3GPP TSG-RAN WG2 Meeting #115e R2-210xxxx

Online, 16th - 27th August, 2021

**Agenda item: 8.10.2.1**

**Source: CATT**

**Title: [draft] Report of [AT115-e][106][NTN] RACH aspects (CATT)**

**Document for: Discussion and Decision**

# 1 Introduction

This document aims at collecting companies’ views regarding the RACH aspects:

* [AT115-e][106][NTN] RACH aspects (CATT)

Scope: Continue the discussion on p1 and p2 from [R2-2107314](file:///C:\Data\3GPP\Extracts\R2-2107314.docx) and p3-p7 and p16-p18 from [R2-2108453](file:///C:\Data\3GPP\Extracts\R2-2108453%20-%20Random%20Access%20timers%20and%20reporting%20information%20about%20UE%20specific%20TA%20pre-compensation%20in%20NTNs.docx) (p8-p15 may be discussed in the future if p7 is agreed)

Intended outcome: Summary of the offline discussion with e.g.:

* + - List of proposals for agreement (if any)
    - List of proposals for further discussion
    - List of proposals that should not be pursued (if any)

Initial deadline (for companies' feedback): Thursday 2021-08-19 1000 UTC

Initial deadline (for rapporteur's summary in R2-2108882): Thursday 2021-08-19 1600 UTC

Proposals marked "for agreement" in R2-2108882 not challenged until Friday 2021-08-20 1000 UTC will be declared as agreed via email by the session chair (for the rest the discussion will further continue offline until the CB session in Week2).

# 2 Discussion

At RAN2#113bis-e the reporting of TA was discussed with the following agreements

1. At least for uplink scheduling adaptations, the UE may report information about the UE specific TA pre-compensation. The exact information and frequency of reports depend on RAN1 outcome. FFS on when/how to report.

* [Post113bis-e][000] “It is FFS whether the UE reports the UE specific TA pre-compensation at the RACH procedure (MSG3 or MSG5) using a MAC CE. Actual content is FFS and also depends on further RAN1 input. Configurability is FFS”

Further at RAN2#114 the following was agreed

Agreement:

1. If enabled by the network, the UE reports information about UE specific TA pre-compensation at the random access procedure (MSGA/MSG3 or MSG5) using a MAC CE. Actual content is FFS and also depends on further RAN1 input (we can revise this whole agreement if RAN1 come to a different conclusion in terms of what needs to be conveyed to the NW)

At the online discussion of RAN2 #115-e meeting, the agreement regarding UE specific TA reporting was achieved as following:

Agreements:

1. UE specific TA reporting during RACH procedure is enabled/disabled by SI (FFS for RACH in connected mode)

## 2.1 The trigger conditions of UE specific TA reporting in connected state

The UE specific TA report may be used by network to schedule the UE accurately at the initial RA procedure. It is agreed to enabled/disabled UE specific TA reporting by SI. There are three options on the trigger conditions of UE specific TA reporting in connected mode. We are going to discuss them one by one.

* Request and response in connected mode
* Periodical reporting in connected mode
* Event triggering in connected mode
* **Request and response in connected mode**

It is proposed that the network can request the UE-specific TA Report to calculate UE-specific K\_offset for scheduling [1]. Therefore, the network can request the UE to report the calculated TA when the network detects the scheduling problem or there is a requirement to schedule UE. It is also clarified that in some scenarios (especially for LEO earth fixed cells) the UEs in connected mode may experience a TA pre-compensation that changes greatly during the connection to a cell while in GEO the TA may be stable during the connection [2]. Therefore, there is a need to inform the gNB about the updated TA pre-compensation.

The proposals in [1] and [2] are given as following:

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| **Proposal 1: For the UE-specific TA reporting under network control, two options can be supported [1]:**  **Option 1: the UE-specific TA Report requested by network;**  **Proposal 6: Network can request the UE to report information about UE specific TA pre-compensation [2].** |

From the online discussion, there is confusion on whether the above mechanism is applied in connected mode or initial random access. The initial random access was already discussed and achieved agreements list above, so the proposals in above table only apply to connected mode.

