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

Online Meeting, August 16th – 27th 2021

**Agenda item: 8.11.1**

**Source: CATT**

**Title: [AT115-e][612][POS] Reply LS to SA2 on scheduled location time (CATT)**

**WID/SID: NR\_pos\_enh-Core**

**Document for: Discussion and Agreement**

# 1 Introduction

This document is to kick off the following email discussion:

* [AT115-e][612][POS] Reply LS to SA2 on scheduled location time (CATT)

Scope: Reply to the SA2 LS on scheduled location time, indicating RAN2 view on the latency benefit (to the extent agreement is possible) and understanding of RAN2 spec impact.

Intended outcome: Approvable LS in R2-2108943

Deadline: Tuesday 2021-08-24 0800 UTC

This email discussion continues to discuss the possible content for the Reply LS.

# 2 Contact Information

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| ZTE | pan.yu24@zte.com.cn |
| Ericsson | Ritesh.shreevastav@ericsson.com |
| Xiaomi | lixiaolong1@xiaomi.com |
| OPPO | liuyangbj@oppo.com |
| Apple | ssirotkin@apple.com |
| CATT | lijianxiang@datangmobile.cn |
| Huawei, HiSIlicon | Yinghao Guo (yinghaoguo@huawei.com) |
| InterDigital | jaya.rao@interdigital.com, fumihiro.hasegawa@interdigital.com |
| vivo | panxiang@vivo.com |
| Lenovo, Motorola Mobility | rthomas7@lenovo.com |
| Intel | ansab.ali@intel.com |

# 3 References

1. R2-2107680 "Summary of agenda 8.11.2 Latency enhancements" Intel Corporation discussion Rel-17 NR\_pos\_enh
2. R2-2106968 Response LS on Scheduling Location in Advance to reduce Latency (S2-2105122; contact: CATT) SA2 LS in Rel-17 5G\_eLCS\_ph2 To:RAN2 Cc:RAN1, RAN3

# 4 Discussion

## 4.1 Benefit analysis

According to the Summary of agenda 8.11.2 [1] and RAN2 on-line discussion, most companies believe that the benefit of scheduled location time in terms of reducing LCS latency is mainly reflected in the preparation phase of the positioning procedure, i.e. The LMF can complete the capabilities and assistance Data transmission in advance before initiating the corresponding location measurement procedure. Some companies do not see the latency benefit in general. They think this is for a specialised use case where the preparation phase can be handled earlier, and they see more of a benefit in reliability/accuracy of the location estimate.

**Question 1: Do you agree that the benefit of scheduled location time in terms of reducing LCS latency is mainly reflected in the preparation phase of the positioning procedure？ Please share your comments here.**

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| --- | --- | --- |
| Company | Yes/ No | Comments |
| Qualcomm | Yes, with comments | With the scheduled location time, the effective response time or latency equals the duration of the location execution phase and excludes the duration of the location preparation phase which can be performed ahead of the scheduled location time. This can be used to reduce latency, as already described in the SA2 CR (S2-2102047).  But there are of course other benefits inherent to the user case/application (i.e., enabling a client to request a UE location for a specified time). |
| ZTE | Yes | The scheduled location time is to let LMF know the deadline of triggering positioning request/sending assistance data. |
| Ericsson | Yes, but | For preparation phase it can help to reduce the latency if client does not know what is the typical TTTF. If a client can learn how long does it takes for NW to provide TTFF then client can request ahead of that time; in this scenario the time T is not critical in terms of latency.  But yes, in terms of improving accuracy/reliability it is good to have. |
| Xiaomi | Yes | The LMF can trigger positioning preparation phase in advance when LMF has the scheduled location time. |
| OPPO | Yes | With such priori information, the LMF could request the capability and send the assistance data from/towards UE in advance. |
| Apple | Yes, but | There can be some benefits, but we don’t see how that affects RAN2 signalling. |
| CATT | Yes | The benefit of scheduled location time in terms of reducing LCS latency is mainly reflected in the preparation phase of the positioning procedure, e.g. the obtaining assistance data. |
| Huawei, HiSilicon | See the comments. | From our understanding, scheduled location time is more like another type of location service that is previously not supported by immediate/deferred MT-LR, i.e., the LCS client can request the location estimate of the UE at a certain time, e.g., T.  We think the latency for scheduled location time should be defined as the time gap when the LCS client receives the location T1\_slt and the scheduled location time T, i.e., T1\_slt-T  Without scheduled location time, the LCS client still can request the location of the UE by some margin e.g., T0, at time T-T0. Then, between [T-T0, T], the LMF can perform transactions with the UE for the preparation phase, i.e., request UE capability and provide AD. Then, at a time close to T, the LMF can send RLI to the UE such that the UE performs measurement at time T. The LCS client then can receives the result at T1\_woslt.  With the above description, it is hard to see how to quantize the latency reduction by scheduled location time, i.e., the difference between T1\_slt and T1\_woslt.  To sum up, the benefits of scheduled location time is that it allows more flexibility for the LCS client to send the LCS request, i.e., do not need to be restricted to send the request to the LMF right before the appointed time T or consider for the margin. |
| InterDigital | Yes | The preparation phase, including providing the assistance data, can be done ahead of time for scheduled location time. This can translate to reduction in latency in the overall positioning procedure, whereby only the latency associated with measurement at T and reporting of measurement results to LMF accounts for the overall latency for scheduled location time under the scope of RAN2. |
| vivo | Yes for specific use cases. | The scheduled location is beneficial for some specific use cases, i.e., the LCS client need to know the location request at some future time in advance.  We think the timing to send out the measurement request can be seen as the schedule location time from LMF perspective. Therefore, the preparation phase includes the procedures before the measurement request, e.g. the capabilities and assistance data transmission while does not include the measurement gap configuration. |
| Lenovo, Motorola Mobility | Yes | Scheduled Location time in advance mainly targets the preparation phase. We agree on the benefits of flexibility for the network to prepare the UE assistance data configuration in advance. |
| Intel | Yes | During the location preparation phase, the LMF can take the scheduled location time into account when scheduling the UE to perform measurements to reduce latency. In our view, from RAN2 perspective, the more important issue is the one addressed in Q3, i.e. how does this affect RAN procedures/specifications |
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In the execution phase of the positioning procedure, there are two views to be considered:

* Option 1: LMF can initiate the corresponding location measurement procedure at or close to the scheduled location time;
* Option 2: LMF can send the Scheduled Location Time to NG-RAN and UE in order to trigger measurements at or close to the scheduled location time;

According to the Summary of agenda 8.11.2 [1] and RAN2 on-line discussion, both of the two options can meet SA2's requirement that the LMF must obtain a current location of the UE at or close to the scheduled location time. However, the difference between the two options lies in whether the location information of the UE can be accurately reflected. So most companies think the scheduled location time does not provide more benefits in the reduction of the LCS latency during execution phase of the positioning procedure.

**Question 2: Do you agree that the scheduled location time does not provide more benefits in the reduction of the LCS latency during execution phase of the positioning procedure？ Please share your comments here.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| Qualcomm | Yes, with comment | With the scheduled locaton time, the latency the client observes is the delay between the time of fix and when it is available to the client. With the scheduled location time the time of fix should be (ideally) T (as requested by the client), and the latency comprise the location measurement time and signalling delay to the client. Since there is no change to e.g., architecture and signalling involved, the signalling latency of the location execution phase does not change. |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| Xiaomi | Yes |  |
| OPPO | Yes |  |
| Apple | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| InterDigital | Yes |  |
| vivo | Yes |  |
| Lenovo, Motorola Mobility | Yes |  |
| Intel | Yes |  |
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**Summary:**

## 4.2 Specification impact

With regard to the impact of specification, based on the Summary of agenda 8.11.2 [1], there are two options:

* Option A: The scheduled location time does not need to be indicated to the UE or NG-RAN, since the LMF can implicitly trigger the positioning procedures at or close to it. Therefore, it is transparent to UE/NG-RAN stage-3 positioning procedures.
* Option B: Latency reduction can be accomplished by sending the scheduled location time T to the UEs and TRPs in order to trigger measurements at or close to it. Therefore, LPP and/or Napa signaling needs to be updated to indicate this information.

It is mainly related to the discussion of the previous chapter, if the above Q2 can be confirmed by most companies, it can be assumed that from the specification impact point of view, the scheduled location time T is transparent to UE/NG-RAN stage-3 positioning procedures.

**Question 3: Do you agree that the scheduled location time T is transparent to UE/NG-RAN stage-3 positioning procedures？Please share your comments here.**

