set with UE-gNB RTT at the start of DRX section. This is because UE will set the DRX RTT with the current UE-gNB RTT instead of the UE-gNB RTT when DRX RTT is actually started. Thus, UE can only set the DRX RTT timer right before DRX RTT is started/restarted.

**Question 12: What is your preferred location for HARQ RTT timer extension text?**

* **Option 1: Current implementation is sufficient**
* **Option 2: Repeated at each instance prior to start of *drx-HARQ-RTT-TimerUL/DL.***

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### Extension of the *configuredGrantTimer*.

During offline [AT116bis][107], extension of the *configuredGrantTimer* was discussed over multiple rounds. Final round outcome resulted in several observations, which led to the following proposal:

***Proposal: configuredGrantTimer length is extended by UE-gNB RTT in NTN.***

During subsequent discussion, several technical issues were raised regarding the proposed solution:

**Technical Issue 1):** Mismatch between UE and gNB

Mismatch between UE and gNB making the UE not transmit when the gNB expects the UE to (UE misses a CG opportunity) or making the gNB not decoding a CG when the UE transmits (This is maybe not a severe issue as it shall not happen frequently).

* *Rapporteur notes that based on past discussion outcome companies recognize this as an issue, however a large majority (8/11) think this may be handled by existing mechanisms with no further specification impact.*

**Technical Issue 2):** gNB resource planning

gNB cannot plan the future resource usage as gNB cannot know how the UE-gNB RTT will vary in advance. In legacy periodicity times configuredGrantTimer gives the time that the timer will be running. A change to base the running of this timer on the UE-gNB RTT means the gNB do not know in advance when in time a CG will be reused by one UE. It also means that the running time of this timer for different UEs will vary differently depending on where in a cell they are located. The gNB may handle thousands of UEs, and not knowing how a CG-config will be used by the UEs is a new limitation for the gNB that it would need to handle the overhead from. This decreases the possibility for the gNB to use CG for as many users as possible.

**Technical Issue 3)** Overhead

Using a new field configuredGrantTimer-r17 of 8 bits will not lead to any overhead, as configuredGrantTimer is an optional parameter.

* *Rapporteur agrees a new IE of 8 bits does not increase overhead. However, based on past discussion a majority (7/11) do no not think that values in Option 2 can be selected to balance overhead and approximately compensate UE-gNB RTT. Comments should therefore focus on whether companies think 8 bits is sufficient to approximately compensate UE-gNB RTT.*

**Question 13: Companies are invited to comment on the above technical issues or provide additional comments regarding the above proposal.**

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## Other Issues

### Identification of non-terrestrial network cells

To identify when UE is to perform NTN-specific actions (e.g., timer extensions to accommodate addition RTT) text such as the following is used in the current version of the running NTN MAC CR [2]:

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 *drx-HARQ-RTT-TimerDL* length for the corresponding HARQ process to *drx-HARQ-RTT-TimerDL* included in *DRX-Config* plus UE-gNB RTT.

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This has led to the following Editor’s Note:

Editor’s note: How UE detects cell originates from a non-terrestrial network to be confirmed by RAN2.

In RAN2#116bis-e, the following was agreed [7]:

1.*UE can know the NW type implicitly no later than SIB1 reception, there is no explicit NW type indication in SIB1.*

RAN2 therefore needs to conclude whether existing text referring to non-terrestrial networks in MAC running CR is sufficient, or if additional clarification is needed how the UE implicitly detects NTN NW type.

**Question 14: Does MAC specification require further clarification on how UE detects a cell originates from a non-terrestrial network? If ‘Yes’, please describe how.**

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| **Company** | **Yes/No** | **Additional comments** |
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# Summary

<To be generated based on company input>

# Conclusions

<To be generated based on company input>

# References

1. R2-2201755 – Summary of [AT116bis][101][NTN] RACH aspects (OPPO)
2. R2-2201899 – [DRAFT] 38.321 running NTN CR (InterDigital)
3. R2-2201739 – Summary of [AT116bis-e][107][NTN] Other MAC issues (InterDigital)
4. R2-2201849 – Summary of [AT116bis-e][107][NTN] Other MAC issues Phase 2 (InterDigital)
5. R2-2201900 – Summary of [Post116bis-e][109][NTN] MAC running CR and list of open issues (InterDigital)
6. R2-2201970 – Report of 3GPP TSG RAN WG2 meeting #116-e (ETSI MCC)
7. Draft\_R2-116bise\_Meeting\_Report\_v1 (ETSI MCC)

# Appendix: Remaining open issues

The following are identified open issues from R2-2201900 which have not been covered under the scope of this discussion.

## To be addressed by CR editor

**Open Issue 4:** Event triggering for UE-specific TA reporting

RAN2 to finalize details regarding event-triggered TA reporting for UE in RRC Connected in RRC specification, with update to MAC as needed (e.g. parameter name of offset threshold). NOTE: This is not to define new behaviour, but to update MAC specification based on RRC.

**Open Issue 5:** Details of UE-specific K\_Offset and TA reporting MAC CEs

Additional details of K\_Offset MAC CE can be updated as needed.

**Open Issue 12:** Details of SR-Prohibit Timer extension – MAC impact.

RAN2 to confirm values included in new *sr-ProhibitTimerExt-r17* IE in RRC discussion. MAC CR can be updated if any impact identified.

## To be addressed by contribution to RAN2#117e

**Open Issue 14:** drx-HARQ-RTT-TimerDL/UL behaviour for HARQ feedback enabled and UL HARQ state A

RAN2 to discuss UE DRX behaviour when PDCCH indicates a UL/DL transmission doesn’t consider the case where drx-HARQ-RTT-TimerUL/DL for the corresponding HARQ process has already been running. (Companies are referred to [R2-2201739](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Inbox/R2-2201739.zip), Section 5.2 for additional details).

**Open Issue 15:** Repetition transmission based HARQ retransmission

RAN2 to discuss whether repetition transmission based HARQ retransmission is always allowed and is explicitly indicated via DCI or semi-statically with RRC signalling (as in legacy). (Companies are referred to [R2-2201739](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Inbox/R2-2201739.zip), Section 5.2 for additional details).

**Open Issue 16:** details of DRX behaviour after sending SR and msg3 for CFRA

RAN2 to discuss whether:

* for DRX in NTN, in the case that a UE sends an SR, the UE enters Active time to monitor for a response after an offset time has elapsed.
* In the case that a UE sends msg3 as response to a RAR message during CFRA, the UE enters Active time when an offset time has elapsed.

(Companies are referred to [R2-2201739](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Inbox/R2-2201739.zip), Section 5.2 for additional details).

**Open Issue 17:** UL synchronization failure

RAN2 to discuss how to handle UL synchronization failure due to the validity timer expiry (discussed in R2-2201755 but no conclusion)

**Open Issue 18:** DL MAC CE execution delay

RAN2 to discuss if we need to capture the DL MAC CE execution delay by K\_MAC agreed by RAN1.

**Open Issue 19:** UE location information for pruposes of TA reporting

RAN2 to confirm support of UE location information for purposes of TA reporting.