|  |  |  |
| --- | --- | --- |
| **Question 1: Do you agree that UE specific TA report can be requested by network when UE in connected mode?** | | |
| **Company** | **Yes/No** | **Comment** |
| MediaTek | Yes | If the network wants it, UE can report it to the network. |
| Xiaomi | Yes | If network can predict the TA change, it can choose to request TA report instead of configuring periodic TA report. |
| Lenovo | FFS | NW can adjust TA using TAC command. Therefore if UE has reported TA in RA, NW will always be aware of the adjusted TA value at UE in RRC\_CONNECTED. We wonder if there is other reason for such request. |
| China Telecom | Yes | NW needs TA for scheduling strategy. |
| Huawei, HiSilicon | No | From our perspective, the TA report during random access procedure is enough. When UE is in connected mode, the network can use the legacy TA adjustment mechanism. The TA is changing continuously, the network can estimate TA based on UL signals and use consecutive TA commands to make adjustment and keep the TA value credible. Even if the TA adjustment is not very precise, it is not a big issue since the UE specific TA is only used to make the scheduling more efficient.  With the legacy mechanism workable, adding additional UE reports increases complexity and signalling overhead. |
| Samsung | See comments | If MAC CE is used for UE-specific TA reporting, it sounds reasonable to have network requested (i.e. via DCI or MAC CE) UE specific TA report. However, if RRC is used for UE-specific TA reporting, we’re not sure whether it is additionally required on top of periodic reporting and event-triggered reporting. Also note one-shot reporting can be done by configuring the number of reporting as “1” in periodic reporting. |
| Ericsson | Yes | The reporting on request can be useful for UEs with long connection time, especially if UE position is reported (fast UEs may have moved far away, say a plane at 1200 km/h). The gNB can then opportunistically piggyback a request for UE position when sending other grants instead of using periodic or triggered reporting. This may save the signalling to configure the reporting and the few UEs that stay connected for long in the same cell can be polled.  In most scenarios it is sufficient with the indication in the SIB and triggered reporting.  If SIB indicate no reporting is needed, then reports shall never be sent except on request. |
| LG | No | If the periodical reporting of UE-specific TA report is introduced, there is no reason to request the UE-specific TA report by the network.  However, the periodical reporting of UE-specific TA report is not introduced, the UE specific TA report should be requested by network |
| InterDigital | Yes | Network requested TA report or event-based reporting would allow the network to receive updated UE-specific TA when most important/useful (e.g. if network wants an updated value for scheduling or if TA difference has exceeded a threshold). Periodic reporting may introduce unnecessary signalling if the TA value doesn’t change that much. |
| NEC | No | If conditions for TA reporting are configured during/following initial access, then one-off TA requests during connected mode will not be necessary. |
| ZTE | Wait for RAN1’s conclusion. | The TA report here is for scheduling adaption the behavior shall be controllable at NW’s side. It is useful for NW to based on its requirement to request UE to report TA since NW is aware of satellites’ trajectory and UE’s mobility state. However, considering the requirement on TA report (e.g., frequency ) shall be decided by RAN1, and there are an on-going discussion in RAN1 discussing the same issues. To avoid duplicated discussion, we think we can wait for RAN1’s conclusion. |
| Apple | No | Agree with Huawei. The entire TA procedure currently is defined for connected mode. We don’t see then need for additional enhancements to the existing procedure. |
| Qualcomm | No | Event triggered based TA reporting is sufficient. In addition, periodic reporting can also be considered. |
| Nokia | No | For UE in connected mode, we think event-triggered TA update should be supported (as indicated in Q3). Before the UE triggering the TA update report via event, it is NW implementation to guarantee UE has sufficient TA for PUSCH transmission based on last reported TA. For example, NW can schedule the UE with an appropriate (Koffset+K2) where the margin of the threshold is taken into account on top of last report TA. Based on the event-triggered TA update, it is not needed for NW to request UE to update TA. |
| vivo | Yes | The UE may move in the connected state, causing the change of the TA compensated by the UE. Such change may be invisible to NW and may not be easy for the NW to predict. So, UE specific TA report can be requested by NW to adjust the scheduling strategy. |
| OPPO | Yes | UE just follows the NW’s indication to report its TA, when NW needs to know UE’s TA. For example, if NW does not enable TA report during RACH or TA cannot be reported in Msg3/Msg5 due to not enough resource, NW can indicate UE to report UE specific TA in connected mode. |
| CATT | Yes | The network can request the UE to report TA when there is a need to adjust TA when UE in connected mode. |
| Convida | Yes | We think the N/W should be able to request a UE specific TA report whilst the UE is in RRC Connected. One additional note, that the “reporting” should be configured and requested in connected or initial access/idle mode. |
| Spreadtrum | No | The legacy TA update procedure is enough. |
| Rakuten Mobile | Yes | Network should be able to request TA as it can be utilized for updating scheduling offsets. |
| ETRI | No | We do not see a need for a network request TA report. |
| Intel | Yes | When UE is CONNECTED, we understand that network should be able to request it as UE may apply and update TA by it’s own in NTN (part of the TA which is based on UE position and satellite ephemeris) . |
| Sequans | Up to RAN1 | We think TA control loop is in RAN1 scope. |
| Sony | Yes | Network can request and UE shall report TA report as UE TA drift may be different based on satellite and UE movement. |

Summary:

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* **Periodical reporting in connected mode**

It is also proposed to support triggering the periodical report of UE-specific TA for timely TA tracking and saving the request signalling [1].

The proposal in [1] is as following:

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| **Proposal 1: For the UE-specific TA reporting under network control, two options can be supported[1]:**  **Updated proposal: periodical reporting of UE-specific TA report in connected** |

Therefore, the rapporteur suggest to discuss whether to support periodical reporting of UE-specific TA report in connected mode.

