3GPP TSG-RAN WG2 Meeting #121bis-e***R2-230xxxx***

Online, April 17 – 26, 2023

**Agenda item:** 7.2.1

**Source:** Qualcomm Incorporated

**Title:** Summary of [AT121bis-e][421][POS] Reply LS to SA2 on PRU procedures

**Document for:**  Discussion and Decision

# 1. Introduction

This document summarizes the following email discussion:

* [AT121bis-e][421][POS] Reply LS to SA2 on PRU procedures (Qualcomm)

 Scope: Draft a reply to R2-2302449, taking related contributions into account.

 Intended outcome: Approved LS (without CB if possible)

 Deadline: Monday 2023-04-24 2359 UTC

# 2. Background

The following LS on PRU procedures from SA2 was received in [R2-2302449](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121bis-e/Docs/R2-2302449.zip) [1]:

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| **1. Overall Description:**SA2 would like to inform RAN1 and RAN2 that the SA2 has agreed the attached CR to TS 23.273 on procedure enhancements for PRU support.Regarding the procedure for location of a target UE using PRUs (clause 6.x.4 of the attached CR), SA2 noticed that RAN had agreements to support some positioning methods that require simultaneous measurements of the target UE and PRU. In the SA2 agreed procedures, it is assumed that the LMF can make the decision and realize such simultaneous measurements by using a common scheduled location time.SA2 would like to seek RAN1 and RAN2’s feedback on such assumption and whether additional enhancement would be needed to support the simultaneous measurements for the target UE and PRU. SA2 would update the specification according to the RAN1 and RAN2 feedbacks if necessary.Additionally, SA2 also would like to know what location information can be provided by PRU, and whether RAN1 and RAN2 see benefit to allow PRU to provide its location information together with the location measurements reports.**2. Actions:****To RAN1 and RAN2 group****ACTION:** SA2 would like to ask RAN1 and RAN2 to provide feedback on whether any enhancement to the PRU procedures is required. |

Essentially, SA2 asks for feedback on the following 3 issues:

(1) Support for simultaneous location measurements of a target UE and a PRU (e.g., using a common scheduled location time).

(2) Location information provided by a PRU.

(3) Whether any enhancement to the PRU procedures is required (S2-2303860, attached to the LS [1]).

RAN1 answered the SA2 question already at RAN1#112 ([R2-2302409](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121bis-e/Docs/R2-2302409.zip) [2]) as follows:

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| **1. Overall Description**RAN1 thanks SA2 for their LS on PRU procedures and would like to provide the replies below.**SA2 request:**

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| Regarding the procedure for location of a target UE using PRUs (clause 6.x.4 of the attached CR), SA2 noticed that RAN had agreements to support some positioning methods that require simultaneous measurements of the target UE and PRU. In the SA2 agreed procedures, it is assumed that the LMF can make the decision and realize such simultaneous measurements by using a common scheduled location time.SA2 would like to seek RAN1 and RAN2’s feedback on such assumption and whether additional enhancement would be needed to support the simultaneous measurements for the target UE and PRU. SA2 would update the specification according to the RAN1 and RAN2 feedbacks if necessary. |

**RAN1 reply:**Current RAN1 specifications do not support a mechanism to ensure simultaneous measurements/transmissions (e.g. in the same slot(s)) for multiple UEs, including a target UE and a PRU.RAN1 will continue discussions on what enhancements to LPP, NRPPa, and/or RAN signaling are necessary to support simultaneous measurements of the same DL-PRS for multiple UEs, including a target UE and a PRU; and to support simultaneous transmission of SRS for multiple UEs, including a target UE and a PRU.Note: The enhancements might or might not have RAN1 specification impact.**SA2 request:**

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| Additionally, SA2 also would like to know what location information can be provided by PRU, and whether RAN1 and RAN2 see benefit to allow PRU to provide its location information together with the location measurements reports. |