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| --- | --- | --- |
| Company | Yes/ No | Comments |
| Qualcomm | No | Without providing the Scheduled Location Time T to the UE and TRPs, the LMF cannot reliably determine the UE location at the scheduled location time, and therefore, the location estimate returned to an LCS Client for a scheduled location time cannot be treated by the LCS Client as a reliable estimate of the location of the UE at the scheduled location time.  With the current LPP specification, the time when the UE should obtain the measurements/location estimate cannot be controlled by an LMF. The available LPP Response Time defines the time when to send a measurement report (at the latest), but not the time when the location measurements should be obtained/valid. The measurements/location estimate may be valid anywhere within the response time, which for some positioning methods could be relatively large.  Providing the scheduled location time (with uncertainty/measurement window) to the UE/TRPs would allow an LMF to more reliably control/trigger the UE and TRP measurements at or close to the scheduled location time. |
| ZTE | Yes | Only LMF knows the scheduled location time is enough. LMF knows the deadline(scheduled location time) for preparation phase, then LMF will schedule the request and AD transfer before the deadline. UE/NG-RAN node will perform measurements subsequently without the guidance of scheduled location time. |
| Ericsson | Yes | Agree with ZTE. The global time T can be transparent to UE/NG-RAN. The measurement window can still be defined in local time instances (SFN, Slot Number) by the LMF. |
| Xiaomi | Yes | The LMF can trigger The LPP location information request and/or NRPPa measurement request at or near to the scheduled location time T and then the UE and/or gNB can perform positioning measurement at or near the scheduled location time. |
| OPPO | Yes | It seems that LMF could predict the time between gNB transmitting of the LocationInformationRequest and UE reception of the msg. Therefore, UE could perform the measurement at the scheduled location time |
| Apple | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | No | We understand the motivation for providing the Scheduled Location Time to the UE as proposed above. As commented online, we think the provision of scheduled location time to the UE is a more precise version of the current responseTime in the LPP message. If such modification is considered to be beneficial, we are ok to adopt it.  Another solution with less spec impact is to reuse the LPP responseTime for UE measurement and add a new field similar to responseTime in the LPP spec to the NRPPa spec for the gNB measurement.  Our concern is mainly on the RAN4 impacts. How does it work with the requirement for measurement period for PRS RSRP, DL-TDOA and UE rx-tx time difference for UE measurement and for SRS RSRP, UL-TDOA, gNB rx-tx time difference for gNB measurement. In TS 38.133, for example, for DL-TDOA measurement, the following requirement is defined 9.9.2.5 Measurements Period Requirements When physical layer receives last of *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from LMF via LPP [34]*,* the UE shall be able to measure and report multiple (up to the UE capability specified in Clause 9.9.2.3) DL RSTD measurements, defined in TS 38.215 [4], during the measurement period defined as:    What is the relationship between the received [T-offset, T+offset] with the above [RLI, T\_RSTD,Total]? What shall the UE do if it cannot perform enough measurements up to the UE capability within the window [T-offset, T+offset]? |
| InterDigital | No | We have a similar understanding with Qualcomm on this issue in that it is unclear how the UE or TRPs are able to perform measurements at T such that the UE location can be determined precisely at time T without the common knowledge of scheduled location time T.  For implicit triggering from LMF (Option A), it is possible that the measurements made may correspond to a UE location which may lie anywhere between the time when the trigger (i.e. LPP request location information) is received at UE and the response time. If Option A is used, it is also unclear if such possible deviation from the UE’s supposed location at T can be tolerated by the LCS client, especially for scenarios where the UE may be fast moving. |
| Qualcomm-2 |  | Reading some of the comments above, I believe there is some confusion. The Question seem not precisely formulated:  (1) **"T transparent to RAN"**:  The scheduled location time T per se (i.e., T as received from an LCS client), would not directly be forwarded/provided to the UE/NG-RAN. The LMF would have to translate this into a measurement time/window suitable for the positioning method (e.g., SFN/slot, GPS time, etc.). I'm not sure if this is meant by "T transparent to RAN"?  (2) **"T is transparent to the positioning procedures"**  This cannot be the case, since an LMF would still need to schedule the individual steps of the location procedure (e.g., provide assistance data, request location information, etc.) such that the location at T can be obtained.  On RAN4 requirements, there should be no impact since the response time/measurement period requirements per se do not need to be affected. However, this is supposed to be a Rel-17 feature, and whether RAN4 requirements would be beneficial or not can be decided by RAN4.  A new interpretation/definition of the Rel-9 LPP Response Time would not be backwards compatible. The LPP Response Time is defined by the signalling requirements of Request/Provide Location Information. The "scheduled location time" should be defined based on the actual measurement time requirements.  Actually, I think the current RAN4 requirements are anyhow related to a "measurement response time" and not the LPP Response Time, since the LPP Response Time would also include the time for requesting/providing measurement gaps, requesting providing additional assistance data, etc.. |
| vivo | Yes | In the LS from SA2, the measurement result is expected to be obtained at or close to the schedule location time. Meanwhile, the format of parameter T has not decided yet.  We think the timing to send out the measurement request can be seen as the schedule location time, which is quite close and no need to introduce the response time in NRPPa.  Whether the potential latency could meet the requirement of SA2 can be re-evaluated after the format/time-unit of the T is decided in SA2, if needed. |
| Lenovo, Motorola Mobility | No, see comments | Agree with QC’s view that the currently configured response time is the latest at which the LMF can hope to receive the UE positioning measurements. Depending on the number and type of positioning methods configured, this time can vary considerably within the current minimum 1s response time window. On HW’s doubt, we think that the UE should capable of dropping measurements not meeting the measurements within the configured window. Alternatively, the measurements can be reported outside the window in a best effort manner, although the measurements will be received by the LMF at a later time (outside the latency budget). |
| Intel | Yes (see comment) | As per QC’s comment, we agree that the scheduled location time T does not need to be forwarded to the UE/NG-RAN per se. So, in that sense, we agree that scheduled location time indication is transparent to RAN.  Then, in our view, the real question is whether there is impact to positioning procedures when taking scheduled location time into consideration. In this regard, we have similar thinking as Huawei in that scheduled location time enhancement here translates to responseTime signaling to the UE and the LMF sets this field considering the scheduled location time without explicitly having to indicate the latter to the UE. This is the only interpretation in which T is considered as transparent to positioning procedures in RAN.  Regarding RAN4 measurement requirement, we think scheduled location time will not have impact on RAN4 measurement requirement since the LMF should take current measurement requirement into account when set response time and do the preparation by taking into account scheduled location time, measurement requirement. But we assume anyway it is up to RAN4 to discuss |
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## 4.3 Discussion about draft Reply LS