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| **Question 2: Do you agree that periodical reporting of UE-specific TA report is supported in connected mode?** | | |
| **Company** | **Yes/No** | **Comment** |
| MediaTek | No | There is no need to report the TA periodically. Event triggered report with network based polling should be enough. |
| Xiaomi | Maybe No | Agree with MediaTek, network trigger and event based may be enough |
| Lenovo | No | NW can adjust TA using TAC command. Therefore if UE has reported TA in RA, NW will always be aware of the adjusted TA value at UE in RRC\_CONNECTED. If there is other reason for TA reporting in RRC\_CONNECTED, we think NW request could be sufficient. |
| China Telecom | No | Periodical reporting UE-specific TA will consume too much power of UEs. We prefer to focus on NW based solutions. |
| Huawei, HiSilicon | No | Same comment as in Q1. |
| Samsung | No | We assume periodical location reporting and event-triggered location reporting are supported for the connected UE. Then we think any RRC based UE-specific TA reporting is quite duplicated with them, i.e. UE-specific TA is calculated by UE location. |
| Ericsson | No | Periodic reporting has the issues:   * many users will send unnecessary reports using precious radio resources and waste UE energy even they are far from a TA pre-compensation level that will require the gNB to adjust the Koffset. * the period needs to be shorter for UEs close to the nadir path on the ground, compared to UEs far from the nadir path to give the same amount of time for the gNB to signal a new Koffset before the UE passes the TA level corresponding to a needed change in Koffset * if the info in the report is the UE position, then one position is sufficient for the gNB in most scenarios, and periodic reporting seems unnecessarily wasteful |
| LG | Yes | If the network configures the periodicity for reporting the UE specific TA pre-compensation value to the UE, the network can keep track of the UE specific TA pre-compensation value without additional signalling. |
| InterDigital | No | Network requested TA report or event-based reporting would allow the network to receive updated UE-specific TA when most important/useful (e.g. if network wants an updated value for scheduling or if TA difference has exceeded a threshold). Periodic reporting may introduce unnecessary signalling if the TA value doesn’t change that much. |
| NEC | No (see comments) | It should be up to network implementation how the UE reports TA, which includes periodical reporting.  However, periodical TA reporting may not be optimal so it should not warrant a specific feature, as opposed to reporting scheduling from the NW. |
| ZTE | Wait for RAN1 | As commented in Q1, we can wait for RAN1 to avoid duplicated discussion. |
| Apple | No | Same comment as in Q1. |
| Qualcomm | Yes | Periodic is better as network triggered method requires more signaling and probably have RAN1 impact if DCI is used. |
| Nokia | No | We think the event triggered report (e.g. threshold-based TA information update) is efficient since UE will report its updated TA information on demand (i.e. only if the TA change exceeds the threshold, UE will report the latest TA information to NW).  With the support of event triggered reporting, it is not reasonable for UE to report the TA periodically even the TA is not changed (or change within the threshold). Compared to the periodical reporting, event triggered reporting will save the Uu interface signalling. |
| vivo | No strong view | It seems that the network request and event trigger report are enough. But we are also fine to go with periodical reporting of UE-specific TA, if the majority would like to have it. |
| OPPO | Yes | UE-specific TA may constantly change due to the movement of satellite, so periodical reporting is straightforward in connected mode. Furthermore, periodical reporting is simpler than event-triggered reporting from UE implementation. |
| CATT | Yes | Triggering the periodical report of UE-specific TA is beneficial for timely TA tracking and saving the DL signalling. |
| Convida | Yes | We think that the N/W could configure the UE to report it’s UE-specific TA report periodically. |
| Spreadtrum | No | If gNB needs the UE specific TA value, legacy TA adjustment procedure is enough. |
| Rakuten Mobile | Yes |  |
| ETRI | No | Signaling overhead is not negligible. There is not much to be gained from periodic reporting. |
| Intel | No | Periodic reporting does not seem necessary as TA may not change with the requested frequency. |
| Sequans | Up to RAN1 | We think TA control loop is in RAN1 scope. |
| Sony | Yes | It should be upto network configuration. |

Note: We will further discuss the way how to configure period to UE in detail proposed by [1] at second round if Q2 is agreed.

Summary:

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* **Event triggering in connected mode**

In some cases, initial UE-specific TA reporting can be used for long period or the UE moves too fast to trigger the TA reporting by network control, the event-triggered method may be more suitable for these scenarios [1]. The UE may trigger transmission of information about the UE specific TA pre-compensation to minimize the signalling [2].

The proposals in [1] and [2] are as following:

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| **Proposal 2: For the UE-specific TA reporting under UE control, event triggered method should be supported in NTN, e.g. a threshold between current TA and the last reported TA [1].**  **Proposal 7: The network may configure triggers for reporting information about UE specific TA pre-compensation [2].** |

Therefore, the rapporteur suggests discussing whether to support event triggered method for the UE-specific TA report.

