3GPP TSG-RAN WG2 Meeting #114-e***R2-2106449***

Electronic, May 19 – May 27, 2021

**Agenda item:** 8.11.2

**Source:** CATT

**Title:** Summary of Agenda Item 8.11.2: Positioning Latency Enhancements

**Document for:**  Discussion and Decision

# 1. Introduction

This document summarizes the following contributions submitted for Agenda Item 8.11.2 on enhancements of signalling, and procedures for positioning latency reduction:

1. R2-2104844 Enhancement for positioning latency vivo discussion NR\_pos\_enh-Core
2. R2-2104845 Discuss Scheduling Location in Advance to reduce Latency vivo discussion NR\_pos\_enh-Core
3. R2-2104922 Scheduled location time based latency reduction Intel Corporation discussion Rel-17 NR\_pos\_enh R2-2102849
4. R2-2105142 Discussion on scheduled location time for latency reduction CATT discussion Rel-17 NR\_pos\_enh-Core
5. R2-2105219 Discussion on positioning latency Huawei, HiSilicon discussion Rel-17 NR\_pos\_enh-Core
6. R2-2105302 Discussion on Enhancements for Latency Reduction InterDigital, Inc. discussion Rel-17 NR\_pos\_enh
7. R2-2105523 Further consideration of positioning latency enhancments OPPO discussion Rel-17 NR\_pos\_enh-Core
8. R2-2105557 Discussion on UE capability regarding positioning latency BEIJING SAMSUNG TELECOM R&D discussion Rel-17
9. R2-2105560 Positioning enhancements on latency reduction Xiaomi discussion
10. R2-2105600 Positioning Latency Reduction Enhancements Lenovo, Motorola Mobility discussion Rel-17
11. R2-2105968 "For latency reduction Need of QoS info in gNB and positioning capability storage" Ericsson discussion Rel-17
12. R2-2105973 draft LS to different groups Ericsson discussion Rel-17
13. R2-2106082 Scheduling Location in Advance to Reduce Latency Qualcomm Incorporated discussion
14. R2-2106261 Discussion on latency reduction for positioning CMCC discussion Rel-17 NR\_pos\_enh-Core
15. R2-2106367 Latency reduction via configured grant for positioning Samsung Electronics discussion NR\_pos\_enh-Core
16. R2-2106368 Discussion on the scheduled location time Samsung Electronics discussion NR\_pos\_enh-Core
17. R2-2106376 posSI request enhancement for latency reduction Samsung R&D Institute UK discussion
18. R2-2106426 Discussion on positioning latency reduction ZTE Corporation, Sanechips discussionRel-17 NR\_pos\_enh-Core

# 2. Overview of the main topics discussed to reduce positioning latency

|  |  |
| --- | --- |
| Topic | Company/Contribution |
| Scheduled location time | R2-2104845 vivo  R2-2104922 Intel Corporation  R2-2105142 CATT  R2-2105219 Huawei, HiSilicon  R2-2105560 Xiaomi  R2-2105600 Lenovo, Motorola Mobility  R2-2105968/ R2-2105973 Ericsson  R2-2106082 Qualcomm Incorporated  R2-2106368 Samsung Electronics |
| using stored/preconfigured assistance data together with procedures/rules on how to trigger a UE to use previously provided assistance data | R2-2104922 Intel Corporation  R2-2105302 InterDigital, Inc.  R2-2105560 Xiaomi  R2-2105600 Lenovo, Motorola Mobility |
| Response time | R2-2105219 Huawei, HiSilicon  R2-2105557 BEIJING SAMSUNG TELECOM R&D  R2-2105600 Lenovo, Motorola Mobility  R2-2106426 ZTE |
| Prioritization of measurements/reports | R2-2105302 InterDigital, Inc.  R2-2105523 OPPO  R2-2105600 Lenovo, Motorola Mobility  R2-2106261 CMCC |
| lower-layer triggered requesting of measurements | R2-2105523 OPPO |
| configured CG grant | R2-2105523 OPPO  R2-2105560 Xiaomi  R2-2105600 Lenovo, Motorola Mobility  R2-2106367 Samsung Electronics |
| Storing Capability | R2-2105968 Ericsson |
| posSI | R2-2106376 Samsung R&D Institute UK |

# 3. Discussion

## 3.1 Scheduled location time

Multiple contributions discuss the reply LS on the scheduled location time from RAN2 [19] and the understanding on the CR in SA2 in S2‑2102047 [20].

