3GPP RAN WG2 Meeting #118-e R2-2206194

eMeeting May 9th – May 20th, 2022

Agenda Item: 6.10.2.1

Source: InterDigital

Title: [DRAFT] Report of [AT118-e][104][NTN] UP corrections: Phase 1

Document for: Discussion, Decision

# Introduction

This document is intended to address general corrections and summarize proposals from selected papers in AI 6.10.2.1, focusing on the main issues identified in RAN2#117e as per the following discussion guidelines:

**[AT118-e][104][NTN] UP corrections (InterDigital)**

* **Initial scope: based on contributions in 6.10.2, discuss corrections for TA reporting, msg3 retx, Contention Resolution timer, validity timer expiry, HARQ RTT timer extension and other general UP corrections**
* **Initial 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)**

Please note the following deadlines:

* Initial deadline (for companies' feedback): **Monday 2022-05-09 2000 UTC**
* Initial deadline (for rapporteur's summary in R2-2206194): Monday 2022-05-09 2200 UTC

# General corrections and clarifications

**Correction 1**: Unclear description on Active Time triggered by SR transmission

The following *condition* is introduced for the DRX Active Time triggered by SR transmission, as an enhancement to NTN:

* a Scheduling Request is sent on PUCCH and is pending (as described in clause 5.4.4 or 5.22.15). *If this Serving Cell is part of a non-terrestrial network, the Active Time is started after the first Scheduling Request transmission plus the UE-gNB RTT*; or

However, the term “first scheduling request transmission” used in 5.7 for DRX procedure is not clearly defined in the current MAC Spec, making the UE unable to judge what such “first SR transmission” actually refers to and unable to determine what the intended UE behaviour should be. For the DRX Active Time triggered by SR transmission in NTN, [15] notes the intention of the related agreement is to consider only the first SR transmission which is performed from the moment the first SR is triggered when there is no other pending SR, until all pending SR(s) are later cancelled.

Considering that there is the following text in 5.4.4 to describe the first SR triggered when there is no pending SR for a given SR configuration (e.g. after previous SR cancellation or for the very first SR triggering), such “first SR transmission” can be interpreted as “the SR transmission that is performed when the *SR\_COUNTER* of all the SR configurations with pending SR(s) is zero”.

*“If an SR is triggered and there are no other SRs pending corresponding to the same SR configuration, the MAC entity shall set the SR\_COUNTER of the corresponding SR configuration to 0.”*

Therefore, [15] proposes to change “the first SR transmission” to **i**n 5.7 DRX procedure to “the SR transmission that is performed when the SR\_COUNTER is 0 for all the SR configurations with pending SR(s)”.A corresponding text proposal for TS 38.321 is provided below:

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| 5.7 Discontinuous Reception (DRX)  …  When DRX is configured, the Active Time for Serving Cells in a DRX group includes the time while:  - *drx-onDurationTimer* or *drx-InactivityTimer* configured for the DRX group is running; or  - *drx-RetransmissionTimerDL*, *drx-RetransmissionTimerUL* or *drx-RetransmissionTimerSL* is running on any Serving Cell in the DRX group; or  - *ra-ContentionResolutionTimer* (as described in clause 5.1.5) or *msgB-ResponseWindow* (as described in clause 5.1.4a) is running; or  - a Scheduling Request is sent on PUCCH and is pending (as described in clause 5.4.4 or 5.22.15). If this Serving Cell is part of a non-terrestrial network, the Active Time is started after the Scheduling Request transmission that is performed when the *SR\_COUNTER* is 0 for all the SR configurations with pending SR(s) plus the UE-gNB RTT; or  - 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). |

**Correction 2:** Clarification on TA reporting when multiple TARs are triggered and pending at once

In the subclause “5.4.8 Timing Advance Reporting”, there could be more than one TAR triggered and pending at a given time. Based on the following procedural text, a MAC PDU shall contain at most one Timing Advance Report MAC CE:

*“A MAC PDU shall contain at most one Timing Advance Report MAC CE, even when multiple events have triggered a Timing Advance report.”*

In this case, the UE needs to generate TAR MAC CE based on the latest UE-gNB RTT value available. [15] proposes that this can be clarified via a NOTE in the TAR reporting procedure, similar to the NOTE that is captured already for the DRX procedure as follows in subclause 5.7. A corresponding text proposal for TS 38.321 is provided below:

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| 5.4.8 Timing Advance Reporting …  NOTE: UL-SCH resources are considered available if the MAC entity has been configured with, receives, or determines an uplink grant. If the MAC entity has determined at a given point in time that UL-SCH resources are available, this need not imply that UL-SCH resources are available for use at that point in time.  NOTE X: The TAR MAC CE is generated based on the latest UE-gNB RTT available. |

**Correction 3:** Clarification on Timing Advance report triggering

In subclause “5.4.8 Timing Advance Reporting”, the following text is captured to describe TAR triggering:

*“A Timing Advance report (TAR) may be triggered if any of the following events occur:”*

As noted in [16] and [17], The procedural text for TA report triggering in MAC spec is a required behaviour. Therefore, it is proposed in both [16] and [17] that the description: “A Timing Advance report (TAR) may be triggered if any of the following events occur” shall be updated to “A Timing Advance report (TAR) shall be triggered if any of the following events occur” A corresponding text proposal for TS 38.321 is provided below:

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| 5.4.8 Timing Advance Reporting …  A Timing Advance report (TAR) shall be triggered if any of the following events occur:  - if *ta-Report* is configured with value enabled, upon initiation of Random Access procedure due to initial access from RRC\_IDLE, RRC Connection Resume procedure from RRC\_INACTIVE, or RRC Connection Re-establishment procedure (see TS 38.331 [5]); |

**Correction 4:** Inclusion of UE-gNB RTT definition in RRC specification

The UE-gNB RTT is a widely used variable in MAC specification which can be reused in RRC specification to help setting the value of RTT timer. [14] therefore proposes that UE-gNB be added in the definition part of TS 38.331. A corresponding text proposal for TS 38.331 is provided below:

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| 3.1 Definitions …  **Uu Relay RLC channel**: An RLC channel between L2 U2N Relay UE and gNB, which is used to transport packets over Uu for L2 UE-to-Network relay**.**  **UE-gNB RTT:** For non-terrestrial networks, the sum of the UE's Timing Advance value (see TS 38.211 [16] clause 4.3.1) and *kmac* provided in *NTN-Config*.  **UE Inactive AS Context**: UE Inactive AS Context is stored when the connection is suspended and restored when the connection is resumed. It includes information as defined in clause 5.3.8.3. |

**Correction 5:** Reconfiguration of *offsetThresholdTA* to disable TA reporting

In subclause “5.4.8 Timing Advance Reporting”, the following TAR triggering condition is captured:

*- upon configuration or reconfiguration of offsetThresholdTA by upper layers, if the UE has not previously reported Timing Advance value to current Serving Cell;*

Like PHR, it is possible for NW to reconfigure UE to release the event triggered TA report. In such case there is no need to trigger TA report, so [18] proposes to capture that UE doesn’t trigger TA report if reconfigured to disable the TA report function (i.e., to release the *offsetThresholdTA*). A corresponding text proposal for TS 38.321 is provided below:

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| 5.4.8 Timing Advance Reporting  …  A Timing Advance report (TAR) may be triggered if any of the following events occur:  - if *ta-Report* is configured with value enabled, upon initiation of Random Access procedure due to initial access from RRC\_IDLE, RRC Connection Resume procedure from RRC\_INACTIVE, or RRC Connection Re-establishment procedure (see TS 38.331 [5]);  - if *ta-Report* with value enabled is indicated in the handover command, upon initiation of Random Access procedure due to reconfiguration with sync;  - upon configuration or reconfiguration of *offsetThresholdTA* by upper layers which is not used to disable the TA report function, if the UE has not previously reported Timing Advance value to current Serving Cell during this connection;  - if the variation between current information about Timing Advance and the last successfully reported information about Timing Advance is equal to or larger than *offsetThresholdTA*, if configured. |

**Correction 6:** Clarification of reference to RAN1 specifications in TAR triggering

In subclause “5.4.8 Timing Advance Reporting”, the following text is captured to describe TA reporting:

*The Timing Advance reporting procedure is used in a non-terrestrial network to provide the gNB with an estimate of the UE's Timing Advance value (i.e., T\_TA as defined in the UE's TA formula, see TS 38.211 [8] clause 4.3.1).*

There is no need to use the L1 spec notation in the MAC spec, it is sufficient to write out Timing Advance and have the reference. [8] therefore proposes the to remove “*T\_TA as defined in the UE's TA formula*” from the above description. A corresponding text proposal for TS 38.321 is provided below:

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| 5.4.8 Timing Advance Reporting The Timing Advance reporting procedure is used in a non-terrestrial network to provide the gNB with an estimate of the UE's Timing Advance value (see TS 38.211 [8] clause 4.3.1). |

**Correction 7:** Alignment of MAC and RRC on use of HARQ mode

There are several instanced where usage of “HARQ mode” in MAC spec is not consistent with other RRC fields. It is proposed in [19] that in several instances, the value shall be in italics to indicate it is a value of a RRC field. A corresponding text proposal for TS 38.321 is provided below:

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| 5.4.3.1 Logical Channel Prioritization …  - *allowedHARQ-mode* which sets the allowed *uplinkHARQ-mode* for transmission.  …  2> *allowedHARQ-mode*, if configured, includes the *uplinkHARQ-mode* for the HARQ process associated to the UL grant. |

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| 5.7 Discontinuous Reception (DRX) …  - *uplinkHARQ-Mode* (optional): the configuration to set *HARQmodeA* or *HARQmodeB* per UL HARQ process.  …  1> if a MAC PDU is transmitted in a configured uplink grant and LBT failure indication is not received from lower layers:  2> if this Serving Cell is not configured with *uplinkHARQ-Mode*; or  2> if the corresponding HARQ process in this Serving Cell is configured with *uplinkHARQ-Mode* equal to *HARQmodeA*:  …  2> if the PDCCH indicates a UL transmission:  3> if this Serving Cell is not configured with *uplinkHARQ-Mode*; or  3> if the corresponding HARQ process in this Serving Cell is configured with *uplinkHARQ-Mode* equal to *HARQmodeA*: |

**Correction 8:** Modelling of UE-gNB RTT

There is an inconsistent use of “UE-gNB RTT” in the spec, the usage has two different forms: 1) “the UE estimate of UE-gNB RTT”; and “the UE-gNB RTT”. As 3.1 has the exact definition of UE-gNB RTT, the usage “the UE estimate of UE-gNB RTT” is unnecessary. [19] therefore proposes that in 5.1.5, the two occurrences of “UE estimate of” are removed. A corresponding text proposal for TS 38.321 is provided below:

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| 5.1.5 Contention Resolution Once Msg3 is transmitted the MAC entity shall:  1> if Msg3 is transmitted on a non-terrestrial network:  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-gNB RTT.  …  1> if *ra-ContentionResolutionTimer* expires:  2> if Msg3 is transmitted on a non-terrestrial network and *ra-ContentionResolutionTimer* expires prior to the first symbol after the end of a Msg3 retransmission plus the UE-gNB RTT:  3> do not consider the Contention Resolution unsuccessful.  2> else:  3> discard the *TEMPORARY\_C-RNTI*;  3> consider the Contention Resolution not successful. |

**Question 1) If you object to one or more of the above text proposal(s), please: 1) Indicate which text proposal(s) is unacceptable; 2) Provide technical justification why the text proposal is unacceptable; and 3) Suggest an alternative acceptable wording (if available).**

