**3GPP TSG-RAN WG2 Meeting #116bis electronicR2-2201656**

**Online, January 17th – January 25th, 2022**

**Agenda Item: 8.10.2.1**

**Source: OPPO**

**Title: Summary of 8.10.2.1 RACH aspects (OPPO)**

**Document for: Discussion and Decision**

# Introduction

This document is to summarize the contributions submitted to AI 8.10.2.1.

# Discussion

## 2.1 TA reporting

**Content of TA reporting**

RAN2 has agreed that the content of UE specific TA pre-compensation reported using MAC CE is UE specific TA, and has also received RAN1 LS on TA reporting after RAN1#106bis e-meeting. The definition of UE’s TA is provided to RAN2 as below, and based on the LS, it is up to RAN2 to decide which component or what combination of the components in the UE’s TA formula to use in TA reporting.

|  |
| --- |
| Agreement:The Timing Advance applied by an NR NTN UE in RRC\_IDLE/INACTIVE and RRC\_CONNECTED is given by:$$T\_{TA}=\left(N\_{TA}+N\_{TA, UE-specific}+N\_{TA,common}+N\_{TA,offset}\right)×T\_{c}$$Where:* $N\_{TA}$ is defined as 0 for PRACH and updated based on TA Command field in msg2/msgB and MAC CE TA command.
	+ FFS: details of NTA update/accumulation.
* $N\_{TA, UE-specific}$  is UE self-estimated TA to pre-compensate for the service link delay.
* $N\_{TA,common}$ is network-controlled common TA, and may include any timing offset considered necessary by the network.
* $N\_{TA,common}$ with value of 0 is supported.
	+ FFS:  details of signaling including granularity.
* $N\_{TA,offset}$ is a fixed offset used to calculate the timing advance.

Agreement:The granularity of the reported TA is slot.* FFS how to round TA value to slot level granularity
 |

In RAN1#107e meeting, RAN1 made the following further agreements for the details of the TA value:

|  |
| --- |
| Agreement15 kHz is used as the reference subcarrier spacing value for the unit of TA reported in FR1.AgreementThe reported TA is the least integer number of slots greater than or equal to the corresponding TA value. |

Relevant RAN2 proposals on the content of TA reporting are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [1]R2-2200214 | Proposal 1: the content of TA report MAC CE is UE specific differential delay, i.e., [T\_TA – minimum TA] / [slot time] rounded down to closest integer. Minimum TA is broadcast in system information, and the default value is 477.48 ms for GEO and 8ms for LEO. | Intel Corporation |
| [2]R2-2200243 | Proposal 1: Include UE’s full TA (i.e. TTA) in TA Report MAC CE. | OPPO |
| [3]R2-2200270 | Proposal 1: For idle/inactive or connected mode, the content of TA report MAC CE is TTA – Koffset. | Xiaomi |
| [4]R2-2200347 | Proposal 1: the content of TA reporting during RACH is UE specific TA (i.e. NTA, UE-specific×Tc) defined in the UE’s TA formula in the granularity of slot. | Huawei, HiSilicon |
| [5]R2-2200377 | Proposal 1: The content of UE specific TA reporting is full TA (i.e., TTA as defined in the UE’s TA formula). | vivo |
| [6]R2-2200520 | Proposal 1: The content of TA report is UE’s service link TA (option 2). | China Telecom |
| [8]R2-2200688 | Proposal 1: The content of TA report is the UE’s service link TA (i.e., NTA, UE-specific as defined in the UE’s TA formula). | CATT |
| [11]R2-2200764 | Proposal 1: The TA reporting in Msg3 or Msg5 via MAC CE is the UE’s service link TA or UE’s service link propagation delay.Proposal 2: The TA reporting in connected mode via MAC CE is the UE’s service link TA, or UE’s service link propagation delay, or the difference value compared to the last reporting. | Lenovo, Motorola Mobility |
| [13]R2-2201007 | Proposal 9: For UE-specific TA pre-compensation reporting, the reporting content is full TA. | Nokia, Nokia Shanghai Bell |
| [14]R2-2201034 | Proposal 3: If UE specific TA reporting during RACH procedure is enabled by SI, UE reports UE specific TA pre-compensation, i.e. $N\_{TA, UE-specific}$, in TA reporting MAC CE.Proposal 4: For connected mode, UE reports UE specific TA pre-compensation, i.e. $N\_{TA, UE-specific}$, in TA reporting MAC CE.  | Samsung Research America |
| [15]R2-2201164 | Proposal 1: TA report content during RACH is the UE’s service link TA (i.e., N\_TA, UE-specific as defined in the UE’s TA formula). | InterDigital |
| [16]R2-2201193 | Proposal 1: Option 1 (full TA) is preferable to Option 2 (UE service link TA).Proposal 2: Option 1 (full TA) is preferable to Option 4 (difference between full TA and the cell-specific Koffset).Proposal 3: The UE reports full TA in Connected mode. | NEC Telecom MODUS Ltd. |
| [17]R2-2201324 | Proposal 1: UE reports full TA in TA report if configured by NW and the report unit is ms. | ZTE Corporation, Sanechips |
| [18]R2-2201363 | Proposal 2. The UE reports the UE specific TA in MAC CE for TA pre-compensation. | LG Electronics Inc. |
| [19]R2-2201630 | Proposal 4: When information about the UE specific TA pre-compensation is reported in a MAC CE, the reporting quantity is the [cell-specific-Koffset – TTA]/[slot length] rounded down to closest integer and where all quantities are expressed in the same unit of time, for example seconds. | Ericsson |

In summary, the following options are proposed by companies:

* Option 1: Full TA (i.e., $T\_{TA}$ as defined in the UE’s TA formula) [2][5][13][16][17]
* Option 2: UE’s service link TA (i.e., NTA, UE-specific or NTA, UE-specific×Tc as defined in the UE’s TA formula) [4][6] [8][11][14][15][18]
* Option 3: The difference between full TA and the cell-specific Koffset (i.e., [Cell-specific-Koffset \* 10-3 – $T\_{TA}$] / [slot time] rounded down to closest integer, or vice versa) [3][19]
* Option 4: The difference between full TA and minimum TA, i.e., [$T\_{TA}$ – minimum TA] / [slot time] rounded down to closest integer, where the minimum TA is broadcast in system information, and the default value is 477.48 ms for GEO and 8ms for LEO. [1]
* Option 5: For RRC connected mode, the difference value compared to the last reporting. [11]

For Option 1, it is stated in [2] and [13] that it is simple and straightforward for network to configure UE-specific K-offset. For Option 2, it is stated in [8] and [14] that in the equation for calculating $T\_{TA}$, only NTA, UE-specific is estimated by UE itself, the rest of components of the equation are all known to NW. Therefore, only the NTA, UE-specific is the useful information for network. However, it is stated in [2] and [5] that since the common TA may change over time, the common TA used by network to derive UE’s full TA may differ from the actual common TA pre-compensated by the UE, which makes it even more difficult for network to derive UE’s full TA. For Option 3, it is the difference between TTA and the cell-specific Koffset, and it is proposed by [3] and [19] given that it would limit the range of values that need to be reported in the TA report by using that. Option 4 is similar to Option 3. Option 5 is mainly for RRC connected mode, which aims to reducing overhead or increasing accuracy.