**RAN1 reply:**A PRU can report its location and associated uncertainty as is the case for other UEs. It is not necessary to always include the PRU location information with the PRU measurements in the same report. The PRU location information and measurements should be decoupled, where decoupled means that the PRU location information is determined independently of the reported measurements, even if the PRU location information and the PRU measurements would be included in the same report. |

In a previous LS, SA2 have asked RAN1 whether a PRU can "support the positioning signal transmission capability and signal measurement capability on PC5" ([R2-2211130](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_120/LSin/R2-2211130.zip) [3]), where RAN1 replied in [R2-2300009](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_121/LSin/R2-2300009.zip) [4] as follows (which was noted at RAN2#121 [2]):

 "From RAN1's perspective, a UE (which could be a PRU) that supports SL positioning can be allowed to support the positioning reference signal transmission capability and signal measurement capability on PC5, if the capability is introduced in R18."

Draft RAN2 Reply LSs (at least on some parts of the SA2 questions) have been submitted to this meeting in:

R2-2302875 [5]: "PRU Procedures (draft response LS to R2-2301939 (S2-2303861)) ", Qualcomm Incorporated.

R2-2302957 [6]: "Discussion and draft LS reply on PRU procedures, vivo.

R2-2303707 [7]: "On the Positioning Reference Units aspects", Ericsson.

NOTE: General PRU functionality is specified in TS 38.305, clause 5.4.5 [8].

# 3. Discussion

## 3.1 Support for simultaneous location measurements of a target UE and a PRU

SA2 request:

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| Regarding the procedure for location of a target UE using PRUs (clause 6.x.4 of the attached CR), SA2 noticed that RAN had agreements to support some positioning methods that require simultaneous measurements of the target UE and PRU. In the SA2 agreed procedures, it is assumed that the LMF can make the decision and realize such simultaneous measurements by using a common scheduled location time.SA2 would like to seek RAN1 and RAN2’s feedback on such assumption and whether additional enhancement would be needed to support the simultaneous measurements for the target UE and PRU. SA2 would update the specification according to the RAN1 and RAN2 feedbacks if necessary. |

R2-2302875 [5] proposed the following answer:

**Proposal 1 [5]:** Regarding the 1st SA2 question on "Support for simultaneous location measurements of a target UE and a PRU", RAN2 to reply the following:

"Dependent on the RAN1 requirements for simultaneous location measurements of the target UE and PRU, RAN2 will add signalling support for such a feature in LPP (and potentially in SLPP, if needed). Whether the LPP "scheduled location time" can be reused and/or enhanced for this purpose will be decided once the RAN1 requirements for this feature are agreed/available. Since this feature is positioning method specific and affects LPP (and potentially NRPPa and SLPP, if needed), RAN2 believes that the solution will have no impacts on the PRU procedures agreed by SA2 in S2-2303860."

R2-2302957 [6] proposes the following answer:

**Proposal 1 [6]:** Reply to SA2 that RAN2 will leave it to RAN1’s decision on the enhancement to support the simultaneous measurements for the target UE and PRU.

 Specifically:

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| Question 1: SA2 would like to seek RAN1 and RAN2’s feedback on such assumption and whether additional enhancement would be needed to support the simultaneous measurements for the target UE and PRU?Answer: RAN2 observed that RAN1 will further discuss it and would leave it to RAN1. |

R2-2303707 [7] does not propose an answer to this question.

Rapporteur comments:

- Both, R2-2302875 [5] and R2-2302957 [6] essentially conclude that this depends on further RAN1 requirements/agreements/input.

- However, R2-2302875 [5] is more specific on the SA2 request regarding:

(a) the assumption made by SA2 to "realize such simultaneous measurements by using a common scheduled location time" (i.e., NOTE 2 in Clause 6.X.4 in the agreed SA2 CR attached to the LS in R2-2302449 [1]).

(b) the specific action requested by SA2 "to provide feedback on whether any enhancement to the PRU procedures is required" [1].

- Therefore, it is proposed to use the draft response in R2-2302875 as baseline (see also discussion in R2-2302875 [5]).