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| **Question 3: Do you agree that the network may configure event-triggers for** **reporting UE specific TA?** | | |
| **Company** | **Yes/No** | **Comment** |
| MediaTek | Yes | The UE should report the TA when there is a change beyond a certain threshold. |
| Xiaomi | Yes | It can work together with network request. Network can predict the TA change and request for TA in case that the prediction error accumulates. Event trigger serves for the situation of TA change dramatically. |
| Lenovo | Yes for IDLE/INACTIVE  FFS for CONNECTED | NW can adjust TA using TAC command. Therefore if UE has reported TA in RA, NW will always be aware of the adjusted TA value at UE in RRC\_CONNECTED. |
| China Telecom | Yes | NW can configure a threshold to trigger UE specific TA report. |
| Huawei, HiSilicon | No | Same comment as in Q1. |
| Samsung | No | We assume periodical location reporting and event-triggered location reporting are supported for the connected UE. Then we think any RRC based UE-specific TA reporting is quite duplicated with them, i.e. UE-specific TA is calculated by UE location. |
| Ericsson | Yes | Triggered reporting saves radio resources and UE energy.  If triggered reporting is configured, then RA in connected mode (besides for handover and “Request for Other SI”) can send the report only if a triggering condition is fulfilled. |
| LG | Yes | It would be helpful to inform UE specific TA pre-compensation value when the UE specific TA pre-compensation value is significantly changed in a short time. |
| InterDigital | Yes | Network requested TA report or event-based reporting would allow the network to receive updated UE-specific TA when most important/useful (e.g. if network wants an updated value for scheduling or if TA difference has exceeded a threshold). Periodic reporting may introduce unnecessary signalling if the TA value doesn’t change that much. |
| NEC | Yes | We support event-triggered TA report from the UE. The network can help configuring the triggers.  Since both the UE and the network should have the same knowledge regarding the TA, the network should define rules for TA reporting. |
| ZTE | Wait for RAN1 | As commented in Q1, we can wait for RAN1 to avoid duplicated discussion. |
| Apple | No | Same comment as in Q1. |
| Qualcomm | Yes | Event triggered TA report is more important than periodic or network triggered TA report. |
| Nokia | Yes | We think the event triggered report (e.g. threshold-based TA information update) is efficient since UE will report its updated TA information on demand (i.e. only if the TA change exceeds the threshold, UE will report the latest TA information to NW). Event triggered report will save the Uu interface signalling. |
| vivo | Yes | Agree with MediaTek and China Telecom, the UE shall report the UE-specific TA when there is a change beyond a certain threshold. |
| OPPO | Yes | Compared with periodical report, event triggered report has benefit on signaling overhead reduction.  Regarding to the trigger condition, since the purpose of TA report is for the NW configuration of Koffset, in our understanding, UE should report TA when Koffset – UE’s TA < Threshold. For example, if NW configures Koffset with a very large value, UE does not even need to report TA until the difference between Koffset and UE’s TA is less than a threshold, so that UE can avoid unnecessary TA reporting. |
| CATT | Yes | Event triggered method is beneficial for scenario where TA changes rapidly in short time. The network can configure one threshold to trigger the aperiodic UE-specific TA reporting. |
| Convida | Yes | We think that the N/W should be able to configure triggers for the UE to report it’s UE-specific TA. |
| Spreadtrum | No | If gNB needs the UE specific TA value, legacy TA adjustment procedure is enough. |
| Rakuten Mobile | Yes | This can be utilized to save UE power. |
| ETRI | Yes | We believe that event-triggered TA reporting is beneficial. |
| Intel | Yes |  |
| Sequans | Up to RAN1 | We think TA control loop is in RAN1 scope. |
| Sony | Yes | For GEO, event trigger is best as this minimises signalling.  For LEO with the triggering event being a change in TA or UE position, signalling load can also be reduced. |

Note: We will further discuss what the trigger event is in detail proposed by [1] and [2] at second round if Q3 is agreed.

Summary:

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## 2.2 What and how to report about UE specific TA

* **The content of** **UE specific TA in RA procedure**

For the content of UE specific TA in RA procedure, [2] notes that reported TA can be used by the gNB to estimate the position of the UE. Meanwhile, reporting TA and TA drift will give faster estimation of UE position. Reporting TA or UE position in a MAC CE will enable any entity to estimate the UE position.

The proposal in [2] is as following:

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| 1. The report about UE specific TA pre-compensation using MAC CE is the UE TA or UE position with a low resolution. |

Therefore, the rapporteur suggests discussing the content of UE specific TA in RA procedure.