Based on split views from companies, rapporteur makes the following proposal:

1. (to discuss) RAN2 to discuss the following options on the content of TA reporting：
* **Option 1: Full TA (i.e.,** $T\_{TA}$ **as defined in the UE’s TA formula)**
* **Option 2: UE’s service link TA (i.e., NTA, UE-specific or NTA, UE-specific×Tc as defined in the UE’s TA formula)**
* **Option 3: The difference between full TA and the cell-specific Koffset (i.e., [Cell-specific-Koffset \* 10-3 –** $T\_{TA}$**] / [slot time] rounded down to closest integer, or** **vice****versa****)**
* **Option 4: The difference between full TA and minimum TA (i.e., [**$T\_{TA}$ **– minimum TA] / [slot time] rounded down to closest integer)**
* **Option 5: For RRC connected mode, the difference value compared to the last reporting.**

**TA report MAC CE design**

Relevant RAN2 proposals on TA report MAC CE design are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [1]R2-2200214 | Proposal 2: if P1 is agreed, the TA report MAC CE consists of a single field with 8 bits length. | Intel Corporation |
| [5]R2-2200377 | Proposal 2: TA reporting MAC CE has a fixed size and consists of two octets. | vivo |
| [17]R2-2201324 | Proposal 2: RAN2 to discuss and select between alt2 or alt3 as given below for TA report MAC CE design. | ZTE Corporation, Sanechips |
| [19]R2-2201630 | Proposal 5 The new MAC CE format for TA reporting during random access uses one field of fixed 8 bits size. | Ericsson |

All the proposals above are related to the size of TA report MAC CE. Rapporteur understands the TA report MAC CE size depends on the value range of the reported TA, meanwhile which content is used for TA reporting also depends on the targeted MAC CE size. As these two issues are coupled, rapporteur suggests to discuss together.

1. (to discuss) RAN2 to discuss the size of TA report MAC CE together with the content of TA reporting.

**Logical channel priority of TA report MAC CE**

As RAN2 has agreed to use MAC CE for TA report, the logical channel priority of TA report MAC CE should be defined. Based on TS38.321, the current logical channel priority is given as below.

|  |
| --- |
| Logical channels shall be prioritised in accordance with the following order (highest priority listed first):- C-RNTI MAC CE or data from UL-CCCH;- Configured Grant Confirmation MAC CE or BFR MAC CE or Multiple Entry Configured Grant Confirmation MAC CE;- Sidelink Configured Grant Confirmation MAC CE;- LBT failure MAC CE;- MAC CE for SL-BSR prioritized according to clause 5.22.1.6;- MAC CE for BSR, with exception of BSR included for padding;- Single Entry PHR MAC CE or Multiple Entry PHR MAC CE;- MAC CE for the number of Desired Guard Symbols;- MAC CE for Pre-emptive BSR;- MAC CE for SL-BSR, with exception of SL-BSR prioritized according to clause 5.22.1.6 and SL-BSR included for padding;- data from any Logical Channel, except data from UL-CCCH;- MAC CE for Recommended bit rate query;- MAC CE for BSR included for padding;- MAC CE for SL-BSR included for padding. |

In RAN2#116e meeting, RAN2 discussed the logical channel priority of TA report MAC CE and made the following agreements.

Agreements:

1. Logical channel priority of the TA report MAC CE should be lower than that of “C-RNTI MAC CE or data from UL-CCCH” and higher than that of “data from any Logical Channel, except data from UL-CCCH”.
2. RAN2 further discuss the exact priority of the TA report MAC CE between “C-RNTI MAC CE or data from UL-CCCH” and “MAC CE for BSR, with exception of BSR included for padding.

Relevant RAN2 proposals on logical channel priority of the TA report MAC CE are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [1]R2-2200214 | Proposal 3: the priority of the TA report MAC CE is right above “MAC CE for BSR, with exception of BSR included for padding.” | Intel Corporation |
| [2]R2-2200243 | Proposal 4: Logical channel priority of the TA report MAC CE is lower than LBT failure MAC CE and higher than MAC CE for SL-BSR prioritized.  | OPPO |
| [3]R2-2200270 | Proposal 2: The logical channel priority of TA report MAC CE is higher than MAC CE for BSR, with exception of BSR included for padding. | Xiaomi |
| [4]R2-2200347 | Proposal 2: The priority of TA report MAC CE should be lower than the LBT failure MAC CE and higher than the the MAC CE for SL-BSR.  | Huawei, HiSilicon |
| [5]R2-2200377 | Proposal 3: The priority of TA reporting MAC CE is higher than CG confirmation MAC CE. | vivo |
| [7]R2-2200627 | Proposal 3: In LCP, the priority of TA report is between LBT failure MAC CE and MAC CE for SL-BSR. | Spreadtrum Communications |
| [8]R2-2200688 | Proposal 3: Logical channel priority of the TA report MAC CE should be lower than that of “LBT failure MAC CE” and higher than that of “MAC CE for SL-BSR prioritized according to clause 5.22.1.6”. | CATT |
| [13]R2-2201007 | Proposal 10: The priority of new UE-specific TA Report MAC CE should be below CG confirmation/BFR MAC CE but above MAC CE for SL-BSR prioritized. | Nokia, Nokia Shanghai Bell |
| [14]R2-2201034 | Proposal 1: The priority of TA reporting MAC CE is higher than BSR MAC CE, i.e. MAC CE for SL-BSR prioritized according to clause 5.22.1.6 and MAC CE for BSR, with exception of BSR included for padding.Proposal 2: The priority of TA reporting MAC CE is at least lower than BFR MAC CE. | Samsung Research America |
| [15]R2-2201164 | Proposal 2: Priority of new UE-specific TA MAC CE is at least lower than BFR MAC CE, and higher than “data from any Logical Channel”. | InterDigital |
| [18]R2-2201363 | Proposal 1. The priority of MAC CE for TA reporting should be between C-RNTI MAC CE or data from UL-CCCH and Configured Grant Confirmation MAC CE. | LG Electronics Inc. |
| [19]R2-2201630 | Proposal 3: The priority of the new MAC CE in the prioritization list in the MAC spec section 5.4.3.1.3 shall be lower than “Configured Grant Confirmation MAC CE or BFR MAC CE or Multiple Entry Configured Grant Confirmation MAC CE” and higher than “Sidelink Configured Grant Confirmation MAC CE”.Proposal 8: RAN2 to discuss the case a TBS can fit all data if a new TA report MAC CE is not included, whether the UE shall then not send the new TA report MAC CE. | Ericsson |

Regarding the exact priority of the TA report MAC CE between “C-RNTI MAC CE or data from UL-CCCH” and “MAC CE for BSR, with exception of BSR included for padding, the following options were proposed by companies:

* Option 1: right above “MAC CE for BSR, with exception of BSR included for padding.” [1]
* Option 2: lower than LBT failure MAC CE and higher than MAC CE for SL-BSR prioritized. [2] [4][7][8]
* Option 3: higher than MAC CE for BSR, with exception of BSR included for padding. [3]
* Option 4: higher than CG confirmation MAC CE. [5] [18]
* Option 5: below CG confirmation/BFR MAC CE but above MAC CE for SL-BSR prioritized. [13] [14][19]
* Option 6: lower than BFR MAC CE, and higher than “data from any Logical Channel”. [15]

Based on split views from companies, rapporteur makes the following proposal:

1. (to discuss) RAN2 to discuss the exact priority of the TA report MAC CE among the following options：
* **Option 1: right above “MAC CE for BSR, with exception of BSR included for padding.”**
* **Option 2: lower than LBT failure MAC CE and higher than MAC CE for SL-BSR prioritized.**
* **Option 3: higher than MAC CE for BSR, with exception of BSR included for padding.**
* **Option 4: higher than CG confirmation MAC CE.**
* **Option 5: below CG confirmation/BFR MAC CE but above MAC CE for SL-BSR prioritized.**
* **Option 6: lower than BFR MAC CE, and higher than “data from any Logical Channel”.**

**TA reporting during connected mode RACH**

In RAN2#115-e meeting, following agreement has been made.

|  |
| --- |
| RAN2#115-e agreement:1. UE specific TA reporting during RACH procedure is enabled/disabled by SI (FFS for RACH in connected mode)
 |

Regarding TA reporting during RACH in connected mode, following proposals were brought up by companies:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [2]R2-2200243 | Proposal 3: TA reporting during RACH in connected mode should not be controlled by the enable/disable indication configured in SI, but should depend on whether a TA update event is triggered. | OPPO |
| [3]R2-2200270 | Proposal 3: In connected mode, TA report MAC CE can be sent during RACH (i.e. in MsgA/Msg3/Msg5) if it is triggered based on the trigger condition configuration, regardless of the enable/disable configuration of TA report during RACH in SI. | Xiaomi |
| [4]R2-2200347 | Proposal 5. No specs change is needed for TA reporting during RACH in connected mode (i.e legacy behaviour applies). [Rapporteur’s comments]: Based on the statements in [4], rapporteur assumes the intention of this proposal is aligned with Option2. | Huawei, HiSilicon |
| [5]R2-2200377 | Proposal 4: Except handover procedure, TA reporting during RACH in connected mode should not be controlled by the enable/disable indication configured in SI.Proposal 5: For an RRC\_CONNECTED UE, UE specific TA is reported during the RACH triggered due to the following events:* RRC Connection Re-establishment procedure;
* DL or UL data arrival during RRC\_CONNECTED when UL synchronisation status is "non-synchronised";
* SR failure;
* Request by RRC upon synchronous reconfiguration (e.g. handover);
* RRC Connection Resume procedure from RRC\_INACTIVE;
* CBRA due to beam failure recovery for SpCell.

[Rapporteur’s comments]: Rapporteur wonders whether the intention of this P5 is that for RACH triggered by these events TA should be reported during RACH regardless of the enable/disable configuration of TA report during RACH in SI. If yes, P5 seems to conflict with P4. Besides, rapporteur understands that RACH during RRC connected mode does not include the case of RACH triggered by RRC Connection Resume procedure from RRC\_INACTIVE. | vivo |
| [7]R2-2200627 | Proposal 2: UE in connect mode does not report UE specific TA value in RA procedure.[Rapporteur’s comments]: Based on the statements in [7], rapporteur assumes the intention of this proposal is aligned with Option2. | Spreadtrum Communications |
| [8]R2-2200688 | Proposal 2: Information about UE specific TA pre-compensation is reported in RA procedure triggered due to “UL synchronisation status is “non-synchronised”” in connected mode. | CATT |
| [9]R2-2200746 | Proposal 1: The “UE specific TA report during RA procedure” is triggered by RA procedure for connecting to a cell from RRC idle/inactive mode or in RRC connected mode (i.e., RA procedure triggered due to initial access from RRC idle mode, RRC connection resume, RRC connection re-establishment and handover).Proposal 2: Event-triggering TA report via RA procedure in connected mode is not controlled by the enable/disable indication configured in SI. | ASUSTeK |
| [13]R2-2201007 | Proposal 15: UE specific TA reporting for RACH in RRC Connected mode should be enabled/disabled by SI, and the TA reporting update should be triggered by TA update event. | Nokia, Nokia Shanghai |
| [18]R2-2201363 | Proposal 3. The TA reporting in CONNECTED is not controlled by the enable/disable indication configured in SI.[Rapporteur’s comments]: Based on the statements in [18], rapporteur assumes the intention of this proposal is aligned with Option2. | LG Electronics Inc. |

In summary, on the issue whether TA reporting during RACH in connected mode should be controlled by the enable/disable indication configured in SI, the following options were proposed by companies:

* Option 1: Yes, and also depends on whether a TA update event is triggered or not. [13]
* Option 2: No, it depends on whether a TA update event is triggered or not [2] [3] ([4]) [7][18]
* Option 3: No, it depends on which event triggers RACH procedure [5] [8] [9]

Based on split views from companies, rapporteur makes the following proposal:

1. (to discuss) RAN2 to discuss whether TA reporting during RACH in connected mode should be controlled by the enable/disable indication configured in SI among the following options：
* **Option 1: Yes, and also depends on whether a TA update event is triggered or not.**
* **Option 2: No, it depends on whether a TA update event is triggered or not**
* **Option 3: No, it depends on which event triggers RACH procedure**

**Event trigger for TA reporting**

In RAN2#115e meeting, RAN2 has agreed to introduce event-triggered TA reporting for RRC connected UEs. More specifically, for a UE in RRC connected, a TA offset threshold is used for event-triggered TA reporting. If the difference between current UE specific TA and the last successfully reported UE specific TA exceeds the offset threshold, UE triggers a TA reporting.