The company proposals related to this topic are summarized in the Table below.

|  |  |
| --- | --- |
| Scheduled location time | |
| R2-2104845 vivo | Observation 2: T is a time slot end of the location preparation phase and in advance of the location execution phase.  Proposal 1: The timing of UE received LPP Request Location Information (the start time of physical layer latency) can be seen as the scheduled location time.  Proposal 2: T is provided from LMF by NRPPa, and should be transparent to UE.  Proposal 3: Scheduled Location Time can support both report one time and several times by indicating in the location request  Observation 3: Question 5 can be resolved if we support the proposal 1 and proposal 2. |
| R2-2104922 Intel Corporation | Observation 2: The LPP RequestLocationInformation message already includes the expected response time for the UE/NG-RAN to perform positioning measurements and additionally providing the scheduled location time may be redundant. |
| R2-2105142 CATT | Observation 1: The scheduled location time is provided by a requesting LCS Client, AF or the UE and transferred to the LMF. The scheduled location time requires the moment at which UE’s location is.  Proposal 1: For the solution of latency optimization from SA2, neither the scheduled location, nor the scheduled measurement time will be forwarded to gNB from LMF in UL positioning methods of UE-Assisted mode.  Proposal 2: For the solution of latency optimization from SA2, neither the scheduled location, nor the scheduled measurement time will be forwarded to UE/gNB from LMF in DL positioning methods of UE-Assisted mode.  Proposal 3: From the reduction of periodic reporting latency point of view, the additional scheduled location time will not be introduced to UE in UE-Assisted mode.  Proposal 4: For the solution of latency optimization from SA2, the scheduled location time may be forwarded to UE from LMF in UE-Based mode. |
| R2-2105219 Huawei, HiSilicon | Proposal 1: There is no RAN2 stage3 spec impacts for scheduled location time. |
| R2-2105560 Xiaomi | Observation 1: if the scheduled location time is the time which the LMF must obtain the UE location, the NRPPa message should be enhanced.  Observation 2: if the scheduled location time is the time which the UE or NG-RAN obtains the location measurements, the UE and/or NG-RAN can’t assure to perform positioning measurement at scheduled location time.  Proposal 1: Whether UE and NG-RAN can perform positioning measurement at scheduled location time should be evaluated. |
| R2-2105600 Lenovo, Motorola Mobility | Observation 2: There is a distinction between the Scheduled time (Tscheduled) and the expected location time (T) in which the LCS Client/AF/UE is anticipating the location estimate.  Observation 3: Splitting the scheduled time offers enhanced control and predictability of the final location estimate.  Proposal 1: RAN2 to clarify the definitions of “scheduled location time” and “expected location time” from RAN perspective, where:  • Scheduled location time, Tscheduled: Duration between transmitting LCS request message from LCS Client/AF/UE(internal LCS client) to LMF and receipt of LPP RequestLocationInformation message at UE.  • Expected location time, T: Duration between transmitting LCS request message from LCS Client/AF/UE(internal LCS Client) and receipt of LCS response message at external/internal LCS Client or AF.  Proposal 2: RAN2 to consider splitting the scheduled time into two parts for better predictability and control and easier tracking from the RAN side:  • The LMF configuring/indicating the response time between receipt of RequestCapability and ProvideCapabilites messages.  • The LMF configuring/indicating the time between receiving the (pre-)configured assistance data (e.g. via posSIB/ProvideAssistanceData message) and receiving the RequestLocationInformation message |
| R2-2105968/ R2-2105973 Ericsson | Observation 1 In Factory/IIOT scenario because of some synchronized event requirement several devices may need to be Positioned at the same time. Besides in other scenarios also having QoS for positioning information would enable efficient resource allocation.  Proposal 1 Time T and Positioning QoS information is provided to gNB for resource allocation and prioritizations.  Proposal 2 Liase with RAN3 for QoS Positioning latency and accuracy info input from LMF to gNB in NRPPa as specified in R2-2105973. |
| R2-2106082 Qualcomm Incorporated | Observation 1: The scheduled location time for the NG-RAN and/or UE positioning procedure corresponds to the location measurement time. I.e., the time when the location estimate is to be valid.  Observation 2: The LPP Provide Location Information messages in the case of UE-based mode include the time stamp when the location estimate is valid/has been performed. The granularity for this time stamp is SFN/slot for the NR positioning methods, up to 250ns for GNSS positioning, and 1sec for common positioning (e.g., standalone mode).  Observation 3: The LPP Provide Location Information message in the case of UE-assisted mode includes the time stamp when the location measurements have been performed. Dependent on the positioning method, either a single time stamp for the whole set of provided measurements is included, or a time stamp for each individual measurement is included. The granularity for this time stamp is SFN or SFN/slot for the RAT-dependent positioning methods, up to 250ns for GNSS positioning, and 1sec for other RAT-independent positioning methods.  Observation 4: No changes to the LPP Provide Location Information messages for the currently defined LPP positioning methods seem required to support the Location Scheduling in Advance according to the SA2 CR in [2].  Observation 5: The NRPPa Measurement Response messages include the time stamp when the location measurements have been performed. The granularity for this time stamp is SFN/slot or the granularity of the SFN Initialisation Time (2-32 seconds ~ 233 pico-seconds).  Observation 6: No changes to the NRPPa Measurement Response messages seem required to support the Location Scheduling in Advance according to the SA2 CR in [2].  Observation 7: For aperiodic SRS, the NRPPa Measurement Request can already include a "Requested Location Time" in form of SFN/slot defining the aperiodic SRS transmission of the UE.  Proposal 1: Include a "Requested Location Time" with uncertainty window in CommonIEsRequestLocationInformation, defining the desired time when the location estimate is to be obtained. In the case of UE-assisted mode, the uncertainty defines the time window within which the location measurements should be performed.  Proposal 2: The existing System Frame Number/Slot Number in the NRPPa Measurement Request message should be generalized to define the "Requested Location Time" (i.e., applicable also for periodic/semi-persistent SRS). Include a measurement time window in the NRPPa Measurement Request message within which the UL measurements are to be made. |
| R2-2106368 Samsung Electronics | Proposal 1: RAN2 further discuss the impact of these optimizations i.e., regarding pre-configuration of necessary information and triggering command later on RAN2 specification and the necessity of and how to realize the scheduled location time. |