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| **Question 4: Which option of the content of UE specific TA reported in RA procedure using MAC CE do you prefer?**  **Option 1. UE specific TA; Option 2. UE position with a low resolution; Option 3. Others** | | |
| **Company** | **Option 1/2/3** | **Comment** |
| MediaTek | Option 1 | UE should report the UE-specific TA. |
| Xiaomi | FFS | In LCS discussion, coarse UE position(GNSS) report in initial access was agreed, but subject to SA3 privacy check. Perhaps we need to wait for the answer from SA3 to see if common design is applicable here. |
| Lenovo | Option 1 | TA reporting could be of less size and can be directly used for scheduling. |
| China Telecom | Option 1 | Option 1 is the most straightforward way. |
| Huawei, HiSilicon | Option 1 | Reporting UE position may have security concerns and is dependent on SA3 reply (same view as Xiaomi). Besides, the motivation for this reporting is to facilitate scheduling, and UE specific TA can serve this purpose well. |
| Samsung | Option-1 |  |
| Ericsson | Option 2 | We are fine with any option, but resolution will need to be low.  The UE position can be quantized (like discussed in the Control Plane discussion), or UE specific TA pre-compensation can be quantized.  It may be that RAN1 will have an opinion on what the UE shall report.  The gNB needs to know the TA or UE position to select a UE specific Koffset.  Note that in IoT NTN, the eNB also needs to know the TA or UE position to respect Half Duplex constraints. |
| LG | Option 1 |  |
| InterDigital | Option 1 |  |
| NEC | Option 1 | Since the UE uses its UE-specific TA in Msg1/MsgA, it should report it to the NW. |
| ZTE | Option 1 | As agreed in previous meeting, the purpose of report pre-compensation is to **assist NW’s scheduling adaption**, therefore it is straightforward to report TA. |
| Apple | FFS | Same views as Xiaomi and Huawei/HiSilicon. We cannot decide anything without hearing back from SA3. |
| Qualcomm | Option 1 | Question is confusing. We are not sure why it has to be mixed up with location. Low resolution UE location reporting should be in Msg5 RRC message in which case we agree TA report is not needed.  But if UE location is not reported or not enabled by network, simply TA report should be enabled in Msg3/MsgA/Msg5. |
| Nokia | Depends on whether coarse UE location can be used for TA estimation | Agree with Xiaomi. RAN2 reached the latest agreements in RAN2-115 online discussion that UE coarse location information can be reported to NW during initial access. But the agreement can be challenged if SA3 show privacy concern on such kinds of reporting.  We understood the main motivation for such kind of coarse UE location is for other purpose (e.g. cell id mapping for LEO moving cell), but it seems feasible for NW to estimate coarse TA for UL scheduling based on UE’s coarse location and satellite ephemeris data. If this is the case, why UE reports both UE’s coarse location and UE specific TA to NW during initial access ? Maybe UE’s coarse location is enough. |
| vivo | Option 1 | If option 2 is adopted, the network needs to convert the UE position into UE specific TA for scheduling. So why not adopt a more straightforward and simpler method: reporting the UE specific TA? Don’t see a benefit to report UE location for the TA-specific purpose. Also share Huawei’s view: reporting coarse UE location was discussed with other purposes, not necessarily mixed with the intention of TA reporting here which is to facilitate scheduling. |
| OPPO | Option 1 |  |
| CATT | Option 1 | The UE should report UE specific TA. |
| Convida | Option 1 |  |
| Spreadtrum | Option 1 |  |
| Rakuten Mobile | Option 1 | We do not support UE to share location at this point. |
| ETRI | Option 1 | SA3 review is required. We believe that if UE does not report the full value, security issue with MAC CE can be resolved. |
| Intel | Option 2 | We understand that reporting of UE position is one option instead of reporting of TA since UE TA can be determined based on UE position. Also, it has the advantage that TA change due to satellite movement can be tracked by the gNB |
| Sequans | Option 1 |  |
| Sony | Option 2 | With UE position, network can calculate UE-specific TA and UE position is quite amenable to event trigger. |

Summary:

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* **How to report in connected mode after RA procedure**

As repeated reports of TA or UE position give the UE position to any observer if using MAC CEs, the UE shall not report using MAC CE in connected mode. Using RRC will give integrity protection and encryption and thus do not reveal the UE position to unwanted parties [2].

Thus, for privacy reasons the TA reporting or position reporting is better done using RRC after security have been activated. If TA reporting is done using MAC CEs, it is better to not report often and not having fine-grained TA report. [2].

The proposal in [2] is as following:

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| --- |
| 1. If the UE reports information about UE specific TA pre-compensation after random access, RRC signalling is used after security has been activated. |

However some companies think that after security is activated we can actually send TA value via MAC CE during online discussion. So the rapporteur suggests discussing the following question.