Relevant proposals on more detials on the event triggered TA reporting are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [2]R2-2200243 | Proposal 2: Upon receiving configuration or reconfiguration of UE-specific TA reporting, if the UE has not reported TA before, the UE triggers a TA reporting. | OPPO |
| [3]R2-2200270 | Proposal 5: Do not introduce additional parameters, e.g. hysteresis and time to trigger, to define the trigger event for TA reporting. | Xiaomi |
| [13]R2-2201007 | Proposal 11: To enable event-triggered UE specific TA reporting, network should configure a TA change threshold via RRC.Proposal 12: For UE specific TA pre-compensation reporting, if the UE detects the TA change between current UE-estimated TA and the last successfully reported TA is larger than network configured threshold, the UE should send the latest UE-estimated TA to the NW. | Nokia, Nokia Shanghai Bell |
| [19]R2-2201630 | Proposal 6 The quantity used by the UE to trigger TA reports is Qta = [Koffset – TTA] expressed in seconds, where Koffset is the cell-specific-TA (or UE-specific-TA if configured) and TTA is the full TA.Proposal 7 The UE may be configured with two thresholds to trigger TA reports based on Qta. ThDown triggers a TA report if Qta < ThDown. ThUp triggers a TA report if Qta > ThUp. | Ericsson |

For the issue how the UE triggers the first TA reporting for event triggered TA reporting, in [2], it is proposed that the UE triggers a TA reporting upon reception of configuration or reconfiguration of TA reporting trigger event and if the UE has not reported TA before. Given this is raised by only one company, rapporteur makes the following proposal:

1. (to discuss) RAN2 to discuss whether the UE triggers a TA reporting upon reception of configuration or reconfiguration of TA reporting trigger event and if the UE has not reported TA before.

RAN2 has agreed to adopt TA offset threshold based event trigger for TA report, and it is FFS whether additional parameters, e.g. hysteresis and time to trigger, are needed similar to other events. In [3], it is stated that the logic for introducing such parameters is to avoid false TA reported due to jitter of TA change. However, it will introduce additional delay for reporting TA, so it thinks no additional parameters, e.g. hysteresis and time to trigger, are needed for the trigger event for TA reporting. In [19], it presents different view, and proposes to introduce two thresholds (i.e. ThDown and ThUp) to trigger TA report in order to avoid frequent TA report. Based on above, rapporteur makes the following proposal:

1. (to discuss) RAN2 to discuss whether to use a single TA offset threshold or introduce additional parameters (e.g. hysteresis and time to trigger, or another offset threshold) for event triggered TA reporting.

**Other trigger condition of TA reporting in connected mode**

In addition to event-triggered TA reporting, whether to introduce other trigger conditions of TA reporting (e.g. NW requested TA reporting, periodical TA reporting) in RRC connected mode was discussed in previous RAN2 meeting, but has made no conclusion.

Relevant proposals on trigger condition of TA reporting in connected mode are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [3]R2-2200270 | Proposal 6: Periodic TA report and network request based TA report is not supported in this release. | Xiaomi |
| [4]R2-2200347 | Proposal 7. In connected mode, no other trigger than event trigger is supported for TA reporting. | Huawei, HiSilicon |
| [6]R2-2200520 | Proposal 2: Event-triggered TA reporting is enough and no other methods are introduced. | China Telecom |
| [8]R2-2200688 | Proposal 4: Periodically triggering the UE-specific TA reporting should be supported and can be configured by network in NR NTN. | CATT |
| [13]R2-2201007 | Proposal 7: When UE in RRC Connected mode, the feature switch on TA reporting enable/disable should be controlled by NW.Proposal 8: UE specific TA reporting for UE in RRC Connected mode is enabled/disabled by SI. | Nokia, Nokia Shanghai Bell  |
| [15]R2-2201164 | Proposal 4: Periodic reporting of UE specific TA is not supported in Rel-17.Proposal 5: Aperiodic reporting of UE specific TA is not supported in Rel-17.Proposal 6: Additional triggering events other than a TA offset threshold are not supported in Rel-17. | InterDigital |
| [19]R2-2201630 | Proposal 9: The gNB can request the UE to report TA in connected mode. |  Ericsson |

In summary, the following views are provided by companies:

* Option 1: Periodical TA reporting. [8]
* Option 2: NW requested TA reporting [19]
* Option 3: TA reporting for UE in RRC Connected mode is enabled/disabled by SI [13]
* Option 4: None [3] [4] [6] [15]

For Option 1, it is stated that in [8] that periodically triggering UE-specific TA reporting is beneficial for real-time TA tracking and most useful for earth-fixed cell scenario.

For option 2, it is stated in [19] that in some use cases there is no need for all UEs to send TA reports during RACH, instead the gNB shall be allowed to request the UE to report the TA for the UEs that fulfil criteria where TA reporting is useful or when the cell load allows.

For Option 3, it is stated in [13] that it is NW’s implementation to decide whether to enable UE to report the TA information considering the potential delay reduction gain and the side effects. Instead of using “implicit” flag to enable/disable UE-specific TA reporting for UE in RRC Connected mode, we believe using the flag in SI is clean and simple, not only for NW design but also for UE implementation.

For option 4, all the supporter think that event triggered TA reporting is enough and see no need to introduce other methods.

Given that the majority of companies does not support to introduce other trigger conditions for TA reporting in RRC connected mode, rapporteur makes the following proposal:

1. (to discuss) Other than event-triggered TA reporting, no more triggers are introduced for TA reporting in connected mode.

**Whether TA reporting can trigger SR/RACH?**

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [2]R2-2200243 | Proposal 5: SR can be triggered if TA reporting has been triggered but there is no available UL-SCH resources, or if the UL-SCH resources cannot accommodate the TA report MAC CE plus its subheader as a result of LCP.Proposal 6: TA report MAC CE can be mapped to one SR configuration, which is configured by RRC using a new parameter, e.g. schedulingRequestID-TA-Report-r17. | OPPO |
| [3]R2-2200270 | Proposal 4: TA report MAC CE can trigger SR/RACH procedure. | Xiaomi |
| [4]R2-2200347 | Proposal 4: If UL resource is not available for TA report in connected mode, UE triggers an SR if SR is configured or triggers RACH if SR is not configured. | Huawei, HiSilicon |
| [5]R2-2200377 | Proposal 6: SR/RACH is triggered when TA reporting has been triggered but there is no available UL-SCH resources for TA reporting. | vivo |
| [18]R2-2201363 | Proposal 4. SR/RACH procedure should be triggered when TA reporting has been triggered and there is no available UL-SCH resources for TA reporting.Proposal 5. The dedicated RA preamble is allocated for the TA reporting. | LG Electronics Inc. |

As all the 5 companies above propose that TA reporting can trigger SR/RACH when there is no available UL-SCH resources for TA report MAC CE, rapporteur makes the following proposal:

1. (easy) SR/RACH should be triggered when TA reporting has been triggered but there is no available UL-SCH resources for TA reporting.

In [18], it is stated that due to the long RTT (up to 544.75ms) in NTN, the network would take a long time to get the changed UE specific TA. In order to align the TA between network and UE as soon as possible, it is proposed the dedicated RA preamble is allocated for the TA reporting. In this way, the network knows which the UE wants to report the TA right after receiving the RA preamble, so that the latency for TA reporting would be reduced.

Given this is raised by only one company, rapporteur makes the following proposal:

1. (to discuss) RAN2 to discuss whether to support allocating dedicated RA preamble for the RACH procedure triggered by TA reporting.

**Impact of TA reporting on timeAlignmentTimer**

The timeAlignmentTimer is used for the maintenance of UL time alignment, which controls how long the MAC entity considers the Serving Cells belonging to the associated TAG to be uplink time aligned. For NTN, UE’s TA is not only controlled by network via Timing Advance Command. The issue on whether the timeAlignmentTimer should be started or restarted after UE reports its TA was discussed in RAN2#116e meeting, but has made no conclusion.