**Summary:**

From the submitted contributions which discuss this topic, the understanding on the questions in rely LS from RAN2 and analyse how scheduling timer works for latency are summarized as three aspects:

1. Understanding on scheduled location time

The understanding on scheduled location time is discussed in contributions. These views are summarized as two types:

* Option A: the timing
  + The time when the location estimate is to be valid, corresponding to the location measurement time.
  + Or take as the timing of UE received LPP Request Location Information (the start time of physical layer latency)
* Option B: the duration
* Duration between transmitting LCS request message from LCS Client/AF/UE(internal LCS client) to LMF and receipt of LPP RequestLocationInformation message at UE.
  + - Expected location time, T: Duration between transmitting LCS request message from LCS Client/AF/UE(internal LCS Client) and receipt of LCS response message at external/internal LCS Client or AF.

Rapporteur's comments:

Although the reply LS from RAN2 is under discussion in SA2 #145-e now and there will be a conclusion after the meeting, RAN2 may still discuss the understanding of scheduled location time before the analysis of impact at first. Eventually RAN2 will align the understanding with SA2 after the feedback from SA2.

1. Impacts on LPP analysis

The corresponding impacts on LPP exist in contributions, so three options are summarized for discussion:

* Option A: no LPP Stage3 specification impacts: T should be transparent to UE.
* Option B: the scheduled location time is provided to UE both in UE-Assisted and UE-based mode:
  + FFS the values for the scheduled location time T
* Option C: the scheduled location time is provided to UE only in UE-based mode.
  + The time budget can be controlled by LMF in UE-Assisted mode

1. Impacts on NRPPa analysis

The corresponding RAN specification impacts on NRPPa exist in contributions, there are three options for discussion:

* Option A: neither the scheduled location nor the scheduled measurement time will be forwarded to gNB in UL positioning methods.
* Option B: the scheduled location time is provided to gNB:
  + FFS any additional "QoS information" which may need to be conveyed

Rapporteur's comments:

The candidate solution for latency reduction may focus on DL and DL+UL positioning methods at first, according to the scope of WID. How much the latency reduction can be achieved should also be evaluated on the candidate options.

**Proposals for Discussion:**

**Proposal 1:** **Discuss the understanding on scheduled location time within two types:**

* **Option A: the timing**
  + The time when the location estimate is to be valid, corresponding to the location measurement time.
  + Or take as the timing of UE received LPP Request Location Information (the start time of physical layer latency)
* **Option B: the duration**
  + Duration between transmitting LCS request message from LCS Client/AF/UE(internal LCS client) to LMF and receipt of LPP RequestLocationInformation message at UE.