**Note: If a company does not comment on a proposal, it is assumed to be agreeable.**

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| **Company** | **Comments** |
| ASUSTeK | For correction 2, the TAR MAC CE could be generated based on the latest “Timing Advance value” as the field description of the TAR MAC CE in subclause 6.1.3.56. The UE-gNB RTT is the sum of UE's TA and K\_mac. As mentioned in [15], the NOTE 1b in subclause 5.7 is for RTT compensation, but not for TA calculation. |
| CATT | For correction 1 and correction 5, it is unnecessary to introduce that corrections, the current text cannot make confusion. |
| vivo | Not sure about correction 6. We think current Spec is clearer in linking the TAR described here in the MAC spec to the related parameters in the PHY Spec, considering also that there is not only one timing advance parameter existing in TS 38.211 (e.g. T\_TA vs. N\_TA).  For correction 2, regarding ASUSTek’s comments, our intention is to clarify that the TA value is generated *based on* the latest UE-gNB RTT value, but did not say that the TA value is directly set to the UE-gNB RTT value itself. Referencing 5.7 merely means that a similar note for clarification is prefereed. If companies are cared about the specific wording, it is ok for us to reword it as “The TAR MAC CE is generated based on the Timing Advance value (see TS 38.211 [8], clause 4.3.1)”.  Correction 1 is needed, since in the current Spec, there is no other places using “first” w/o specifying from which moment the “first” is counted. We are open to other solutions, but doing nothing is not an option. |
| OPPO | Correction 6 is unacceptable.  Based on UE’s TA formula (i.e. 𝑇TA = (𝑁TA + 𝑁TA,offset + 𝑁TA,adj common + 𝑁TA,adj UE )𝑇c) defined in RAN1 spec, UE’s TA consists of multiple components. There may be different understandings for “an estimate of the UE's Timing Advance value”, e.g. it can be interpreted as UE’s full TA (i.e. 𝑇TA) or estimate of the service link’s TA (i.e. 𝑁TA). It would be not clear what “an estimate of the UE's Timing Advance value” refers to if we remove “*T\_TA as defined in the UE's TA formula*”. So we suggest to keep the description as it is. |
| ZTE | For correction 2, since UE only generate the TAR when there are UL resource available, therefore it is guaranteed that UE will report the latest TA.  For correction 5 we are the proponent, and we think the correction is needed. The intention is to clarify that if NW reconfigure to release the event triggered TA configuration UE doesn’t need to report the TAR which the same as we handle for event triggered PHR. Otherwise based on the procedure it is possible UE will compare current TA with previous reported TA to since there is no specified UE behavior on how/when UE stores/releases the previous reported TA. Also it is to clarify that the received configuration only valid for the same connection.  For correction 6, we share the same understanding as Oppo that it is necessary to keep the notation to indicate that UE reports full TA.. |
| Huawei, HiSilicon | Correction 5 is unnecessary. Actually, UE reporting TA upon reconfiguration of *offsetThresholdTA* will not happen from our perspective:   * If the UE has previously reported TA (e.g. during RACH), obviously UE will not report TA during reconfiguration; * If the UE has not previously reported TA (e.g. during RACH), UE will report TA during configuration of *offsetThresholdTA*. In this case, UE will not report TA during reconfiguration either.   Therefore, we suggest the following changes:  - upon configuration of *offsetThresholdTA* by upper layers, if the UE has not previously reported Timing Advance value to current Serving Cell during this connection; |
| Ericsson | Correction 4 is incorrect.  There is no need to take a timer in MAC that is set according to information that is available in MAC (and that is changing all the time) and hide it away in a field description in RRC or introduce RRC-MAC signalling to enable the RRC to update the timers at correct point in time. It may have been fine if UE-gNB RTT was not changing all the time. Further see question 6a below.  About correction 6, if not agreed, at least T\_TA shall be updated to “TTA“. |
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# Issues from RAN2#117e: Potentially agreeable aspects

## Configuration for Blind Msg3 retransmission

In RAN2#117e, it was agreed to support blind MSG3 retransmissions in NTN via procedural text, although details are still FFS. A main point from past offline discussion is whether explicit configuration is needed to support blind MSG3 retransmission.

*Support for configuration* [5]:

[5] states that under the current implementation, no matter whether blind Msg3 retransmission is used or not by network, UE shall keep PDCCH monitoring once *ra-ContentionResolutionTimer* is (re)started until the timer expires. This would lead to unnecessary UE power consumption if blind MSG3 retransmission is not used by the network. Introducing a configuration would allow for differentiate behaviour on whether blind scheduling for Msg3 retransmission is used by network.

*Do not support configuration* [6, 7]

Alternatively, [6] noted that blind MSG3 retransmission should always be possible for UE, and there is no extra benefit in making the solution over complex by introducing two configurable sub-solutions. This opinion is shared by [7], where it is stated that a configuration-based solution is over-optimized and would require additional specification effort to support.

**Question 2) Do you agree to introduce an explicit configuration to support blind Msg3 retransmission in NTN?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| ASUSTeK | Disagree | For simplification, we can follow current text style in spec. |
| CATT | Disagree | The current text in specification is enough. |
| vivo | Disagree | As long as the UE doesn’t consider CR unsuccessful if there is a Msg.3 Retx to restart the CR timer at its expiry, the UE will not terminate the on-going RA procedure unexpectedly. So, the resolution adopted by the current Spec (i.e. not considering CR unsuccessful in this case) has no real technical problem, and no other optimization is needed.  Regarding the Spec description, however, we’d propose to change related texts to a positive way of description, i.e. describing in which case the UE “shall consider CR unsuccessful”, instead of in which case the UE “shall not” do this as in the current Spec. This is more in line with how the Spec is usually written. |
| OPPO | Agree | UE behaviour should be different depending on whether blind scheduling for Msg3 retransmission is used by network.  If blind Msg3 retransmission is not configured, UE should stop ra-ContentionResolutionTimer upon receiving PDCCH indicating Msg3 retransmission and then start ra-ContentionResolutionTimer after the end of the Msg3 retransmission plus UE-gNB RTT. With this, not only unexpected expiry of ra-ContentionResolutionTimer could be avoided, but also it would be beneficial for UE power saving. |
| Lenovo | Disagree | We would like to keep it simple at this stage. |
| ZTE | Disagree | Prefer to support Msg3 blind retransmission without configuration to avoid different UE behavior.  Also in our contribution, it is proposed that the ra-ContentionResolutionTimer needs to be started after the end of initial Msg3 transmission since in legacy it is allowed NW to schedule blind retransmission after the end of initial Msg3 transmission there is no need to always wait additional UE-gNB RTT. |
| Xiaomi | Disagree | No need to support this optimization |
| Huawei, HiSilicon | Disagree | No need for extra configuration on MSG3 blind retransmission to UE. |
| Ericsson | Disagree | In legacy there is no configuration for blind retx, using explicit config for blind retx is just a waste of signalling and specification effort. |
| LG | Disagree | We do not see the benefit to introduce the explicit configuration for Msg3 retransmission. |
| Samsung | Disagree | As there is a simpler solution to make blind Msg3 retransmission always possible as legacy operation, explicit configuration is not needed and requires additional specification work. |
| Nokia | Disagree | From NW point of view, we think it is NW flexibility in scheduling to decide whether schedule blind Msg3 retransmissions (e.g., by DCIs) but there is no need to disable the feature in a semi-static way via RRC. |

## MSG3 repetition

In [8] it is noted that another Rel-17 WI has introduced support for MSG3 repetitions, captured in TS 38.321, section 5.1.5 as follows:

1> if Msg3 is transmitted on a non-terrestrial network:

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 if the Msg3 transmission (i.e. initial transmission or HARQ retransmission) is scheduled with Type A PUSCH repetition:

2> start or restart the *ra-ContentionResolutionTimer* in the first symbol after the end of all repetitions of the Msg3 transmission.

1> else:

2> start or restart the *ra-ContentionResolutionTimer* in the first symbol after the end of the Msg3 transmission.

Considering coverage can also be an issue in non-terrestrial networks, [8] proposes that this functionality also be supported for NTN UEs, as well as an accompanying TP to update the NTN part of the CRT handling in section 5.1.5 to support MSG3 repetition.