**Question1:**

Regarding the 1st SA2 question on "Support for simultaneous location measurements of a target UE and a PRU", do you agree with the following RAN2 response:

"Dependent on the RAN1 requirements for simultaneous location measurements of the target UE and PRU, RAN2 will add signalling support for such a feature in LPP (and potentially in SLPP, if needed). Whether the LPP "scheduled location time" can be reused and/or enhanced for this purpose will be decided once the RAN1 requirements for this feature are agreed/available. Since this feature is positioning method specific and affects LPP (and potentially NRPPa and SLPP, if needed), RAN2 believes that the solution will have no impacts on the PRU procedures agreed by SA2 in S2-2303860."

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| Company | Yes/No | Comments |
| OPPO |  | RAN1 still work on the detail of the configuration of the indicated time window, as well as the relationship with the schedule location time. We may postpone to discuss our reply after we get a confirmation of their discussion result latter. |
| Rapporteur |  | To OPPO: The action and request for feedback in the SA2 LS is for both, RAN1 and RAN2. As mentioned in the LS and SA2 CR attached to the LS, SA2 assumes that a "scheduled location time" can be used to realize simultaneous measurements. The "scheduled location time" was introduced in RAN2 specifications, so we should indicate to SA2 that "we don't know yet" if the LPP "scheduled location time" can be used for this purpose. This essentially means "postponed", as proposed by OPPO. But we should indicate that LPP will support "simultaneous location measurements" --- in whatever way this will be agreed later, since part of the SA2 procedures. |
| Huawei, HiSilicon | Yes,but | It seems that NRPPa does not have support for scheduled location time. Maybe it is also meaningful to indicate in the reply LS (cc RAN1) what are the positioning methods that currently support scheduled location time. |
| Xiaomi |  | According to the LS from RAN1, it implies that the scheduled location time can’t be reused for simultaneous location measurements of the target UE and PRU, there may be no need to mention it again in the RAN2 LS, we suggest to consider the following response:Dependent on the RAN1 progress for simultaneous location measurements of the target UE and PRU, RAN2 will add signalling support for such a feature in LPP (and potentially in SLPP, if needed). And RAN2 believes that the solution will have no impacts on the PRU procedures agreed by SA2 in S2-2303860. |
| CATT | Yes, but | Below wording may not be necessary.Since this feature is positioning method specific and affects LPP (and potentially NRPPa and SLPP, if needed), RAN2 believes that the solution will have no impacts on the PRU procedures agreed by SA2 in S2-2303860."Let SA2 make their own decision if there will be impacts on SA2 or not. I’m fine with the other wordings. |
| Intel | No | RAN1 already mentioned they will continue the discussion on this, including LPP, NRPPa impact. We can rely on RAN1 on simultaneous measurement in order to avoid duplicated discussion in both RAN1 and RAN2 considering RAN1 will continue the discussion. |
| vivo | No | For ‘RAN2 will add signalling support for such a feature in LPP (and potentially in SLPP, if needed)’, the spec impact should wait for RAN1 solution.For ‘Whether the LPP "scheduled location time" can be reused and/or enhanced for this purpose will be decided once the RAN1 requirements for this feature are agreed/available. Since this feature is positioning method specific and affects LPP (and potentially NRPPa and SLPP, if needed), RAN2 believes that the solution will have no impacts on the PRU procedures agreed by SA2 in S2-2303860.", the conclusion has an impact on the PRU procedure as they have captured the following in 6.x.4.*A common scheduled location time may be used if the LMF determines that simultaneous measurements for UE and PRU(s) are desirable.*In conclusion, we prefer only feedback RAN2 will wait for RAN1’s conclusion in the LS reply. |
| Ericsson | No | We also think RAN1 should further analyse the PRU requirements and further RAN2 should also discuss the procedural impacts.We can reply as:“*RAN2 will wait for RAN1 input on requirements and solutions for simultaneous location measurements of a target UE and a PRU and RAN2 would discuss further any RAN2 impacts and provide the input to SA2.**“* |
| ZTE | No | Suggest to wait for RAN1’s outcome this meeting, then we can reply to SA2 on whether/how we changed RAN2’s spec |
| Spreadtrum | No | In RAN1 reply, RAN1 already mentioned they will continue the discussion enhancements to LPP, NRPPa, RAN impact. We can reply as:“*RAN2 will wait for RAN1 input on requirements and solutions for simultaneous location measurements of a target UE and a PRU and RAN2 would discuss further any RAN2 impacts and provide the input to SA2*”  |
| InterDigital | No | Same view as Intel. It’s better to let RAN1 continue the discussion and RAN2 wait for their input. |
| Samsung | No | Same view with Ericsson. Regarding the issue on simultaneous location measurement, we can just reply that RAN2 will discuss any potential spec. impact later based on further input from RAN1. |
| Lenovo | Yes, partially | SA2 assumes that common scheduled location time can be realized for performing simultaneous measurements between PRU UE and target UE. At the moment, there is no decision or requirements on this aspect. This is addressed by the following part of the LS: “*Whether the LPP "scheduled location time" can be reused and/or enhanced for this purpose will be decided once the RAN1 requirements for this feature are agreed/available.*“ We also share the view that the last sentence may not be necessary or useful at this stage of the reply. |
| Nokia | Yes | We see that both R2-2302875 and R2-2302957 are saying the same thing, which is to wait for RAN1 to come up with the requirements first. The former is detailed and specifically addresses the SA2 assigned actions for RAN2. However, we are also fine to go with a reply proposed by Xiaomi or Spreadtrum.One thing we don’t like in the RAN1 reply is this: “RAN1 will continue discussions on what enhancements to LPP, NRPPa, and/or RAN signaling are necessary to support simultaneous measurements”. Signalling enhancements are not in RAN1 domain. They just need to identify the solution and provide the requirements. RAN2/RAN3 should discuss the signalling enhancements. |
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## 3.2 Location information provided by a PRU