**Proposal 2:** **Continue evaluation of the LPP impacts for supporting a scheduled location time including the following options:**

* **Option A: no LPP Stage3 specification impacts: T should be transparent to UE.**
* **Option B: the scheduled location time is provided to UE both in UE-Assisted and UE-based mode:** 
  + **FFS the values for the scheduled location time T**
* **Option C: the scheduled location time is provided to UE only in UE-based mode.**

**Proposal 3:** **Continue evaluation of the NRPPa impacts for supporting a scheduled location time including the following options:**

* **Option A: neither the scheduled location nor the scheduled measurement time will be forwarded to gNB in DL+UL positioning methods.**
* **Option B: the scheduled location time is provided to gNB:** 
  + **FFS any additional "QoS information" which may need to be conveyed and LS to RAN3**

## 3.2 Preconfigured assistance data

Contributions discuss on the support of using stored/preconfigured assistance data together with procedures/rules. Company proposals on this topic are summarized in the table as below:

|  |  |
| --- | --- |
| using stored/preconfigured assistance data together with procedures/rules on how to trigger a UE to use previously provided assistance data | |
| R2-2104922 Intel Corporation | Proposal 1: RAN2 is proposed to confirm that in order to accomplish latency reduction related to reporting and request of positioning assistance data, pre-configuration of assistance data to the UE during the location preparation phase shall be supported.  Proposal 2: Existing LPP/NRPPa and RRC procedures can be utilized for pre-configuration of positioning assistance data for measurements to the UE.  Proposal 3: The UE shall retain the pre-configured positioning assistance information without having to perform positioning measurements until it is triggered to do so.  Proposal 4: In case of NI-LR/MT-LR and deferred MT-LR, the location information request from the LMF can serve as an indication to the UE to utilize the pre-configured assistance data to perform positioning measurements during the location execution phase.  Proposal 5: In case of MO-LR, it is up to the UE to determine and indicate the scheduled location time to the core network in order to obtain pre-configured assistance data in advance of the location execution phase. |
| R2-2105302 InterDigital, Inc. | Observation 1: Enhancements for LPP assistance data transfer procedure should take into account of network-initiated and UE-initiated scenarios for requesting/sending assistance data  Observation 2: Reconfiguring PRS configuration via assistance data update can result in significant latency  Observation 3: Measurement driven DL PRS reconfiguration based on preconfigured PRS is beneficial and effective for latency reduction  Proposal 2: Support using preconfigured assistance information (e.g. PRS configuration) in UE for making measurements on DL-PRS and sending measurement reports/location estimates  Proposal 3: The UE is configured with validity conditions (e.g. time validity, area validity) when supporting preconfigured assistance data containing PRS configurations  Proposal 4: The UE uses the stored assistance information (e.g. PRS configuration) so long as the associated validity conditions are met  Proposal 5: Support dynamic triggering of a preconfigured PRS at UE by LMF or gNB for making measurements on DL-PRS  Proposal 6: Support dynamic triggering of a preconfigured SRSp at UE by gNB for transmitting SRSp based on measurement report provided by UE |
| R2-2105560 Xiaomi | Proposal 2: LMF provides PRS configurations to gNB, and the PRS configurations can be pre-configured to UE by the gNB before UE performing positioning. |
| R2-2105600 Lenovo, Motorola Mobility | Proposal 3: Existing procedures can be utilised to provide the (pre-)configured assistance data to support obtaining the location estimate in advance.  Proposal 4: Support priority indications for multiple (pre-)configured assistance data sets corresponding to multiple position fixes for UE-based and UE-assisted positioning. Send LS to RAN1 for feedback on associated impacts to the physical layer DL-PRS configuration. |

**Summary:**

Contributions discuss the support of using stored/preconfigured assistance data together with procedures/rules on how to trigger a UE to use previously provided assistance data. How to config pre-config DL PRS and how to trigger to use it are summarized as below:

* How to preconfigure assistance information (e.g. PRS configuration):
  + Option A: The UE is configured with validity conditions (e.g. time validity, area validity) when supporting preconfigured assistance data containing PRS configurations
  + Option B: Support dynamic triggering of a preconfigured PRS at UE by LMF or gNB for making measurements on DL-PRS
  + Option C: Support priority indications for multiple (pre-)configured assistance data sets corresponding to multiple position fixes for UE-based and UE-assisted positioning.
  + Option D: Support dynamic triggering of a preconfigured SRSp at UE by gNB for transmitting SRSp based on measurement report provided by UE
* How to trigger to utilize the retained pre-configured positioning assistance information in UE:
  + Option A: The location information request may serve as an indication to the UE to utilize the pre-configured AD when NI-LR/MT-LR and deferred MT-LR, and UE indicates the scheduled location time to core network in order to obtain pre-configured assistance data.