**Question 3) Do you agree the Msg3 repetition functionality introduced in Rel-17 shall also be supported in NTN?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| ASUSTeK | See comment | We are fine to support Msg3 repetition in NTN.  However, regarding the TP, the UE behavior should be inherited from Msg3 repetition and modified based on agreement from NTN (i.e. an offset to the start of the ra-ContentionResolutionTimer is introduced), such as below:  Once Msg3 is transmitted the MAC entity shall:  ~~1> if Msg3 is transmitted on a non-terrestrial network:~~  ~~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~~ if the Msg3 transmission (i.e. initial transmission or HARQ retransmission) is scheduled with Type A PUSCH repetition:  2> if Msg3 is transmitted on a non-terrestrial network:  3> start or restart the *ra-ContentionResolutionTimer* in the first symbol after the end of all repetitions of the Msg3 transmission plus the UE estimate of UE-gNB RTT.  2> else  3> ~~2>~~start or restart the *ra-ContentionResolutionTimer* in the first symbol after the end of all repetitions of the Msg3 transmission.  1> else:  2> if Msg3 is transmitted on a non-terrestrial network:  3> start or restart the *ra-ContentionResolutionTimer* in the first symbol after the end of the Msg3 transmission plus the UE estimate of UE-gNB RTT.  2> else  3> ~~2>~~ start or restart the *ra-ContentionResolutionTimer* in the first symbol after the end of the Msg3 transmission. |
| CATT | Disagree | The impact of Msg3 repetition functionality introduced in Rel-17 should be discussed in Rel-18 NTN. The impacts of Msg3 repetition introduced for NTN may not only involve RA procedure but also other procedures, we have no enough time to evaluate these one by one, thus we should postpone this discussion. |
| vivo | Disagree | NTN-specific coverage enhancement should be a topic that falls into the Rel-18 NTN enh. WI scope. To our knowledge, there have already been contributions submitted to RAN1 Rel-18 NTN enh. AI to evaluate the feasibility of such msg.3 repetition in NTN. It is therefore not possible to decide whether there’s technical problem in supporting this Rel-17 inter-WI feature, by simply reusing the Rel-17 CE design in NTN, within Rel-17. We propose to not support this inter-WI support in this release. |
| OPPO | Disagree | Coverage enhancement is out of scope in R17 NTN.  Suggest to consider it in R18 NTN. |
| Lenovo |  | We think it may be too late to have a good solution. We are OK to carefully consider enhancements to CE in Rel-18 |
| ZTE | Agree | Coverage enhancements are important for NTN. Considering Msg3 repetition selection is also based on RSRP comparison during RA initialization phase, the general procedure can be easily reused in NTN with small twist. For example, the same adaption for Msg3 blind retransmission can also be adopted in Msg3 repetition.  If Msg3 repetition is not agreeable in this release, then we need to update RRC specs to clarify that NW is not expected to configure this feature in NTN. |
| Xiaomi | See comment | We have sympathy for this proposal. As msg3 repetition has already been introduced in Rel-17, if we do not do anything for NTN, it is unclear about the meaning of “after the end of the Msg3 transmission”. Thus, at least some clarification is required, in the spec or chairman note. |
| Huawei, HiSilicon | Disagree | Suggest to postpone to R18. |
| Ericsson | Agree | Proponent.  There is only small change needed, and coverage is improved, seems like a no-brainer. |
| LG | Disagree | It can be discussed in Rel-18 |
| Samsung | Disagree with comment | Msg3 repetition is a new issue which has not been discussed. Considering limited time and WI is closed, we think this issue should be postponed and discussed in Rel-18 coverage enhancement. However we are also fine to support this functionality if this is majority view. |
| Nokia | Disagree | Agree with other companies, the topic can be further discussed in R18 NTN for further coverage enhancement. |

## UE behaviour upon validity timer expiry

The validity timer *ntn-UlSyncValidityDuration* is introduced in Rel-17 to support uplink synchronization in non-terrestrial networks. *ntn-UlSyncValidityDuration* is configured by the network, and indicates the maximum time during which the UE can apply satellite assistance information (i.e. Serving satellite ephemeris and Common TA parameters) without having acquired new assistance information. In NR, satellite assistance information is carried in SIB19. Current UE behaviour upon validity timer expiry is captured as a working assumption: “*Upon validity timer expiry, UE shall suspend uplink transmission and re-acquire SI, flushing HARQ buffers”*.

*Support for confirmation of working assumption* [9, 10, 12]

A main point of disagreement is whether to support flushing of HARQ buffers. As noted in [9, 10, 12] this is useful to avoid HARQ state mismatch, and a similar agreement has already been made in IoT NTN. Another concern is that the network doesn’t know whether UE’s validity timer is expired or not. However, [12] states if epoch time is explicitly provided network knows that the validity timer at UE side may expire at (epoch + validity duration). The network can confirm this assumption if a missing UL data transmission or UL HARQ feedback for DL data is detected close to validity timer expiry.