SA2 Request:

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| Additionally, SA2 also would like to know what location information can be provided by PRU, and whether RAN1 and RAN2 see benefit to allow PRU to provide its location information together with the location measurements reports. |

R2-2302875 [5] proposed the following answer:

**Proposal 2 [5]:** Regarding the 2nd SA2 question on "Location information provided by a PRU", RAN2 to reply the following:

"A PRU should be able to report

(a) the location coordinates of the PRU only,

(b) the location measurements performed by the PRU only, or

(c) the location coordinates of the PRU together with any performed location measurements,

where location measurements above include the currently defined location measurements in LPP and potential new location measurements defined in Rel-18 and location coordinates provide the known location of the PRU, obtained independently from the location measurements.
Since the above reporting affects LPP (and potentially SLPP, if needed), RAN2 believes that the above reporting has no impacts on the PRU procedures agreed by SA2 in S2-2303860."

R2-2302957 [6] proposes the following answer:

**Proposal 2 [6]:** Reply to SA2 that RAN2 sees the benefit to allow PRU to provide its location information together with the measurement report.

 Specifically:

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| Question 2: SA2 also would like to know what location information can be provided by PRU, and whether RAN1 and RAN2 see benefit to allow PRU to provide its location information together with the location measurements reports.Answer: RAN2 sees the benefit to allow PRU to provide its location information together with the measurement reports, and will discuss what enhancements of LPP are needed. |

R2-2303707 [7] proposes the following answer:

**Proposal 1 [7]:** PRU UE provides location measurement and current location estimate using the same transaction upon NW request.

 Specifically:

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| RAN2 reply:PRU UE is a cooperative UE and hence such UEs are expected of assisting NW by providing both measurement and location.As PRU UE could have moved from previous location or because of change in radio condition there can be errors in the new computed location (delta as compared to previous stationary well known location); hence a PRU UE should provide both measurements and location to allow all the possible calibration parameters to the LMF.PRU UE should provide both location measurement and current location estimate using the same transaction upon NW request. |

Rapporteur comments:

- All 3 proposed RAN2 responses agree that a PRU should be able to report both, location measurements and known PRU location coordinates.