**Proposals for Discussion:**

**Proposal 4:** **Continue evaluation of the signalling and procedures to support pre-configuration of assistance data to the UE during the location preparation phase on how to preconfigure assistance information (e.g. PRS configuration):**

* **Option A: The UE is configured with validity conditions (e.g. time validity, area validity) when supporting preconfigured assistance data containing PRS configurations**
* **Option B: Support dynamic triggering of a preconfigured PRS at UE by LMF or gNB for making measurements on DL-PRS**
* **Option C: Support priority indications for multiple (pre-)configured assistance data sets corresponding to multiple position fixes for UE-based and UE-assisted positioning.**
* **Option D: Support dynamic triggering of a preconfigured SRSp at UE by gNB for transmitting SRSp based on measurement report provided by UE**

**Proposal 5:** **Continue evaluation of the signalling and procedures to support pre-configuration of assistance data to the UE during the location preparation phase on how to trigger to utilize the retained pre-configured positioning assistance information in UE:**

* **Option A: The location information request may serve as an indication to the UE to utilize the pre-configured AD when NI-LR/MT-LR and deferred MT-LR, and UE indicates the scheduled location time to core network in order to obtain pre-configured assistance data.**

## 3.3 Response time

Granularity of Response time and related capability are discussed in contributions. The company proposals related to this topic are summarized in the Table below.

|  |  |
| --- | --- |
| Response time | |
| R2-2105219 Huawei, HiSilicon | Proposal 2: Extend the value of the “unit” field to include the “ten-mini-seconds” in “ResponseTime” field in TS 37.355. |
| R2-2105557 BEIJING SAMSUNG TELECOM R&D | Proposal 1: RAN2 to introduce a new capability for the support of latency reduction in the ProvideCapabilities message body. |
| R2-2105600 Lenovo, Motorola Mobility | Observation 5: RequestLocationInformation and ProvideLocationInformation messages contribute a combined 30% of the total latency UE assisted DL-TDOA and DL-AoD positioning methods.  Observation 6: The existing configured minimum response times of 1000ms between receipt of the RequestLocationInformation and transmission of a ProvideLocationInformation (measurement report, location estimate) do not fall within the target 100ms end-to-end latency requirements and can be further optimized.  Proposal 5: Introduce additional finer time granular values for the responseTime IE. FFS the values to be supported and consultation with RAN1 may be necessary based on feasibility of aspects related to UE capability, measurement processing times, etc. |
| R2-2106426 ZTE | Observation 3: By configure a proper value of responseTimeEarlyFix according to the subset of reference signals from DL PRS in LPP ProvideAssistanceData message for a specific positioning service, LMF can receive the early location information report earlier than before.  Proposal 3: RAN2 shall send an LS to RAN4 to trigger the discussion about whether new granularity of the responseTimeEarlyFix is needed in Rel-17 |

**Summary:**

Companies mentioned that the current TS 37.355, the minimum representable value of the response time (1sec) is too large to meet the Rel-17 latency requirement (100ms), so they proposed:

* extend the value of the “unit” field to include the “ten-mini-seconds” in “ResponseTime” field in TS 37.355,
* send an LS to RAN4 to trigger the discussion about whether new granularity of the responseTimeEarlyFix is needed in Rel-17.

Rapporteur's comments:

Companies commented that the response time depends on the needed granularity based on the solutions we evaluate during the online of #113bis-e. There is no such evaluated result in contributions of RAN2 so far.

**Proposals for Discussion:**

**Proposal 6:** **Discuss if the LS to RAN4 to trigger the discussion about whether new granularity of the responseTimeEarlyFix is needed in Rel-17.**

## 3.4 Prioritization of measurements/reports

Company proposals on prioritization of measurements/reports are summarized in the table below:

|  |  |
| --- | --- |
| Prioritization of measurements/reports | |
| R2-2105302 InterDigital, Inc. | Observation 4: The configuration of priority rules and indication of priority for PRS can be dependent on the latency requirement of the supported positioning service  Proposal 7: Support priority rules for determining prioritization of DL PRS measurement and reporting of measurements/location estimates  Proposal 8: The existing LPP and RRC/MAC procedures can be enhanced for indicating priority rules and supporting prioritized DL PRS measurements/reporting |
| R2-2105523 OPPO | Observation 3: both of the allowedPHY-PriorityIndex and allowedCG-List, introduced in the R16 URLLC WI, could help reduce the latency regarding the location measurement report to be carried on the dynamic grant and configured grant, respectively.  Proposal 1: RAN2 to agree that no RAN2 impact is foreseen for reducing the latency regarding the transmission of the location report. |
| R2-2105600 Lenovo, Motorola Mobility | Observation 7: Priority indications for measurements and reporting enable more aggressive scheduling of low latency positioning reports for computing the first fix of the location estimate.  Proposal 6: RAN2 considers the support and configuration of priority rules associated to configured measurements and associated reports. FFS on how to indicate the measurement priority and optionally associated response time. |
| R2-2106261 CMCC | Observation: In the study phase, priority rules for the reception of DL PRS are listed as the potential solution for the collision handling rule to reduce the latency.  Proposal: RAN2 is kindly asked to support physical layer priority rules for the reception of DL PRS and DL signals/channels carrying LPP signaling. |