**Question 4) Do you agree to confirm the following RAN2 working assumption from RAN2#117e:**

***“Upon validity timer expiry, UE shall suspend uplink transmission and re-acquire SI, flushing HARQ buffers”***

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| **Company** | **Agree/Disagree** | **Additional comments** |
| ASUSTeK | Agree |  |
| CATT | Agree |  |
| vivo | Agree with comments | Considering the potential introduction of the validity timer(s) for the neighbour cells, this WA should be limited to the validity timer of the serving cell only (or, more specifically, Pcell, as NTN does not support CA in this release) |
| OPPO | Agree | We could align with IoT NTN. |
| Lenovo | Agree |  |
| ZTE | Agree with comments | Though flush HARQ buffer is not necessary in NR but considering the limited time it is simpler to confirm the WA to save time for more critical issues |
| Xiaomi | Agree |  |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Partly agree with comment | Formulation is not good, “re-acquire” insinuates that the UE reads the same information – while it needs to read a new SIB19 with updated ephemeris and common TA. Better to use “acquire”.  The ephemeris/common TA in SIB19 is likely updated as often as possible (to provide fresh info for UEs entering the system). If a UEs connection time is longer than the time between updates of ephemeris/common TA, the gNB do not know when the will UE start/restart the validity timer.  When validity expires, the UE cannot transmit in the UL and as gNB is not aware of this, gNB may schedule the UE wasting resources and increasing interference.  In NR NTN, the UEs can read SIBs in connected mode, it is a rare case that the UE fails to acquire the SIB19. If a UE did not succeeds acquiring SIB19 before validity timer expiry, the UE is also unlikely to succeed acquiring SIB19 after validity timer has expired.  Therefore, there is no need to spend time to optimize a solution for this when the UE can trigger RLF immediately instead.  Note that at RLF, UE does cell reselection (which is an advantage as the UE have proven problems receiving the SIB19 and may need to switch cell, thus we this may decrease the interruption time) and then acquire SIB19 to do RRC reestablishment where MAC is reset (which has the same effect as flushing HARQ buffers).  Thus, the spec impact is smaller triggering RLF and has the effect to acquire SIB19 and flush buffers, all spec change that is needed is informing lower layers that the UE is out of synch to suspend all UL transmissions.  Without RLF triggering, we risk lazy UE implementations, that do not actively try receive SIB19 before validity timer expires, causing system problems with UEs disappearing and not replying to assignments/grants which can become a huge issue with the long RTTs in NTN before the gNB can detect what has happened. |
| LG | Disagree | We do not see a case where the validity timer expires. Since the UE can identify when to expiry the validity timer, the UE always re-acquires the SIB before expiry by smart UE implementation. In addition, the radio link failure procedure would be triggered before expiring of the validity timer since the out-of-sync problem happens if the UE cannot re-acquire the SIB. If the radio link failure procedure is triggered, the MAC is reset and all the running timers shall be stopped. Thus, there is no reason to specify the UE behaviour at validity timer expiry.  If we need to specify the UE behaviour at the validity timer expiry, the RLF should be triggered. |
| Samsung | Agree with comment | Same view as ZTE. |
| Thales | Agree |  |
| Nokia | Disagree | We agree that upon validity timer expiry, UE shall suspend uplink transmission and re-acquire SI. However, it is not clear why HARQ buffer flushing is needed and what’s the expected UE behaviour. There are several aspects which may need further discussion.  1) In this discussion, NW and UE has no common understanding on validity timer expiry (i.e., NW does not exactly know when the timer is expired in UE). NW may continue scheduling the UE even the validity timer expired. However, if the timer expired, how UE will process the following dynamic grants and configured grants ? (e.g., will UE still build the TB for grants as 38.321 5.4.1?). If UE build the TBs for following grants, should UE always flush the buffer ?  2) As no common understanding on the validity timer status between UE and NW, flushing HARQ buffer cannot avoid HARQ state mismatch between UE and NW. We are wondering what’s the benefit if UE performs it autonomously while NW is unaware of that. The buffer flush will bring more uncertainty for NW scheduling.  3) What’s the assumption on the time interval between UE out of sync and UL sync-up recovery after reading new SIB ?  - if the time interval is very short, no buffer flushing is helpful to enable following retransmission scheduling.  - if the timer interval is quite long, then NW and UE should have common understanding on validity timer status to avoid UL resource waste due to blind NW scheduling. In this case, it is like TAT timer expiry which means buffer flush is possible. Hence, we propose the validity timer expiry should be handled with the similar rule as TAT timer expiry.  If companies do think the validity timer is a rare case for NR NTN, then we prefer not to specify any optimization (other than suspend uplink transmission and re-acquire SI) for this case. |

## Validity timer location and MAC/RRC interaction

Current RRC implementation in NR implies that *ntn-UlSyncValidityDuration* is maintained in MAC layer. However, *ntn-UlSyncValidityDuration* is controlled (e.g., started/restarted) by reception of SIB19, and upon expiry triggers re-acquisition of SIB. Furthermore, in RAN2#117e it has been agreed that UE behaviour upon validity timer expiry is covered in RRC. [10] notes the above would suggest the validity timer is better maintained at the RRC layer (as in IoT NTN) and proposes a new T3XX timer should be introduced and maintained in the NR RRC specification. A similar procedure is also proposed in [12].

**Question 5a) Do you agree a new T3XX timer is introduced in RRC specification with duration *ntn-UlSyncValidityDuration*. T3XX is started/restarted upon acquisition of SIB19. Upon T3XX expiry, the UE re-acquires SIB19.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| ASUSTeK | Agree |  |
| CATT | Agree with comments | We suggest achieving an agreement firstly as:  **a new T3XX timer is introduced in RRC specification with duration *ntn-UlSyncValidityDuration*.**  for the part of star or restarting, we think(the red part is added):  **T3XX is started/restarted with the duration *ntn-UlSyncValidityDuration* upon acquisition of SIB19 *from the subframe indicated by epoch time.***  And for the expiry case, only the connected UE who has not re-acquired a valid SIB19 successfully need to re-acquire SIB19,  **Upon T3XX expiry, the connected UE who has not re-acquired a valid SIB19 successfully should re-acquire~~s~~ SIB19.** |
| vivo | Agree with comments | Further discussion is needed on whether this should be applicable to the serving cell validity timer only, or is also applicable to neighbour cells’ validity timer(s). |
| OPPO | Agree |  |
| Lenovo | Agree | The T3XX shall be with a duration associated to at least the epoch time and validity duration of the serving cell ephemeris. |
| ZTE | Agree with comments | Agree to introduce new Timer T3XX in RCC.  In my understanding the proposal here is to clarify that we introduce the timer and maintained it in RRC instead of in MAC. While how to update the SIB19 and detailed UE behavior is discussed in another on-going discussion in [AT118-e][107][NTN] System information (Huawei) , therefore only first part of the proposal “**Do you agree a new T3XX timer is introduced in RRC specification with duration *ntn-UlSyncValidityDuration*.**” is needed to be confirmed here. |
| Xiaomi | Agree |  |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Partly agree with comments | 1) We support having a T3XX timer, similar to IoT NTN.  2) The T3XX shall be started at the epochTime indicated in the SIB19 where ephemeris/commonTA was received, not when the SIB19 is acquired.  Note that epochTime can be in the future (as always when implicit indication of epochTime, at the end of the SIB window where the SIB19 is received).  A reasonable assumption is that if the epochTime is in the future, then either 1) the UE can be considered to be in-synch from reception of ephemeris until *ntn-UlSyncValidityDuration* after the epochTime or 2) the UE can be considered to be in-synch *ntn-UlSyncValidityDuration* before and after the epochTime (In this case if the UE has an earlier received SIB19 with ephemeris/commonTA that is still valid, the RRC shall not indicate to lower layers that synch is lost when the new SIB is received).  3) When T3XX expires, the UE shall trigger RLF, see answer to question 4, which leads to acquiring SIB19.  4) The T3XX needs to be associated to a certain cell, otherwise we will have issues to restart T3XX at failed HO when source cell still has valid ephemeris/commonTA. |
| LG | Agree |  |
| Samsung | Agree |  |
| Thales | Agree |  |
| Nokia | Agree with comments | Agree with CATT for the rewording that the T3xx should be start/restarted at epoch time. |

As noted in [10] if the current WA is agreed, the suspension of UL transmission and flushing HARQ buffers upon validity timer expiry requires MAC-RRC interaction. It is proposed that (as in IoT case) RRC should inform lower layers (i.e., MAC) that UL synchronization is lost. Once SIB19 has been re-acquired, RRC should indicate to lower layers that UL synchronisation is restored.