Relevant proposals are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [3]R2-2200270 | Proposal 7: timeAlignmentTimer is not restarted after UE reports its TA. | Xiaomi |
| [4]R2-2200347 | Proposal 8: UE starts or restarts the *timeAlignmentTimer* after TA is reported to the gNB. | Huawei, HiSilicon |
| [5]R2-2200377 | Proposal 7: The *timeAlignmentTimer* is not started/restarted after UE reports its TA. | vivo |
| [7]R2-2200627 | Proposal 5: UE does not start or restart the timeAlignmentTimer after UE reports its TA. | Spreadtrum Communications |

3 out of 4 companies above propose that the *timeAlignmentTimer* is not started/restarted after UE reports its TA. In [3], it is stated that no matter UE report TA or not, the error of the TA part for network adjustment will accumulate. This kind of fine adjustment by gNB can not be well compensated by UE itself. If UE restarts the TAT timer, UE will falsely consider UL synchronized but actually it is not. It is also stated in [5] that the MAC PDU carrying TA MAC CE may suffer from multiple retransmissions. If UE starts or restarts the *timeAlignmentTimer* after UE reports its TA, there’ll be misalignment between the UE and NW on the understanding of the actual starting point of *timeAlignmentTimer*, which may impact the subsequent scheduling.

On the other hand, one company holds the different view. In [4], it is argued the concern that TA reporting is not accurate enough for UL synchronization is actually not an issue that prevents restarting the timeAlignmentTimer. Because the gNB can send TA command MAC CE to UE as soon as TA report is received. If timeAlignmentTimer is not started or restarted after TA reporting, the timeAlignmentTimer may run out shortly after TA is reported which will lead to unnecessary UL resource release and RACH initiation. In this case, restarting the timeAlignmentTimer can avoid this to happen as TA report can be seen as some kind of pre UL-synchronization.

Given majority views, rapporteur makes the following proposal:

1. (to discuss) Do not start or restart the timeAlignmentTimer after UE reports its TA.

**Reporting location information for TA reporting purpose**

For TA reporting purpose, RAN2-115e agreed NW can configure UE to send either UE-specific TA pre-compensation or the UE location if the UE can report its location to NW. However, the working assumption should be confirmed by SA3. RAN2 has sent multiple liaison statements concerning UE location reporting and use those were mainly targeting SA3 and the intention was to verify if the user consent shall be given prior to any reporting of UE’s location.

|  |
| --- |
| RAN2-115 meeting agreement:1. Under the work assumption "the UE location information can be reported in connected mode", for TA reporting purposes in connected mode, the network can configure the UE to send either the UE specific TA pre-compensation (for the details of the TA value, confirmation from RAN1 is needed) or the UE location information |

After RAN2#116e meeting, we have received SA3 reply LS [20], in which the following information is provided on NTN specific user consent.

|  |
| --- |
| Depending on the local jurisdiction and its regulations, NTN specific user consent may be needed before gNB can configure the UE to report the UE location information. SA3 is currently introducing new requirements to TS 33.501 for user consent handling. Although such requirements are generic, they may need to be complemented in order to cover the different use cases, such as, in this context, the handling of user consent for UE location information for NTNs. SA3 has not yet studied how this user consent handling can be used specifically for the NTN use case. |

Relevant proposals on UE location based TA reporting are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [2]R2-2200243 | Proposal 7: If the gNB has NTN specific user consent to obtain UE location, the UE location information can be reported for TA reporting purposes in connected modeProposal 8: If the content of TA reporting is UE location information, reuse the TA-based trigger condition, i.e. when TA change between current UE-estimated TA and the last successfully reported TA (corresponding to the last successfully reported UE location) is larger than the network configured threshold. | OPPO |
| [3]R2-2200270 | Proposal 10: RAN2 to progress with UE location report for TA pre-compensation purpose (and may deprioritize issues related to UE location report for LCS), and send LS to SA3 to ask: 1. Whether “location information derived at the network side is considered as more reliable” is only related to A-GNSS measurement for core network reselection. If the answer is yes, whether SA3 has any concern on UE location report for TA pre-compensation purpose.
2. Whether UE location report for TA pre-compensation purpose requires separate user consent as for core network reselection purpose.

Proposal 11: For TA report using RRC, reuse existing signalling method(potential enhancement are not precluded) i.e., by configuring includeCommonLocationInfo in the corresponding reportConfig.Proposal 12: RAN2 to confirm that MR is used to report the location information for TA pre-compensation purpose, and measurement results are always included in the MR as legacy.Proposal 13: It is up to network implementation to decide to configure reportType in reportConfigure to either periodical or eventTriggered for location report for TA pre-compensation purpose, i.e. no specification modification is needed.Proposal 14: if the content of TA reporting is UE location, location-based trigger condition is introduced, i.e. when the distance change between current UE location and the last successfully reported UE location is larger than network configured threshold.Proposal 15: Do not introduce additional parameters, e.g. hysteresis and time to trigger, to define the trigger event for location report for TA pre-compensation purpose.Proposal 16: Do not support concurrent configuration of report of UE location and UE specific TA for TA pre-compensation purpose.Proposal 17: If location information (either finer or coarse location) is included in the report, all the triggers for location report for any purpose (e.g. for SON/MDT or NTN TA report) should be cancelled.Proposal 18: If location information (either finer or coarse location) is reported, the comparison of location change for TA pre-compensation purpose should be compared with the location at the time of this location report.Proposal 19: If location information (either finer or coarse location) is included in the report, an indication of whether the location is finer or coarse location is needed.Proposal 20: If location information (either finer or coarse location) is included in the report for SON/MDT, UE needs to cancel the triggered TA report for TA pre-compensation purpose.Proposal 21: If location information (either finer or coarse location) is reported, the comparison of TA change should be compared with the TA at the time of this location report.Proposal 22: The location information for NTN TA report purpose only considers GNSS coordinates.Proposal 23: if the gNB has user consent to obtain UE location for NTN TA report purpose, reporting of finer location information/full GNSS coordinates in RRC\_CONNECTED can be supported after AS security is enabled.Proposal 24: When UE needs to report UE location for TA report purpose, UE acquires location information to report if location information is not available.Proposal 25: If gNB has no user consent for NTN TA report purpose, coarse GNSS coordinates can be reported for TA pre-compensation purpose. Need to send LS to SA3 to ask if there is privacy issue.Proposal 26: Network indicate UE whether to report finer or coarse GNSS location information when configuring UE to report location information for TA pre-compensation purpose.Proposal 27: RAN2 to discuss the accuracy of coarse GNSS coordinates, whether to define fixed accuracy such as 2km or the accuracy is configurable.Proposal 28: When UE needs to report UE location for TA report purpose, UE acquires location information to report if GNSS location information is not available. | Xiaomi |
| [4]R2-2200347 | Proposal 6. In connected mode, reporting UE location information as TA report is not supported.  | Huawei, HiSilicon |
| [6]R2-2200520 | Proposal 3: Either UE specific TA information or UE location be reported to NW for TA compensation and no need for both in parallel. | China Telecom |
| [13]R2-2201007 | Proposal 4: RAN2 to confirm the working assumption that, the UE location information can be reported in connected mode if the AS security is established and the NTN specific user consent is stored in the gNB.Proposal 5: For TA reporting purposes in connected mode, the network can configure the UE to send either the UE specific TA pre-compensation or the UE location information if the AS security is established and the NTN specific user consent is stored in the gNB.Proposal 6: There is no need to report UE location and the UE specific TA information in parallel.Proposal 13: For UE location information update, reuse the same TA change threshold which is defined for UE-specific TA pre-compensation reporting.Proposal 14: For UE location information update, if the UE detects that the TA deviation between TA estimation based on current UE location and the TA estimation based on last successfully reported UE location is larger than network configured threshold, the UE should send a location update to the NW. | Nokia, Nokia Shanghai Bell |
| [14]R2-2201034 | Proposal 5: In case UE location information can be reported to network, RRCReconfiguration message is used to configure UE to report either the UE location or the UE specific TA information for the purpose of TA reporting in connected mode. | Samsung Research America |
| [15]R2-2201164 | Proposal 7: In case UE location information can be reported to network, a UE may be configured to report either the UE location or the UE specific TA information for the purpose of TA reporting in connected mode. | InterDigital |
| [16]R2-2201193 | Proposal 4: It is up to network whether TA reporting can be configured in parallel with location reporting (i.e., no specification restriction). | NEC Telecom MODUS Ltd. |
| [17]R2-2201324 | Proposal 3: For pre-compensation information report purpose, discussion of UE location report is deprioritized in this release. | ZTE Corporation, Sanechips |
| [19]R2-2201630 | Proposal 10 If the information about UE specific TA pre-compensation in connected mode is the UE position, then the event triggered report of information about the UE specific TA pre-compensation can be the same as in Proposal 6 and Proposal 7 but the reported quantity can be the UE location. | Ericsson |