**Summary:**

Company contribution [R2-2105302] proposed to support priority rules for determining prioritization of DL PRS measurement and reporting of measurements/location estimates, accordingly, LMF can determine the priority rules and inform the UE or gNB via LPP/NRPPa message. Additionally, company contribution [R2-2106261] mentioned: for the DL signals/channels carrying LPP signaling, DCI can be reused to configure the priority to UE and the priority is informed to the gNB via NRPPa message from the LMF. Besides, based on the description of company contribution [R2-2105523], both of the allowedPHY-PriorityIndex and allowedCG-List, introduced in the R16 URLLC WI, can be reused to reduce the latency regarding the location measurement report to be carried on the dynamic grant and configured grant. But from our understanding, this is about how does gNB configure signaling to support minimal latency for location reporting from UE. Additionally, company contribution [R2-2105600] proposed to support priority rules associated to multiple measurements and associated reports.

According to these contributions, RAN2 needs to discuss the following possible enhancements:

* Option A: Support of prioritization handling of DL PRS measurement
* Option B: Support of prioritization handling of reporting of measurements/location estimates
* Option C: Support of prioritization handling of DL signals/channels carrying LPP signaling
* Option D: Support of priority rules associated to multiple fixes of measurements and associated reports

**Proposals for Discussion:**

**Proposal 7: For prioritization of measurements/reports, RAN2 to discuss the options of prioritization of measurements/reports for latency reduction as below:**

* **Option A: Support of prioritization handling of DL PRS measurement**
* **Option B: Support of prioritization handling of reporting of measurements/location estimates**
* **Option C: Support of prioritization handling of DL signals/channels carrying LPP signaling**
* **Option D: Support of priority rules associated to multiple fixes of measurements and associated reports**

## 3.5 Lower-layer triggered requesting of measurements

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| --- | --- |
| lower-layer triggered requesting of measurements | |
| R2-2105523 OPPO | Observation 1: Although the decoding latency of RRC and LPP msg is avoided, the lower-layer triggered requesting of measurement approach involves two other latency components: decoding work for the NRPPa and generating the lower layer signalling at the gNB.  Observation 2: sending the location report via RRC msg and NRPPa msg from UE to gNB, and then from gNB to LMF involves the coding/decoding of RRC msg latency, which introduces a lot also to overall latency. |

**Summary:**

From LMF to UE, the decoding latency of RRC and LPP message and the latency spent on decoding NRPPa message and generating lower layer signalling at the GNB can offset each other. However, the latency of sending the location report via RRC and NRPPa message introduce additional latency. Therefore, the enhancement in this aspect has no obvious gain.

So there is no proposal for online discussion here.

## Configured UL grant for location reports

The company proposals related to this topic are summarized in the Table below.

|  |  |
| --- | --- |
| Configured UL grant for location reports | |
| R2-2105523 OPPO | Observation 4: sending the location measurement/ estimation results on the dynamic UL grant is considered to be time-consuming.  Proposal 2: RAN2 to agree that NRPPa msg should support the transmission of the PRS measurement period and starting position in time of the other TPRS to the serving gNB from LMF for configuring proper CG for UE to send location measurement/location estimation results towards the serving gNB for deferred 5GC-MT LR. |
| R2-2105560 Xiaomi | Proposal 3: The LMF can provide an indication to gNB and then gNB decides to configure/activate CG resource or deactivate/release the CG resource for UE transmitting location measurements or location estimate based on the indication.  Proposal 4: LMF can provide assistance information to assist gNB to decide appropriate CG resource for UE transmitting location measurements or location estimate. |
| R2-2105600 Lenovo, Motorola Mobility | Observation 8: Although CG-based solution is intended for ProvideLocationInformation messages, it can be equally applicable to other UL LPP messages.  Observation 9: The impact of CG-based measurement reporting will also be tackled during the RRC\_INACTIVE positioning discussion.  Proposal 7: Support CG-based solution for reporting the positioning measurements or location estimate in RRC\_CONNECTED state. CG solution is assumed to be supported for RRC\_INACTIVE states based on SDT framework. RAN3 input may be required for associated impacts.  Proposal 8: Introduce additional finer time granular values for the reportingAmount and reportingInterval IEs corresponding to a periodical reporting configuration. FFS the values to be supported to align with CG-based solution. |
| R2-2106367 Samsung Electronics | Proposal 1. RAN2 discuss which method between LMF based or UE based CG configuration indication is better to reduce the total latency on measurement reporting. |