**Question 5b) If ‘Agree’ to previous question, do you agree that upon T3XX expiry: 1) RRC indicates to lower layers that the** **UL synchronisation is lost; and 2) once SIB19 has been re-acquired RRC indicates to lower layers that the UL synchronisation is restored?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| ASUSTeK | Agree |  |
| CATT | Disagree | The RRC have no idea of whether the UL synchronisation is lost, therefore, the RRC should indicate to lower layer that T3XX expiry, lower to execute the corresponding behaviour. |
| vivo | Agree with comments | This can be applied to the validity timer of the serving cell. Further discussion is needed on what specific operation is needed upon the expiry of neighbour cell validity timer(s). |
| OPPO | Agree |  |
| Lenovo | See comments | We think RRC should indicate what has occurred, i.e. *ntn-UlSyncValidityDuration* expires. The lower layer may decide whether UL sync is lost based on the indication. |
| ZTE | Agree with comments | To make it more precise we can simply said indicating to lower layer that T3XX is expiry or is restarted.. |
| Xiaomi | agree |  |
| Huawei, HiSilicon | Agree |  |
| Ericsson | Disagree | At T3XX expiry, UE shall inform lower layers and trigger RLF.  When UE acquires SIB19, depending on the epochTime and timer values, the UE shall inform lower layers that it is in synch. No need to use the word “restored”, RRC just informs lower layers that it is in-synch. |
| LG | Disagree | We do not see a case where the validity timer expires. Since the UE can identify when to expiry the validity timer, the UE always re-acquires the SIB before expiry by smart UE implementation. |
| Samsung | Agree with comment | Agree with Lenovo and ZTE. Lower layer determines whether UL sync is lost or is restored. RRC only indicate timer status. |
| Thales | Agree |  |
| Nokia | Agree with comments | Similar view as ZTE |

## HARQ RTT Timer extension

As described in [14], to accommodate increased propagation delay in NTN RAN2 has agreed to extend *drx-HARQ-RTT-TimerDL/UL* by UE-gNB RTT when HARQ feedback is enabled/UL-HARQ-mode A is used. There has been some discussion on how to specify this behaviour, and in RAN2#117e it was agreed to capture the setting of corresponding DRX timer length in RRC specs with possible interaction in MAC specs.

[14] describes two options on how the HARQ RTT Timer extension may be implemented in TS 38.331:

*Option 1: Introduce procedural text*

Whether HARQ RTT timers apply legacy value or are extended by UE-gNB RTT depends on configuration of *downlinkHARQ-FeedbackDisabled* and *uplinkHARQ-Mode*. Procedural text capturing this behaviour was discussed in [Post117-e][101] and received wide support.

*Option 2: Change field description of drx-HARQ-RTT-TimerDL/UL*

Alternatively, [14] notes that considering the *drx-HARQ-RTT-TimerDL/UL* is configured in *DRX-Config*, a simple implementation is to clarify in the field description that UE set the value of *drx-HARQ-RTT-TimerDL/UL* to the value configured plus UE-gNB RTT. This would avoid discussing which subclause is a better place for HARQ RTT timer extension implementation.

**Question 6a) Please indicate your preferred option to capture HARQ RTT Timer extension in RRC specification:**

* **Option 1: Introduce procedural text**
* **Option 2: Change field description of *drx-HARQ-RTT-TimerDL/UL***
* **Option 3: Other, please describe**

|  |  |  |
| --- | --- | --- |
| **Company** | **Supported Option(s)** | **Additional comments** |
| CATT | Option 1 or option 2 |  |
| vivo | Option 2 preferred;  Option 1 acceptable |  |
| OPPO | Option 1 |  |
| Lenovo | Option 1 or Option 2 |  |
| ZTE | Either opt 1 or opt 2, but 2 is preferred |  |
| Xiaomi | See comment | We are not sure either option 1 or option 2 works, as it means that UE only set the RTT timer upon configuration. However, UE needs to set the timer every time upon timer restarts to use the latest UE-gNB RTT. But, if all other companies insist to capture it in RRC, the following text may be better:  *indicate MAC to extend the value of drx-HARQ-RTT-TimerDL by the latest UE-gNB RTT each time before starting the timer.*  If above text is considered not suitable, then perhaps we have to describe it in MAC. |
| Huawei, HiSilicon | Option 2 preferred, but | Fine with majority. |
| Ericsson | **We object to this question.**  **There is no RAN2 agreement to capture HARQ RTT Timer extensions in RRC.** | This is a particularly bad idea.  The RRC spec cannot extend the DRX timers because the values of the DRX HARQ RTT timers must be updated whenever they are started (if they are extended), and this starting occasion is not known in RRC, but it is known in MAC. The existing uplinkHARQ-mode and downlinkHARQ-FeedbackDisabled informs MAC on exactly what MAC shall do regarding extending HARQ RTT timers.  In principle MAC can inform RRC of the occasion to update the timer, but such a new method would set a bad precedence for RRC as this is a MAC issue and not an RRC issue. Further, it does not remove the ambiguity of if the UE can autonomously update RRC parameters as it feels like. It also entails  If captured in a field description, this does not work as the UE-gNB value changes all the time and thus in the field we can only indicate what shall be done for each HARQ process at (re)configuration (which is exactly what the existing uplinkHARQ-mode and downlinkHARQ-FeedbackDisabled does).  If captured in procedural text, this is a completely new type of behaviour to introduce in the RRC spec. Then MAC must indicate to higher layers that a timer is to be started, and RRC must then calculate the timer value to use and reply to lower layers. This type of integration of RRC and MAC on a scheduler time scale is unwanted and will greatly affect the UE implementations as RRC and MAC becomes mote dependent on each other. Note that it is already specified in uplinkHARQ-mode and downlinkHARQ-FeedbackDisabled if HARQ processes RTT timers shall be extended or not.  The simple solution is to have two helper variables in MAC instead.  First, the current NOTE 1b in the section 5.7 in MAC spec is misplaced:  When DRX is configured, the MAC entity shall:  1> if a MAC PDU is received in a configured downlink assignment:  2> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;  NOTE 1a: If Serving cell is configured with *downlinkHARQ-FeedbackDisabled* and DL HARQ feedback is disabled, *drx-HARQ-RTT-TimerDL* is not started for the corresponding HARQ process.  NOTE 1b: If this Serving Cell is part of a non-terrestrial network, the latest UE-gNB RTT value shall be used to set *drx-HARQ-RTT-TimerDL* and *drx-HARQ-RTT-TimerUL* length prior to timer start (see TS 38.331 [5] clause [X]).  2> stop the *drx-RetransmissionTimerDL* for the corresponding HARQ process.  The “NOTE 1b” is hidden under the “if a MAC PDU is received in a configured DL assignment:” and concerns both *drx-HARQ-RTT-TimerDL* and *drx-HARQ-RTT-TimerUL*, and the reference to RRC spec does not make sense. It must have been a mistake to include it in the MAC spec.  **Proposal 1 Remove the NOTE 1b in 5.7 of MAC spec.**  The only way to avoid ambiguity of the UE changing RRC configured parameters, we must introduce helper variables that are updated, according to the configuration at that moment and the current UE-gNB RTT value, in a separate section before the current “When DRX is configured, the MAC entity shall: …” section. This method was for example used for the *REPETITION\_NUMBER* in section 5.4.2.1 between Rel-15 and Rel-16. Any other updates to MAC will give ambiguity as to if the UE changes an RRC parameter or not.  **Proposal 2 Use two helper variables for the HARQ RTT timer extension.**  **Proposal 3 Consider adding the following text proposal just before “When DRX is configured, the MAC entity shall:” in 5.7 in MAC spec. After that line at every place exchange “*drx-HARQ-RTT-TimerDL*” for “*HARQ\_RTT\_TIMER\_DL*” and exchange “*drx-HARQ-RTT-TimerUL*” for “*HARQ\_RTT\_TIMER\_UL*”.**  The following UE timers 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 HARQ process to *drx-HARQ-RTT-TimerDL* plus UE-gNB RTT.  1> else:  2> set *HARQ\_RTT\_Timer\_DL* for the HARQ process to *drx-HARQ-RTT-TimerDL*.  1> if this Serving Cell is configured with *uplinkHARQ-Mode* and a HARQ process is configured with *HARQmodeA*:  2> set *HARQ\_RTT\_Timer\_UL* for the HARQ process to *drx-HARQ-RTT-TimerUL* plus UE-gNB RTT.  1> else:  2> set *HARQ\_RTT\_Timer\_UL* for the HARQ process to *drx-HARQ-RTT-TimerUL*.  NOTE X: In non-terrestrial networks, before the timer *HARQ\_RTT\_TIMER\_DL* or *HARQ\_RTT\_TIMER\_UL* is started, the value shall be set using the latest UE-gNB RTT value.  Note that the “else” parts above are needed in cases when the *downlinkHARQ-FeedbackDisabled* or *uplinkHARQ-Mode* are reconfigured. |
| LG | Option 2 |  |
| Samsung | Option 1 or 2 |  |
| Nokia | Option 2 is preferred. |  |