- This is also in agreement with the RAN1 response to the same SA2 question [2].

- However, both R2-2302957 [6] and R2-2303707 [7] do not to address the first part of SA2's question ("what location information can be provided by PRU") and the specific action requested by SA2 ("to provide feedback on whether any enhancement to the PRU procedures is required").

- Therefore, it is proposed to use the draft response in R2-2302875 [5] as baseline (see also discussion in R2-2302875 [5]).

NOTE: All 3 contributions (R2-2302875 [5], R2-2302957 [6], and R2-2303707[7]) propose also specific Stage 3 LPP design aspects, which however, requires further discussion in appropriate agenda items (possibly together with RAN1 input) and seems not affecting the answer to the specific SA2 question.

**Question 2:**

Regarding the 2nd SA2 question on "Location information provided by a PRU", do you agree with the following RAN2 reply:

"A PRU should be able to report:

(a) the location coordinates of the PRU only,

(b) the location measurements performed by the PRU only, or

(c) the location coordinates of the PRU together with any performed location measurements,

where location measurements above include the currently defined location measurements in LPP and potential new location measurements defined in Rel-18 and location coordinates provide the known location of the PRU, obtained independently from the location measurements.
Since the above reporting affects LPP (and potentially SLPP, if needed), RAN2 believes that the above reporting has no impacts on the PRU procedures agreed by SA2 in S2-2303860."