Based on the previous discussion, we draft the following contents of the Reply LS：

**1. Overall Description:**

RAN2 would like to thank SA2 for the LS on scheduled location time.

RAN2 thinks that this is for a specialised use case where the preparation phase can be handled earlier, but the scheduled location time does not provide more benefits in the reduction of the LCS latency during execution phase.

In addition, from the specification impact point of view, the LMF can implicitly trigger the positioning procedures at or close to the time point. Therefore, it is transparent to UE / NG-RAN stage-3 positioning procedures.

**2. Actions:**

**To SA2:**

RAN2 respectfully requests SA2 to take the above information into account.

**3. Date of Next RAN2 Meetings:**

TSG-RAN2 Meeting #116e 01 - 11 Nov 2021 Electronic Meeting

TSG-RAN2 Meeting #116bis-e 17 - 26 Jan 2022 Electronic Meeting

**Question 4: Do you agree with the above contents？Please share your comments in the table.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/ No | Comments |
| Qualcomm | No | The original question from SA2 in R2-2102665 was:  "SA2 would like to ask RAN1 and RAN2 whether support can be provided for a scheduled location time as part of Rel-17 and as defined in the attached CR to TS 23.273."  This question hasn't been answered yet. Instead, RAN2 sent several questions for clarification at RAN2#113bis-e.  The response LS to RAN2's questions in R2-2106968 included a further question for RAN2:  **Question A:** in order to get a clear view from RAN WG, SA2 sincerely ask RAN2 to investigate whether Scheduled Location Time could help the reduction of the LCS latency.  Therefore, RAN2 should (at least) answer this question (and not speculate or comment on e.g., user case, etc. )  For Question A, we suggest the following response (see also our input to this meeting (R2-2108376)):  "A scheduled location time T allows the latency for obtaining and reporting the location of a target device to be reduced by the duration of the location preparation phase which allows substantial reduction of latency. With the RAN2 assumptions summarized in TR 38.857, the latency reduction can be:  DL+UL NR positioning methods: Latency reduction of more than 62 %  UL-only NR positioning methods: Latency reduction of more than 78 %  DL-only NR positioning methods: Latency reduction of more than 50 %".  If there are concerns with the actual numbers (although, they are all based on TR 38.857), we would also be O.K. with a single sentence:  "A scheduled location time T allows the latency for obtaining and reporting the location of a target device to be reduced by the duration of the location preparation phase which allows substantial reduction of latency." |
| ZTE | Yes | Agree with the LS content |
| Ericsson | Yes |  |
| Xiaomi | Yes |  |
| OPPO | Yes |  |
| Apple | Yes, but | The text need to be polished, I will edit the draft directly |
| CATT | Yes |  |
| Huawei, HiSilicon | No | The LS can be drafted with the conclusion of the above discussion. |
| InterDigital | No | Similar understanding with Huawei in that the text in LS should be drafted upon reaching conclusion in RAN2 on whether scheduled location time results in latency reduction. |
| vivo | Yes |  |
| Lenovo, Motorola Mobility | No | Disagree that the scheduled location time T should be transparent to the UE/NG-RAN and the LS should be further discussed. |
| Intel | Yes | We think it is important to reach conclusion to Q3 before sending the LS |
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# 5 Conclusion

TBD