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| **Question 5: Which option do you prefer to report UE specific TA pre-compensation in connected mode after random access and security has been activated?**  **Option 1. RRC signalling; Option 2. MAC CE; Option 3. Others** | | |
| **Company** | **Option 1/2/3** | **Comment** |
| MediaTek | Option 2 | We prefer using a single method to report the TA using MAC CE (option 2) all the time. |
| Xiaomi | FFS | Same as Q5, wait for SA3 answer for LCS |
| Lenovo | FFS | NW can adjust TA using TAC command. Therefore if UE has reported TA in RA, NW will always be aware of the adjusted TA value at UE in RRC\_CONNECTED. We wonder if there is other reason for TA reporting in CONNECTED. |
| China Telecom | Option1 | Considering the security of UEs, we prefer Option1 in connected mode. |
| Huawei, HiSilicon | Option 3 | Same answer as in Q1, UE specific TA is only reported during initial access. |
| Samsung | Option-2 | We assume periodical location reporting and event-triggered location reporting are supported for the connected UE. Then we think any RRC based UE-specific TA reporting is quite duplicated with them, i.e. UE-specific TA is calculated by UE location. |
| Ericsson | Option 1 | We think we shall protect the TA/position information as much as possible. Using MAC CEs will enable unwanted parties to detect it, using multiple MAC CE reports from the same user (potentially after a handover, or satellite must have moved substantially or using other information). |
| LG | Option 2 |  |
| InterDigital | Option 1 or Option 2 | No strong view. If there is already a MAC CE introduced for UE-specific TA reporting in RA then a unified solution might be preferrable. However, we can understand the arguments for RRC-based signalling especially if TA value is not expected to change that quickly. |
| NEC | Option 2 | Reporting TA does not require high resolution of the UE position and can be made via MAC CE without using RRC security |
| ZTE | Option 2 | MAC CEs would be more efficient way to go, but SA3 might be consulted first to see if frequent TA report has any privacy concerns. |
| Apple | Option 3 | No need of this report and existing procedure is supposed to be self correcting anyway. |
| Qualcomm | Option 2 | Given the TA report is coarse TA report, e.g., in granularity of 1 slot. |
| Nokia | Option 1 | We prefer the UE to report its location (as indicated in Q6) via RRC after security has been activated, since using RRC will have integrity protection and encryption on UE location information. |
| vivo | Option 2 | We prefer using the same way as reporting UE specific TA during initial access procedure. |
| OPPO | Option 1 | We prefer TA reporting via RRC signalling since RRC signaling is secured. |
| CATT | Option 2 | It was agreed to use MAC CE to report UE specific TA in RA procedure at previous meeting. The same method can be applied to connected mode. |
| Convida | Option 2 | Our slight preference is for Option 2, however, both options are feasible. |
| Spreadtrum | Option 3 | UE specific TA report is not needed after random access procedure. |
| Rakuten Mobile | Option 2 |  |
| ETRI | Option 2 | We prefer MAC CE. It can be revisited if SA3 has any concerns. |
| Intel | Option 1 | We prefer RRC signaling as our preference is to send location (instead of TA). In addition, for some NTN scenario (e.g. LEO), UE location may be easily calculated based on multiple TA reports for statis UEs. Therefore RRC signaling may be better. |
| Sequans | Option 2 as baseline | This can be decided once need/frequency/accuracy of the reporting is decided, but MAC CE could be the baseline unless issues are found. |
| Sony | Option 2 | MAC CE is faster and deterministic |

Summary :

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* **The content of UE specific TA in connected mode after RA procedure**

With the UE position and the satellite ephemeris, the gNB can predict TA variations with less signalling than the UE reporting TA or TA+TA drift [2]. For the content of UE specific TA after procedure, the proposal in [2] is as following:

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| 1. The report about UE specific TA pre-compensation using RRC is the UE position. |

Therefore, the rapporteur suggests discussing the following question.

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| **Question 6: Which option of content of UE specific TA in connected mode after RA procedure do you prefer?**  **Option 1. UE specific TA; Option 2. UE position; Option 3. Others** | | |
| **Company** | **Option1/2/3** | **Comment** |
| MediaTek | Option 1 | UE should report the UE-specific TA. |
| Xiaomi | FFS | In LCS, there is also discussion on UE position report. Perhaps we need to wait for the answer from SA3 to see if common design is applicable here. |
| Lenovo | FFS | NW can adjust TA using TAC command. Therefore if UE has reported TA in RA, NW will always be aware of the adjusted TA value at UE in RRC\_CONNECTED. If there is other reason for TA reporting in CONNECTED, we slightly prefer Option 1 as TA reporting could be of less size and can be directly used for scheduling. |
| China Telecom | Option 1 | We can reuse the position report in LCS. However, if it is not sufficient, Option 1 is straightforward. |
| Huawei, HiSilicon | Option 3 | Same answer as in Q1, UE specific TA is only reported during initial access. |
| Samsung | See comments | If MAC CE is used, option-1, but if RRC is used, option-2. |
| Ericsson | Option 2 | UE position shall be reported by RRC signalling. |
| LG | Option 1 |  |
| InterDigital | See comments | Agree with Samsung. Depends on outcome of Q5. |
| NEC | Option 1 | UE-specific TA is enough for synchronisation. |
| ZTE | Option 1 | UE specific TA is more useful for NW’s scheduling adaption. |
| Apple | Option 3 | No need of this reporting in RRC connected mode. |
| Qualcomm | Option 1 | We do not understand the point of mixing up with UE location. Their purpose is different.  If network has UE location, there is no need to report TA. But TA report should belong to TA associated with UL scheduling. Network may need this fast information via MAC CE. |
| Nokia | Option 2 | The UE position will facilitate the NW to predict TA change, thus minimize the Uu signalling. |
| vivo | Option 1 | Same answer as in Q4, reporting the UE specific TA is a more straightforward and simpler way. |
| OPPO | Option 1 |  |
| CATT | Option 1 | UE specific TA is good enough to network schedule. |
| Convida | Option 1 | We think that after RACH procedure, the content of UE specific TA should be the UE-specific TA, rather than UE position. |
| Spreadtrum | Option 3 | UE specific TA related information report is not needed after random access procedure. |
| Rakuten Mobile | Option 1 |  |
| ETRI | Option 1 |  |
| Intel | Option 2 |  |
| Sequans | FFS RAN1 | It depends on RAN1 decision on TA control loop. |
| Sony | Option 2 | With UE position, network can calculate UE-specific TA and UE position is quite amenable to event trigger. |