In [Post117-e][101], the procedural text proposal was captured in subclause “5.3.5.5.5 MAC entity configuration” and received wide support. Although, another option raised in discussion is to instead capture this text in “5.3.5.5.7 SpCell Configuration”.

**Question 6b) If you selected ‘Option 1’ in the previous question, please indicate the preferred subclause for procedural text:**

* **Option 1: 5.3.5.5.5 MAC entity configuration**
* **Option 2: 5.3.5.5.7 SpCell Configuration**
* **Option 3: Other, please describe**

|  |  |  |
| --- | --- | --- |
| **Company** | **Supported Option(s)** | **Additional comments** |
| CATT | Option 1 |  |
| vivo | Option 1 |  |
| OPPO | Option 1 |  |
| Lenovo | Option 1 |  |
| ZTE | Option 1 |  |
| Xiaomi | Option 1 |  |
| Ericsson | Disagree | The RRC would need to have indication from MAC that there is a need to update a parameter every time the RTT timers are to be started, further the timing advance value would be needed in RRC, and RRC then would need to indicate back a timer value every time. Unnecessary. |
| Samsung | Option 1 |  |
|  |  |  |
|  |  |  |

# Summary

<To be generated pending company input>

# Conclusions

<To be generated pending company input>

# References

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4. [R2-2205478](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_118-e/Docs/R2-2205478.zip): Further consideration on TA report MAC CE – Huawei, HiSilicon
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19. [R2-2205995](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_118-e/Docs/R2-2205995.zip): Other NR NTN user plane issues – Ericsson

# Annex: Issues from RAN2#117e postponed to Phase 2

## Timing Advance: Reporting during Random Access and SR

Topic 1: Clarification of trigger conditions in MAC specification [1, 3, 4]

From TS 38.321, a Timing Advance report (TAR) may be triggered if any of the following events occur:

*- if ta-Report is configured with value enabled, upon initiation of Random Access procedure due to initial access from RRC\_IDLE, RRC Connection Resume procedure from RRC\_INACTIVE, or RRC Connection Re-establishment procedure (see TS 38.331 [5]);*

*- if ta-Report with value enabled is indicated in the handover command, upon initiation of Random Access procedure due to reconfiguration with sync;*

*- upon configuration or reconfiguration of offsetThresholdTA by upper layers, if the UE has not previously reported Timing Advance value to current Serving Cell;*

*- if the variation between current information about Timing Advance and the last successfully reported information about Timing Advance is equal to or larger than offsetThresholdTA, if configured.*

[1] addresses the first two triggering conditions, noting it is usually assumed the specific RRC procedure which triggers RACH is invisible to the MAC entity. It is proposed that reference to specific RRC-based procedures be removed from MAC and instead specified in RRC. If the corresponding RRC procedures are initiated (e.g. initial access, connection resume), RRC indicates to MAC to trigger TAR procedure based on the *ta-Report* indicator in SIB/dedicated signalling.

[3] addresses the third triggering condition, noting that there will be some cases where the UE has no pre-reported TA value available for TA report triggering. For example, if the *offsetThresholdTA* is released by RRC after a previous (re)configuration and the UE releases the last reported TA value, upon subsequent configuration of *offsetThresholdTA* a TAR will not be triggered because the UE has already reported Timing Advance value to current Serving Cell. As a result, the UE will have no pre-reported TA value to use for TA triggering comparison, and TA reporting effectively disabled in RRC\_CONNECTED (as illustrated in Figure 2 from [3]). To resolve this issue, it is proposed that the third triggering condition be revised to “upon configuration or reconfiguration of *offsetThresholdTA* by upper layers, if the UE *has no available Timing Advance value previously reported* to current Serving Cell”.

[4] addresses the fourth triggering condition, noting that based on current description, UE should compare current TA with “last successfully reported TA”. However, the meaning of “last successfully reported information about Timing Advance” is ambiguous as UE may not be able to know whether a TA reporting is successful or not (especially when the TA report MAC CE is transmitted on a HARQ process configured with HARQ mode B). It is proposed that RAN2 clarify the meaning of “successfully reported information about Timing Advance” to avoid ambiguity and specifically how UE can determine a TA reporting is successful.