**Summary:**

All company contributions support to use configured UL grant for location reports. According to company contribution [R2-2106367], there are two ways to deliver the CG information to the gNB, via UE or via LMF directly, RAN2 should discuss which method is better to reduce the total latency on measurement reporting. Furthermore, company contribution [R2-2105600] proposed to address the CG-based solution for measurement reporting, irrespective of the UE state of operation. And to align with CG-based solution, additional finer time granularities need to be introduced for both *reportingAmount* and *reportingInterval* IEs, which are part of the *periodicalReporting* configuration in LPP. Additionally, company contribution [R2-2105523] mentioned that NRPPa message should support the transmission of the PRS measurement period and starting position in time of the other TRPs to the serving gNB from LMF for configuring proper CG for UE.

According to these contributions, the proposals discuss the following possible enhancements:

* Which method to deliver the CG information to the gNB
  + CG configuration information via LMF
  + CG configuration information via UE
* Support of CG-based solution for measurement reporting of in-active UEs
* Whether additional finer time granularities need to be introduced for both *reportingAmount* and *reportingInterval* IEs within the *periodicalReporting* configuration in LPP message.
* Whether NRPPa message should support the transmission of the PRS measurement period and starting position in time of the other TRPs to the serving gNB

Rapporteur's comments:

The reduced latency within the CG should be studied and analyzed at first before the detail solutions how to support it, e.g. why CG is needed in CONNECTED mode? There is short of an evaluation of the latency benefits because of the CG in the contributions. On the other hand, it seems at least one additional NRPPa procedure is required for the proposals to work, and therefore, potential latency gains are unclear.

Proposal for Discussion:

**Proposal 8: With regard to configured UL grant for location reports, RAN2 may discuss support of CG-based solution for measurement reporting in Inactive mode at first. Interesting companies are encouraged to provide an evaluation of the latency benefits and complexity within CG in Connected mode.**

## 3.3 Storing Capabilities

Storing capabilities are discussed in contributions. The company proposal is list in the Table below.

|  |  |
| --- | --- |
| Storing Capabilities | |
| R2-2105968 Ericsson | Proposal 3 RAN2 to discuss capability structure and signalling for capability retrieval and storage in AMF. |

Rapporteur's comments:

This issue is also discussed in SA2. And there is no conclusion on this proposal in #113bis-e meeting.

**Proposal 9: With regard to storing UE positioning capabilities in an LMF/AMF, RAN2 may await more progress in SA2 for determining any RAN2 impacts.**

## 3.4 posSI

Latency reduction related to the posSIB request is a new proposal. The company proposal related to this topic is summarized in the Table below:

|  |  |
| --- | --- |
| posSI | |
| R2-2106376 Samsung R&D Institute UK | Observation 1. Using parameters in rach-configCommon in initial UL BWP for requesting posSI could make more congestion than using dedicated ones, and make more latency to get the positioning assistance data in idle/inactive mode UE to resolve the congestion.  Observation 2. To reuse the rach-OccasionsSI parameters configured for normal SI request can reduce the possible latency due to the congestion when initial UL BWP’s rach-configCommon parameters is used for posSI request, and can enhancing the utilization of the resource.  Proposal 1. RAN2 agree to reuse rach-OccasionsSI parameters configured for normal SI request, if configured, when rach-OccasionsSI dedicated to posSI request is not configured for a UE. |

Rapporteur's comments:

There is a pre-condition in this proposal: rach-OccasionsSI is configured for posSI while it is configured for SI. But why is rach-OccasionsSI configured for normal SI but not for posSI? The problem mentioned in the contribution can be solved if the rach-OccasionsSI parameter is configured for posSI. So RAN2 may first discuss the motivation and the use case of this proposal at first.