Companies hold different views on whether to support reporting UE location information for TA reporting purpose. In [2] and [13], it is suggested that if the gNB has NTN specific user consent to obtain UE location, the UE location information can be reported for TA reporting purposes in connected mode. While in [4] and [17], it is proposed not to support UE location based TA reporting. Given this, rapporteur makes the following proposal:

1. (to discuss) RAN2 to decide whether to support UE reporting location information for TA reporting purpose in connected mode.

If UE reporting location information for TA reporting purpose in connected mode can be agreed, the next issue is how to define the trigger condition for that. Based on companies’ input, the following options are proposed:

* Option 1: Reuse the TA-based trigger condition, i.e. when TA change between current UE-estimated TA and the last successfully reported TA (corresponding to the last successfully reported UE location) is larger than the network configured threshold. [2] [13]
* Option 1a: Reuse the TA-based trigger condition, where separate thresholds ThUp and ThDown are used. [19]
* Option 2: Introduce location-based trigger condition, i.e. when the distance change between current UE location and the last successfully reported UE location is larger than network configured threshold. [3]

Based on above, rapporteur makes the following proposal:

1. (to discuss) If reporting UE location information for TA reporting purpose in connected mode is agreed, RAN2 to discuss the following trigger conditions:
	* + - **Option 1: Reuse the TA-based trigger condition**
			- **Option 2: Introduce location-based trigger condition**

If UE reporting location information for TA reporting purpose in connected mode can be agreed, another issue RAN2 should address is whether UE can be configured to report both the UE location and the UE specific TA information for the purpose of TA reporting in connected mode. In [6] [13] [14] and [15], it is proposed that a UE may be configured to report either the UE location or the UE specific TA information, and there is no need to report both at the same time. While in [16], it is suggested not to introduce such specification restriction.

Based on above, rapporteur makes the following proposal:

1. (to discuss) If reporting UE location information for TA reporting purpose in connected mode is agreed, RAN2 to discuss whether UE can be configured to report both the UE location and the UE specific TA information or only report either one.

For other detailed proposals related to location information reporting, no summary is given here. Rapporteur assumes that they can be further discussed after RAN2 formally agrees to support location information reporting.

**SIB broadcasting for NTN parameters**

In [12], it is proposed to include the ephemeris, K\_mac, common TA and cell-specific Koffset in the new SIB. In [7], it is proposed to broadcast the network enable/disable TA report via SIB1. Rapporteur assumes all NTN specific parameters are broadcasted in the new SIB. Companies can share views during the offline discussion phase.

1. (to discuss) RAN2 to discuss how to broadcast following NTN specific parameters, e.g. ephemeris, K\_mac, common TA, cell-specific Koffset, network enable/disable TA report, etc.

## 2.2 UE-specific K\_offset

In the last RAN1 meetings, RAN1 discussed how to configure UE-specific K\_offset, and has reached the following agreements.

RAN1#106e:

|  |
| --- |
| Agreement: * The UE-specific K\_offset can be provided and updated by network with MAC CE.
 |

RAN1#107e:

|  |
| --- |
| **Agreement**For determining UE specific K\_offset * Option 2: MAC CE provides a differential UE specific K\_offset value. The full UE specific K\_offset value equals the cell specific K\_offset value minus the differential UE specific K\_offset value.
	+ FFS: whether/how to resolve ambiguity of which cell-specific K\_offset value to use during the SIB modification period

**Agreement**The value range of the differential UE specific K\_offset provided in MAC CE is 0 – 63 ms. |

Based on the agreements above, MAC CE is used for UE-specific K\_offset configuration. It should be RAN2 to design the new K\_offset MAC CE.

Relevant proposals on the UE specific Koffset MAC CE are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [2]R2-2200243 | Proposal 9: The size of K\_offset MAC CE is fixed to 1 byte. | OPPO |
| [19]R2-2201630 | Proposal 11 RAN2 to discuss the UE specific Koffset MAC CE name and whether it uses an LCID or eLCID. | Ericsson |

It is stated in [2] that since RAN1 has agreed that the value range of the differential UE specific K\_offset provided in MAC CE is 0 – 63 ms, with 1ms step size, 6 bits are needed for the UE specific K\_offset configuration. Therefore, it is proposed that the size of new K\_offset MAC CE can be fixed to 1 byte.

Based on above, rapporteur makes the following proposal:

1. (to discuss) The size of MAC CE for UE-specific K\_offset configuration is fixed to 1 byte. FFS on the MAC CE name and whether it uses a LCID or eLCID.

## 2.3 UL synchronisation

In previous RAN1 meetings, RAN1 discussed validity time for NTN assistance information (i.e. serving satellite ephemeris data or common TA parameters), and has agreed to introduce an epoch time together with a validity timer for NTN assistance information, where the validity timer indicates the maximum time during which the UE can apply the satellite ephemeris and common TA for TA pre-compensation without re-acquiring new NTN assistance information. UE starts or restarts the validity timer at the epoch time of the NTN assistance information, and the UE assumes that it has lost uplink synchronization if the validity timer expires.