Topic 2: Clarification of SR configuration for TA report MAC CE reporting [2]

In RAN2#117e, it was agreed that the network may configure UE to trigger an SR if a Timing Advance report (TAR) is triggered and there are no available UL-SCH resources to accommodate the TA report MAC CE. Based on current implementation in TS 38.321, this is controlled by RRC via configuration of *timingAdvanceSR*:

However, it is noted in [2] that RAN2 has so far not discussed which SR configuration should be used by TA report MAC CE. If the UE is configured to trigger SR to report TA MAC CE to NW, UE should report TA to NW in time to avoid UL data transmission failure (and UL scheduling failure). To ensure this is the case, [2] proposes the following options (with a preference for Option 2 considering the late phase of Rel-17 and less specification impact):

***Option 1:*** *Explicit SR configuration for TAR MAC CE :*

* TA report MAC CE is mapped to one SR configuration.
* If the SR configuration is absent, UE should not trigger SR and RACH to report TA MAC CE.
* SR configuration presence/absence can be used by NW to configure UE to trigger an SR, hence parameter *timingAdvanceSR* is not needed.

***Option 2:*** *Implicit SR configuration for TAR MAC CE:*

* Reuse the parameter *timingAdvanceSR* to control whether UE should trigger SR for TA MAC CE
* SR configuration for LCH can be reused for TA MAC CE (e.g. the SR configuration of the highest priority LCH is used to transmit the SR triggered by TA MAC CE to make sure NW can schedule the UE in time for TA reporting).

## Contention Resolution Timer and MSG3 retransmission

The following modifications to *ra-ContentionResolutionTimer* operation in NTN are suggested in the selected contributions. Companies are encouraged to refer to the referenced contribution for exemplary text proposals.

[5] proposes that CRT operation be based on configuration, which is beneficial from a power-saving perspective if blind retransmission is not used. The following UE behaviour is proposed:

If blind Msg3 retransmission is not configured, 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.

* If blind Msg3 retransmission is configured, if *ra-ContentionResolutionTimer* expires after receiving PDCCH indicating Msg3 retransmission, the UE does not consider the Contention Resolution unsuccessful.

1. [6] proposes that instead of procedural text, there should instead be a NOTE that if *ra-ContentionResolutionTimer* expires during the UE-gNB RTT after Msg3 retransmission, the UE does not consider the Contention Resolution unsuccessful. This is because there is no extra benefit in making the solution over complex by introducing two configurable sub-solutions, and that according to previous agreement a solution not based on configuration should be captured as a NOTE in specs (which is not currently the case).
2. [7] notes that to support blind Msg3 retransmission, the *ra-ContentionResolutionTimer* should not be stopped upon receiving PDCCH indicating Msg3 retransmission since the UE is not able to monitor PDCCH for blind Msg3 retransmission. Instead, *ra-ContentionResolutionTimer* should run longer for the UE to monitor PDCCH. It is proposed that this be captured as follows:

* the *ra-ContentionResolutionTimer* is started or restarted after the end of the Msg3 retransmission plus UE-gNB RTT.
* When the *ra-ContentionResolutionTimer* expires, the UE does not consider the contention resolution not successful if the *ra-ContentionResolutionTimer* has been scheduled to be started/restarted after the *ra-ContentionResolutionTimer* expires.

1. [8] proposes two modifications to current text in 5.1.5 to enable blind MSG3 retransmissions:

* In the part on (re)starting CRT in NTN, the UE must start the CRT also for the first transmission of MSG3.
* In the part about CRT expiry, it states to not consider the Contention Resolution as unsuccessful if CRT expires before “the first symbol after the end of a Msg3 retransmission plus the UE-gNB RTT” because in that case, the CRT will be restarted later (it will be restarted “in the first symbol after the end of the Msg3 transmission plus the UE estimate of UE-gNB RTT”). However, it says after a MSG3 retransmission, and with the change above, CRT is started also for the first MSG3 transmission It is proposed this be changed to apply for all MSG3 transmissions.

## Validity timer

Topic 1: Additional behaviour upon validity timer expiry

*Triggering of RACH procedure* [10, 13]

Another contentious issue is whether UE triggers RACH upon validity timer expiry (which was ultimately not included in WA). Justification for triggering RACH is that it informs network that the UE has regained UL synchronization and allows refinement of the UE-estimated UE-gNB RTT (via RAR). However, [10] mentions that validity timer expiry should be rare in NR, and a complex solution avoided. Similarly, [13] mentions that unless there is uplink data arrival, it is not necessary for UE to trigger RA procedure.

*Do not specify anything* [11]

Alternatively, [11] notes that RAN2 has concluded UE will re-acquire the NTN assistance information before validity timer expiry, so there would be no case that the validity timer expires except if UE does not receive the SIB before expiry of the validity timer due to the bad radio conditions. Since this case may already be handled by the radio link failure procedure, [11] proposes RAN2 do not need to specify any UE behaviour regarding validity timer expiry.

Topic 2: Other issues regarding SIB19 acquisition [9, 12, 13]

*Search space configuration for SIB-19 acquisition* [9]

RAN2 has agreed that upon validity timer expiry UE shall re-acquire serving satellite ephemeris data and common TA parameters from SIB19. However, in NR a UE may not be configured with *searchSpaceSIB1* or *searchSpaceOtherSystemInformation* on the active BWP. In this case [9] proposes UE switch to *initialDownlinkBWP* to re-acquire SIB19 and then return to the previous active BWP.

[9] also mentions RAN2 should discuss the case when UE is not configured with *searchSpaceSIB1* or *searchSpaceOtherSystemInformation* on the active BWP and attempts SIB19 acquisition prior to validity timer expiry. If a BWP switch to re-acquire SIB19 is allowed the consequence would be the same as that when UE re-acquires SIB19 after validity timer expiry (i.e. in both cases, UE would be unreachable since the UE switches to *initialDownlinkBWP* until it returns back, which is unknown to network).

*Stop vs. Suspending validity timer if UE acquires SIB19 prior to timer expiry* [12]

As mentioned in [12], it is unclear whether UE stops or suspends UL validity timer if UE acquires the new SIB19 before timer expiry. [12] notes that based on RAN1 discussion, the epoch time can be indicated to a future time. In this case, if UE acquires the new SIB19 and does not restart the validity timer, it will expire before UE can apply the new SIB19. There will be a gap between the expiry of the timer and the epoch time in the new SIB19, which result in UL interruption during the gap.

If epoch time is implicitly indicated, epoch time will be started at the end of SI window, which means that there will be maximum *si-WindowLength* time gap between the reception of SIB19 and the start of epoch time. If validity timer is expired during *si-WindowLength*, there will be UL interruption. It is therefore proposed in [12] to stop the validity timer upon reception of SIB19.

*Application time of updated parameters* [12, 13]

[12] also notes it also unclear whether UE applies the parameter immediately or until epoch time. It is proposed that if epoch time indicates a past time, UE applies it immediately; if epoch time indicates a future time, since the gap between UE receiving SIB19 and the epoch time might be long, early application of parameters may result in inaccurate TA pre-compensation. It is noted however that this is common understanding, no spec change is needed. A similar issue is raised in [13], where it is proposed that whether the UE shall apply the content of newly acquired SIB19 or use the former (still valid) parameters is up to UE implementation.