Summary:

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## 2.3 UE specific TA reporting in RA procedure

To clarify the RACH aspects in connected mode, we list the following events that trigger the random access procedure:

- Initial access from RRC\_IDLE;(idle mode)

- RRC Connection Re-establishment procedure; (connected mode)

- DL or UL data arrival during RRC\_CONNECTED when UL synchronisation status is "non-synchronised"; (connected mode)

- UL data arrival during RRC\_CONNECTED when there are no PUCCH resources for SR available; (connected mode)

- SR failure; (connected mode)

- Request by RRC upon synchronous reconfiguration (e.g. handover); (connected mode)

- Transition from RRC\_INACTIVE;(inactive mode)

- To establish time alignment for a secondary TAG; (out of NTN Rel-17 scope)

- Request for Other SI (see clause 7.3); (connected mode)

- Beam failure recovery; (connected mode)

- Consistent UL LBT failure on SpCell; (out of NTN Rel-17 scope)

In [2], the paper proposes that reporting information about the UE specific TA pre-compensation is not necessary in some of these events. For example, if the UE has reported its position to the network, the network can estimate the UE specific TA pre-compensation after a handover regardless of which satellite or which gateway the new cell is associated with. Another example is if a new cell is in the same gNB and uses the same gateway.

We will discuss the P16-P18 one by one regarding the UE specific TA reporting in RACH in [2]:

* **TA reporting controlled by network during handover**

It is proposed by [2] TA reporting should be controlled by network during the handover.

1. For all types of handovers, the network indicates in the handover command whether the UE reports information about the UE specific TA pre-compensation during the random access to the target cell.

Therefore, the rapporteur suggests discussing the following question.

|  |  |  |
| --- | --- | --- |
| **Question 7: Do you agree that the network indicates in the handover command to UE - whether the UE should report information of the UE specific TA pre-compensation to the target cell during the random access?** | | |
| **Company** | **Yes/No** | **Comment** |
| MediaTek | Yes |  |
| Xiaomi | Yes |  |
| Lenovo | Yes |  |
| China Telecom | Yes |  |
| Huawei | Yes | It is a quite natural behaviour, since other important information in SIB1 is also carried in HO command, e.g. multiple fields in *ServingCellConfigCommon* have their counterparts in *ServingCellConfigCommonSIB*. |
| Samsung | Yes |  |
| Ericsson | Yes with comment: change “handover command” to “RRC reconfiguration with sync” | This avoids defining all cases where the UE knows if gNB has the UE position (or sufficient TA information to the new cell), if feeder link will be switched, or if the new cell is in a different satellite etc. Instead gNB tells the UE what it shall do.  Better to write “RRC reconfiguration with sync” instead of “handover” to cover all cases. |
| LG | Yes |  |
| InterDigital | Yes |  |
| NEC | Yes, but | But it is enough to just follow the indication in the target cell’s SI. |
| ZTE | Yes |  |
| Apple | NO | Why is this argument different from the regular connected mode procedures in TN ? Even if a new procedure needs to be identified, we don’t see why this is UE impacting. The network can do something on its own and provide the updated value during the RACH procedures similar to how it is done in TN today without specification impact. There is no UE specific pre-compensation to report needed during Handovers. |
| Qualcomm | No if this a new indication in HO command | TA report enable/disable is cell’s common configuration in SIB1. The HO command message anyway contains target cell’s common configuration. Is this not sufficient? |
| Nokia | Yes, but | Same comment as Qualcomm. |
| vivo | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| Convida | Yes |  |
| Spreadtrum | Yes with comments | Same as Qualcomm |
| Rakuten Mobile | Yes |  |
| ETRI | Yes |  |
| Intel | Yes |  |
| Sequans | Yes with comments | Same view as Qualcomm |
| Sony | Yes | This may shorten the TA alignment procedure with the target cell |

Summary:

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* **Request for Other SI in RA procedures**

It is proposed that there is an exception not to report UE specific TA in RA procedure which is “Request for Other SI”.

1. In RA procedures triggered due to “Request for Other SI”, information about UE specific TA pre-compensation is not reported.