Relevant proposals on UL synchronisation recovery are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [2]R2-2200243 | Proposal 10: UE may re-acquire new NTN assistance information before the validity timer expires, if the UE is provided with common search space including searchSpaceSIB1 and searchSpaceOtherSystemInformation on the active BWP. The exact time for the UE to re-acquire new NTN assistance information is up to UE implementation.Proposal 11: Upon expiry of the validity timer, the UE should flush all HARQ buffers and release all resource configuration including PUCCH, SRS, CG, SPS, etc.Proposal 12: Upon expiry of the validity timer, UE needs to firstly acquire the serving satellite ephemeris data and common TA parameters from SIB, and then trigger a RACH to recover UL synchronization.Proposal 13: 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. | OPPO |
| [19]R2-2201630 | Proposal 12 If the UL synchronization timer expires, the UE stop all uplink transmissions and triggers RLF.Proposal 13 If the UE fails to acquire an accurate UE location to be used in the calculation of the full TA, the UE stop all uplink transmissions and trigger RLF. |  Ericsson |

In summary, the following options for UL synchronisation recovery due to validity time expiry are brought by companies:

* Option 1: Upon expiry of the validity timer, UE flushes all HARQ buffers and release all resource configuration, and UE needs to firstly acquire the serving satellite ephemeris data and common TA parameters from SIB, before trigger a RACH to recover UL synchronization. [2]
* Option 2: If the UL synchronization timer expires, the UE stop all uplink transmissions and triggers RLF. [19]

For option 1, it is stated in [2] that similar to the legacy UL out of synchronization caused by the expiry of TAT, UL out of synchronization caused by the expiry of validity timer leads to the infeasible UL transmission. Therefore, a straight way to recovery UL synchronization is to firstly acquire the serving satellite ephemeris data and common TA parameters from SIB, and then trigger a RACH.

For option 2, it is stated in [2] that if the UE fails to reacquire synchronisation before this validity timer expires, all configured resources needs to be dropped and the higher layers need to be informed of the event, that is to trigger an RLF.

Given this, rapporteur makes the following proposal:

1. (to discuss) RAN2 to discuss how UE recovers from UL synchronization failure due to the validity timer expiry among the following options:
* Option 1: UE flushes all HARQ buffers and releases all resource configuration, re-acquires the SIB and triggers RACH procedure to recover from UL synchronization loss failure.
* Option 2: UE triggers RLF.

The issue on UL out of synchronization caused by unavailable UE location for TA pre-compensation is raised in [19]. It is stated that when the UE fails to acquire the GNSS fix for the UE location to be used in the full TA calculation, the UE must refrain from making any UL transmissions, and trigger RLF.

However, rapporteur understands this issue may only be valid for IoT NTN where IoT devices could not acquire the GNSS fix during RRC connected mode and not so relevant for NR NTN. Of course, companies can share views during the offline discussion phase.. Therefore, rapporteur makes the following proposal:

1. (to discuss) RAN2 to discuss whether the UE should stop all uplink transmissions and trigger RLF if the UE fails to acquire an accurate UE location to be used in the calculation of the full TA.

Other detailed proposals in [2] can be further discussed after RAN2 makes conclusion on proposal 16.

## 2.4 handling of contention resolution timer

The issue of restarting ra-ContentionResolutionTimer with RTT offset was discussed offline in RAN2#116e meeting but has made no conclusion.

Relevant proposals on handling of contention resolution timer are listed below:

|  |  |  |
| --- | --- | --- |
| Tdoc No. | Relevant Proposals | Source |
| [2]R2-2200243 | Proposal 14: The UE stops ra-ContentionResolutionTimer once receiving PDCCH which schedules Msg3 retransmission and then starts ra-ContentionResolutionTimer after the end of the Msg3 retransmission plus UE-gNB RTT. | OPPO |
| [3]R2-2200270 | Proposal 9: Ignore the expiry of ra-ContentionResolutionTimer during the delay of the restart of the ra-ContentionResolutionTimer by UE-gNB RTT. | Xiaomi |
| [4]R2-2200347 | Proposal 3: UE should stop ra-ContentionResolutionTimer once having received PDCCH which schedules Msg3 retransmission and then start ra-ContentionResolutionTimer after the end of the Msg3 retransmission plus UE-gNB RTT. | Huawei, HiSilicon |
| [10]R2-2200747 | Proposal 1: RAN2 discuss which of the following options is adopted for the concerned issue:* Option 1: 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.
* Option 2: If ra-ContentionResolutionTimer expires during the UE-gNB RTT after Msg3 retransmission, the UE does not consider the Contention Resolution not successful.
 | ASUSTeK |
| [13]R2-2201007 | Proposal 1: Blind scheduling for MSG3 retransmission should be possible for NTN.Proposal 2: To handle the case Contention Resolution timer expired during UE-gNB RTT to wait for the next Contention Resolution timer restart, the UE should only consider the Contention Resolution failure if the timer expires and there is no MSG3 has been transmitted after the start of the ra-ContentionResolutionTimer.Proposal 3: To avoid unintended Contention Resolution failure declaration, RAN2 could take the proposed text into account . | Nokia, Nokia Shanghai Bell |

Base on above, the following options are proposed by companies:

* Option 1: UE stops ra-ContentionResolutionTimer upon receiving PDCCH for Msg3 retransmission and start the timer after Msg3 retransmission plus UE-gNB RTT. [2] [4]
* Option 2: If ra-ContentionResolutionTimer expires during the UE-gNB RTT after Msg3 retransmission, the UE does not consider the Contention Resolution not successful. [3] [13]

For option 1, the ra-ContentionResolutionTimer would not unexpectedly expire in the case of Msg3 retransmission with this solution. Another benefit brought by this solution is power saving since the UE could reduce PDCCH monitoring. The main concern of the opponent is that blind scheduling of Msg3 retransmissions would not be possible.

For option 2, blind scheduling for MSG3 retransmission should be possible for NTN with this solution [3] [13], which may reduce the RACH delay. Howerever, it is argued in [2] that RAN2 has agreed to delay the start of ra-ContentionResolutionTimer by the UE-gNB RTT, during this UE-gNB RTT, UE is not required to monitor PDCCH, which means blind scheduling of Msg3 retransmissions is not expected from UE. This logic should apply for both the first Msg3 retransmissions and the subsequent Msg3 retransmissions, otherwise (i.e. if blind scheduling for subsequent Msg3 retransmissions is expected), UE should restart ra-ContentionResolutionTimer immediately after each Msg3 retransmission rather than waiting for a UE-gNB RTT.

Given split views from companies, rapporteur makes the following proposal:

1. (to discuss) RAN2 to discuss the issue of ra-ContentionResolutionTimer between the following options:
* Option 1: 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.
* Option 2: If ra-ContentionResolutionTimer expires during the UE-gNB RTT after Msg3 retransmission, the UE does not consider the Contention Resolution not successful.