**Proposal 10: With regard to posSI enhancement, RAN2 may discuss if the enhancement is required when rach-OccasionsSI dedicated to posSI request is not configured for a UE but rach-OccasionsSI parameters configured for normal SI request.**

# Summary of Proposals for Discussion

The contributions discussed latency reduction and proposals may be discussed online as below aspects:

Scheduled location time aspect:

**Proposal 1:** **Discuss the understanding on scheduled location time within two types:**

* **Option A: the timing**
  + The time when the location estimate is to be valid, corresponding to the location measurement time.
  + Or take as the timing of UE received LPP Request Location Information (the start time of physical layer latency)
* **Option B: the duration**
  + Duration between transmitting LCS request message from LCS Client/AF/UE(internal LCS client) to LMF and receipt of LPP RequestLocationInformation message at UE.

**Proposal 2:** **Continue evaluation of the LPP impacts for supporting a scheduled location time including the following options:**

* **Option A: no LPP Stage3 specification impacts: T should be transparent to UE.**
* **Option B: the scheduled location time is provided to UE both in UE-Assisted and UE-based mode:** 
  + **FFS the values for the scheduled location time T**
* **Option C: the scheduled location time is provided to UE only in UE-based mode.**

**Proposal 3:** **Continue evaluation of the NRPPa impacts for supporting a scheduled location time including the following options:**

* **Option A: neither the scheduled location nor the scheduled measurement time will be forwarded to gNB in DL+UL positioning methods.**
* **Option B: the scheduled location time is provided to gNB:** 
  + **FFS any additional "QoS information" which may need to be conveyed and LS to RAN3**

Preconfigured assistance data aspect:

**Proposal 4:** **Continue evaluation of the signalling and procedures to support pre-configuration of assistance data to the UE during the location preparation phase on how to preconfigure assistance information (e.g. PRS configuration):**

* **Option A: The UE is configured with validity conditions (e.g. time validity, area validity) when supporting preconfigured assistance data containing PRS configurations**
* **Option B: Support dynamic triggering of a preconfigured PRS at UE by LMF or gNB for making measurements on DL-PRS**
* **Option C: Support priority indications for multiple (pre-)configured assistance data sets corresponding to multiple position fixes for UE-based and UE-assisted positioning.**
* **Option D: Support dynamic triggering of a preconfigured SRSp at UE by gNB for transmitting SRSp based on measurement report provided by UE**

**Proposal 5:** **Continue evaluation of the signalling and procedures to support pre-configuration of assistance data to the UE during the location preparation phase on how to trigger to utilize the retained pre-configured positioning assistance information in UE:**

* **Option A: The location information request may serve as an indication to the UE to utilize the pre-configured AD when NI-LR/MT-LR and deferred MT-LR, and UE indicates the scheduled location time to core network in order to obtain pre-configured assistance data.**

Response time aspect:

**Proposal 6:** **Discuss if the LS to RAN4 to trigger the discussion about whether new granularity of the responseTimeEarlyFix is needed in Rel-17.**

Prioritization of measurements/reports aspect:

**Proposal 7: For prioritization of measurements/reports, RAN2 to discuss the options of prioritization of measurements/reports for latency reduction as below:**

* **Option A: Support of prioritization handling of DL PRS measurement**
* **Option B: Support of prioritization handling of reporting of measurements/location estimates**
* **Option C: Support of prioritization handling of DL signals/channels carrying LPP signaling**
* **Option D: Support of priority rules associated to multiple fixes of measurements and associated reports**

Configured UL grant for location reports:

**Proposal 8: With regard to configured UL grant for location reports, RAN2 may discuss support of CG-based solution for measurement reporting in Inactive mode at first. Interesting companies are encouraged to provide an evaluation of the latency benefits and complexity within CG in Connected mode.**

Storing capabilities aspect:

**Proposal 9: With regard to storing UE positioning capabilities in an LMF/AMF, RAN2 may await more progress in SA2 for determining any RAN2 impacts.**

posSI aspect:

**Proposal 10: With regard to posSI enhancement, RAN2 may discuss if the enhancement is required when rach-OccasionsSI dedicated to posSI request is not configured for a UE but rach-OccasionsSI parameters configured for normal SI request.**

# References

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8. R2-2105557 Discussion on UE capability regarding positioning latency BEIJING SAMSUNG TELECOM R&D discussion Rel-17
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12. R2-2105973 draft LS to different groups Ericsson discussion Rel-17
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15. R2-2106367 Latency reduction via configured grant for positioning Samsung Electronics discussion NR\_pos\_enh-Core
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19. R2-2104420 Response LS on Scheduling Location in Advance to reduce Latency Qualcomm
20. R2-2102665 (S2-2102048) LS on Scheduling Location in Advance to reduce Latency Qualcomm