Therefore, the rapporteur suggests discussing the following question.

|  |  |  |
| --- | --- | --- |
| **Question 8: Do you agree that in RA procedures triggered due to “Request for Other SI”, information about UE specific TA pre-compensation is not reported?** | | |
| **Company** | **Yes/No** | **Comment** |
| MediaTek | Yes | TA information is not needed during on-demand SI Request. |
| Xiaomi | No | It seems like optimization. We do not see the need to differentiate different RACH trigger cases, no much gain observed. |
| Lenovo | Yes | TA reporting in RA is for scheduling, which is not necessary for on-demand SI Request. |
| Huawei, HiSilicon | Yes |  |
| Samsung | No | Agree with Xiaomi. |
| Ericsson | Yes | If dedicated preambles are used for “Other SI”, there is no possibility to send an MAC CE. |
| LG | No | Same view as Xiaomi |
| InterDigital | Yes | Agree with MTK/Lenovo |
| NEC | Yes | As there is no UE identification during RA procedure in this case, the TA information is not needed/reported. |
| Apple | Yes |  |
| Qualcomm | Yes |  |
| Nokia | Yes |  |
| vivo | Yes | Same view as MediaTek and Lenovo. The intention of TA reporting in RA is for scheduling, which is not needed during on-demand SI request. |
| OPPO | Yes |  |
| CATT | Yes |  |
| Convida | Yes, with comments | We don’t see the need, unless there is a case where the UE specific TA pre-compensation is somehow beneficial for the N/W to determine the Other SI |
| Spreadtrum | Yes |  |
| Rakuten Mobile | NO |  |
| ETRI | Yes |  |
| Intel | No | We do not see strong need to change legacy behaviour for this. |
| Sequans | Yes |  |
| Sony | Yes | We should avoid mixing procedures |

Summary:

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* **TA reporting in other scenarios in RA procedures**

It is proposed that TA is required to report when not configured with a triggering condition for reporting information about UE specific TA pre-compensation in these scenarios in RA procedures in [2].

1. In RA procedures not due to handover and not due to “Request for Other SI” and when the UE is not configured with a triggering condition for reporting information about UE specific TA pre-compensation, the UE shall report information about UE specific TA pre-compensation in the RA procedure.

Therefore, the rapporteur suggests discussing the following question.

|  |  |  |
| --- | --- | --- |
| **Question 9: Do you agree that In RA procedures not due to handover and not due to “Request for Other SI” and when the UE is not configured with a triggering condition for reporting information about UE specific TA pre-compensation, the UE shall report information about UE specific TA pre-compensation in the RA procedure?** | | |
| **Company** | **Yes/No** | **Comment** |
| MediaTek | Yes | This is needed to maintain the synchronization with the network. |
| Xiaomi | Yes | In all RA cases, whether to report TA is only controlled by SI configuration. |
| Lenovo | Yes | For UE in NTN, reporting TA in RA is necessary in synchronization and scheduling. |
| China Telecom | Yes |  |
| Huawei, HiSilicon | No | Similar answer as in Q1. We don’t see a strong motivation for UEs in connected mode to report TA. |
| Samsung | See comments | Sorry, we’re not crystal clear on the question. If “when the UE is not configured” for UE specific TA reporting, why the UE shall report the UE specific TA information in RA procedure? |
| Ericsson | Yes | Should be complemented with another proposal:  In RA procedures not due to handover and not due to “Request for Other SI” and when the UE is configured with a triggering condition for reporting information about UE specific TA pre-compensation, the UE shall only report information about UE specific TA pre-compensation in the RA procedure when a report have been triggered. |
| LG | Yes |  |
| InterDigital | Yes |  |
| NEC | Yes |  |
| ZTE |  | Not sure why this proposal is needed. Based on existing agreements, UE can based on indication in SI to know whether to report TA precompensation in RA procedure, which is sufficient. |
| Apple | No | Same views as Huawei. |
| Qualcomm | No | If TA report is not enabled, why would UE send the TA report. Network should make sure to either enable coarse UE location or TA report. |
| Nokia | No | For UE in RRC Connected mode, gNB will maintain UE’s reported TA after the first report (e.g. report in RACH from idle mode if NW enable it via SIB). Whether UE reporting the updated TA pre-compensation should base on event-triggered reporting, no matter in which RACH procedures in RRC\_Connected mode. |
| vivo | Yes |  |
| OPPO | No | If TA report during RACH is not enabled in SIB1, UE should follow the configuration by NW, and not to report UE specific TA to NW. |
| CATT | Yes | It is more like clarification. If the RA procedures due to handover and “Request for Other SI” are specified, the other RA procedures should be followed the normal trigger condition, e.g. based on SI information. We are fine with this proposal if the Q7 and Q8 are agreed. |
| Convida | Yes |  |
| Spreadtrum | No | If TA report is not enabled by gNB, UE is not needed to report TA in random access procedure. |
| Rakuten Mobile | Yes |  |
| ETRI |  | Agree with Ericsson’s revised proposal. |
| Intel | Yes |  |
| Sequans | FFS | Depends on earlier agreements on TA control loop. |
| Sony | No | We are not sure about the use case |

Summary:

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# 3 Conclusions

Based on the views expressed in the previous sections, we propose the following:

Proposals

# 4 List of referenced documents

[1] [R2-2107314](file:///C:\Data\3GPP\Extracts\R2-2107314.docx) Discussion on UE Specific TA Report CATT discussion

[2] [R2-2108453](file:///C:\Data\3GPP\Extracts\R2-2108453%20-%20Random%20Access%20timers%20and%20reporting%20information%20about%20UE%20specific%20TA%20pre-compensation%20in%20NTNs.docx) Random Access timers and reporting information about UE specific TA pre-compensation in NTNs Ericsson discussion

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