# 3. Conclusion

Based on the summary above, following proposals are given:

1. (to discuss) RAN2 to discuss the following options on the content of TA reporting：
* **Option 1: Full TA (i.e.,** $T\_{TA}$ **as defined in the UE’s TA formula)**
* **Option 2: UE’s service link TA (i.e., NTA, UE-specific or NTA, UE-specific×Tc as defined in the UE’s TA formula)**
* **Option 3: The difference between full TA and the cell-specific Koffset (i.e., [Cell-specific-Koffset \* 10-3 –** $T\_{TA}$**] / [slot time] rounded down to closest integer, or** **vice****versa****)**
* **Option 4: The difference between full TA and minimum TA (i.e., [**$T\_{TA}$ **– minimum TA] / [slot time] rounded down to closest integer)**
* **Option 5: For RRC connected mode, the difference value compared to the last reporting.**
1. (to discuss) RAN2 to discuss the size of TA report MAC CE together with the content of TA reporting.
2. (to discuss) RAN2 to discuss the exact priority of the TA report MAC CE among the following options：
* **Option 1: right above “MAC CE for BSR, with exception of BSR included for padding.”**
* **Option 2: lower than LBT failure MAC CE and higher than MAC CE for SL-BSR prioritized.**
* **Option 3: higher than MAC CE for BSR, with exception of BSR included for padding.**
* **Option 4: higher than CG confirmation MAC CE.**
* **Option 5: below CG confirmation/BFR MAC CE but above MAC CE for SL-BSR prioritized.**
* **Option 6: lower than BFR MAC CE, and higher than “data from any Logical Channel”.**
1. (to discuss) RAN2 to discuss whether TA reporting during RACH in connected mode should be controlled by the enable/disable indication configured in SI among the following options：
* **Option 1: Yes, and also depends on whether a TA update event is triggered or not.**
* **Option 2: No, it depends on whether a TA update event is triggered or not**
* **Option 3: No, it depends on which event triggers RACH procedure**
1. (to discuss) RAN2 to discuss whether the UE triggers a TA reporting upon reception of configuration or reconfiguration of TA reporting trigger event and if the UE has not reported TA before.
2. (to discuss) RAN2 to discuss whether to use a single TA offset threshold or introduce additional parameters (e.g. hysteresis and time to trigger, or another offset threshold) for event triggered TA reporting.
3. (to discuss) Other than event-triggered TA reporting, no more triggers are introduced for TA reporting in connected mode.
4. (easy) SR/RACH should be triggered when TA reporting has been triggered but there is no available UL-SCH resources for TA reporting.
5. (to discuss) RAN2 to discuss whether to support allocating dedicated RA preamble for the RACH procedure triggered by TA reporting.
6. (to discuss) Do not start or restart the timeAlignmentTimer after UE reports its TA.
7. (to discuss) RAN2 to decide whether to support UE reporting location information for TA reporting purpose in connected mode.
8. (to discuss) If reporting UE location information for TA reporting purpose in connected mode is agreed, RAN2 to discuss the following trigger conditions:
	* + - **Option 1: Reuse the TA-based trigger condition**
			- **Option 2: Introduce location-based trigger condition**
9. (to discuss) If reporting UE location information for TA reporting purpose in connected mode is agreed, RAN2 to discuss whether UE can be configured to report both the UE location and the UE specific TA information or only report either one.
10. (to discuss) RAN2 to discuss how to broadcast following NTN specific parameters, e.g. ephemeris, K\_mac, common TA, cell-specific Koffset, network enable/disable TA report, etc.
11. (to discuss) The size of MAC CE for UE-specific K\_offset configuration is fixed to 1 byte. FFS on the MAC CE name and whether it uses a LCID or eLCID.
12. (to discuss) RAN2 to discuss how UE recovers from UL synchronization failure due to the validity timer expiry among the following options:
* Option 1: UE flushes all HARQ buffers and releases all resource configuration, re-acquires the SIB and triggers RACH procedure to recover from UL synchronization loss failure.
* Option 2: UE triggers RLF.
1. (to discuss) RAN2 to discuss whether the UE should stop all uplink transmissions and trigger RLF if the UE fails to acquire an accurate UE location to be used in the calculation of the full TA.
2. (to discuss) RAN2 to discuss the issue of ra-ContentionResolutionTimer between the following options:
* Option 1: 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.
* Option 2: If ra-ContentionResolutionTimer expires during the UE-gNB RTT after Msg3 retransmission, the UE does not consider the Contention Resolution not successful.

# 4. References

1. R2-2200214 Discussion on remaining issues on TA reporting Intel Corporation discussion Rel-17 NR\_NTN\_solutions-Core
2. R2-2200243 Discussion on RACH and TA report in NTN OPPO discussion Rel-17 NR\_NTN\_solutions-Core
3. R2-2200270 Remaining issues related to TA report Xiaomi discussion Rel-17
4. R2-2200347 Remaining issues about RACH and TA reporting Huawei, HiSilicon discussion Rel-17 NR\_NTN\_solutions-Core
5. R2-2200377 Discussion on UE specific TA reporting vivo discussion
6. R2-2200520 Consideration of TA report remaining issues of NTN China Telecom discussion Rel-17 NR\_NTN\_solutions-Core
7. R2-2200627 TA report procedure Spreadtrum Communications discussion Rel-17
8. R2-2200688 The Left Issues on UE-specific TA information reporting in NTN CATT discussion Rel-17 NR\_NTN\_solutions-Core
9. R2-2200746 Discussion on TA report during RA procedure ASUSTeK discussion Rel-17 NR\_NTN\_solutions-Core
10. R2-2200747 Discussion on issue of restarting contention resolution timer ASUSTeK discussion Rel-17 NR\_NTN\_solutions-Core
11. R2-2200764 Further discussion on TA reporting in NTN Lenovo, Motorola Mobility discussion Rel-17
12. R2-2200876 Considerations on RACH aspects CMCC discussion Rel-17 NR\_NTN\_solutions-Core
13. R2-2201007 Discussion on RACH open issues and TA reporting aspects Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_NTN\_solutions-Core
14. R2-2201034 Further considerations on TA reporting Samsung Research America discussion NR\_NTN\_solutions-Core
15. R2-2201164 UE-specific TA reporting and other RACH aspects InterDigital discussion Rel-17 NR\_NTN\_solutions-Core
16. R2-2201193 Remaining issues on TA Report NEC Telecom MODUS Ltd. discussion
17. R2-2201324 Consideration on remaining issues of RACH aspects ZTE Corporation, Sanechips discussion Rel-17
18. R2-2201363 Discussion on RACH and TA report aspects LG Electronics Inc. discussion NR\_NTN\_solutions-Core
19. R2-2201630 Reporting information about UE specific TA pre-compensation in NTNs Ericsson discussion
20. S3-214349, Reply LS on NTN specific User Consent