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| Company | Yes/No | Comments |
| OPPP | Yes for c, a and b needs further clarification of the purpose | Cannot see a straightforward reason why a PRU reports solely the location coordinates of the PUR or the location measurement performed by the PRU. The location coordinates and the measurement results should work together for network positioning result calibration.If reporting the location coordinates of the PRU in one-shot way is for the network to start to recognize the location information of the PRU and use such information together with following obtained solely location measurement results, that is OK. But we need to clarify the purpose firstly. |
| Rapporteur |  | To OPPO:According to TS 38.305 (which is known and used by SA2), a "PRU can transmit SRS to enable TRPs to measure and report UL positioning measurements (e.g., RTOA, UL-AoA, gNB Rx-Tx Time Difference, etc.) from PRU at a known location."Therefore, for UL-only positioning, a PRU may need to report its location coordinates only, without any location measurements. Hence (a).The PRU location coordinates can be provided e.g., in the initial PRU Association Request (see CR attached to [1]). If the PRU is stationary, there is no need to provide the PRU known location every time when measurements are sent, hence (b).However, if a PRU is moving (c) is needed. See also discussion in [5]. This seems actually also aligned with RAN1 response LS. |
| Huawei, HiSilicon |  No strong view |  It seems that R1 has already addressed the question. Do we need to mention it again? |
| Xiaomi |  | SA2 also asked what location information can be provided by PRU. In our understanding, there could be two kinds of location, one is the known location, which is obtained by PRU based on implementation. And the other is the location based on the positioning measurement, for example, when LMF requests the DL-TDOA related positioning measurements, the PRU can calculate the location according to the DL-TDOA. We suggest indicate this in the response. For the detailed report, we agree that there could be a, b and c. And we think current LPP spec already support c.  |
| CATT | No | RAN1 already replied the LS, indicating that ‘The PRU location information and measurements should be decoupled, where decoupled means that the PRU location information is determined independently of the reported measurements, even if the PRU location information and the PRU measurements would be included in the same report.’The intention of SA2 to ask this question is that, they are wondering if the reported location from PRU to LMF can be verified by network, in TS 23.273 clause 6.17.4 Positioning of a target UESo CATT prefers to reply SA2 that the reply LS from RAN1 already answers the question from SA2. |
| Intel | No | Seems the main info is “RAN2 believes that the above reporting has no impacts on the PRU procedures agreed by SA2 in S2-2303860.”, however we did not discuss the details, and we also cannot predict what RAN1 will agree.  |
| vivo | Yes with comments | Agree with Intel that RAN2 can not conclude that there is no impact on PRU procedure. SA2 captured the following in 6.x.4:The serving LMF uses the procedure defined in clause 6.11.1 to obtain location information related to the target UE from the PRU(s) selected at step 4.Editor's note: Location information for a target UE obtained from a PRU needs to be verified by RAN.The location information is derived based on the PRU measurement and location. Therefore, at least the description can be refined based on the feedback.Besides, the current spec only supports a and b. To support c, a new Location Information Type is needed, e.g., locationEstimateAndLocationMeasurementsRequired. In conclusion, we support the draft reply if the last sentence is removed. |
| Ericsson | c | Agree with Vivo and Intel.We should say:A PRU should be able to report(a) the location coordinates of the PRU only, (b) the location measurements performed by the PRU only, or (c) the location coordinates of the PRU together with any performed location measurements,where location measurements above include the currently defined location measurements in LPP and potential new location measurements defined in Rel-18 and location coordinates provide the known location of the PRU, obtained independently from the location measurements.Since the above reporting affects LPP (and potentially SLPP, if needed), RAN2 can discuss further of any potential RAN2 impacts. ~~believes that the above reporting has no impacts on the PRU procedures agreed by SA2 in S2-2303860~~. |
| ZTE | Yes with comments | Agree with the content, option a ,b and c are to clearly explain the condition in RAN1’s reply ‘It is not necessary to always include the PRU location information with the PRU measurements in the same report’.Agree with other companies that last sentence is not needed to be sent |
| Spreadtrum | Yes with comments | We think the current spec can support a, b and c. and agree with other companies that last sentence is not needed to be sent. |
| InterDigital | Yes but | We are fine to keep a), b) and c) in the reply but we think it should be left to SA2 to conclude the SA2 impact and so suggest to remove the last sentence (i.e. “RAN2 believes that the above reporting has no impacts on the PRU procedures agreed by SA2 in S2-2303860.") |
| Samsung | Yes with comments | We agree with other companies that the last sentence should be removed and support the draft LS content except the last sentence. |
| Lenovo | Yes  | Also share the view that the last sentence may also not be needed.Additionally, one aspect that is missing from this discussion is the inclusion of the reporting of PRU location quality/confidence/uncertainty along with the location coordinates, which is an essential functionality of leveraging the PRU UE. A PRU UE providing location coordinates with low quality (or high uncertainty) defeats the purpose of the PRU UE. Therefore, suggest the following edits in the reply: A PRU should be able to report:(a) the location coordinates and associated location quality/uncertainty of the PRU only, (b) the location measurements performed by the PRU only, or (c) the location coordinates and associated location quality/uncertainty of the PRU together with any performed location measurements,where location measurements above include the currently defined location measurements in LPP and potential new location measurements defined in Rel-18 and location coordinates and location quality/uncertainty provide the known location and quality of the reported location, respectively of the PRU, obtained independently from the location measurements. |
| Ericsson |  | For below*obtained independently from the location measurements.*The location could be based upon the measurements as well; not necessarily always independent.Since, the PRU could be moving, it can provide new location and associated measurements from that new location. So, we do not see it is always independent.Perhaps, we need more discussion on this. For now, we propose to remove this part. |
| Nokia | Yes | We see that the capability to report either an estimate or measurement or both is already possible in LPP protocol (LMF has a choice to specify what it wants and UE has the choice to provide one or the other depending on what is available at the UE, if the UE cannot meet the LMF request).Frankly, we are not sure if RAN1 understood this SA2 question well. RAN1 answer seems to give the impression that the measurement and estimate signalled in the reporting message back to LMF are independent and that the UE can treat the measurement as sort of an additional independent thing that the UE can signal to LMF. In current LPP, the estimate and measurement signalled to LMF has some correlation. Anyway, this is signalling aspects which RAN2 should decide and not RAN1. |
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# References

[1] R2-2302449, "LS on PRU procedures (S2-2303861; contact: Qualcomm)", SA2 LS in Rel-18 5G\_eLCS\_Ph3 To:RAN2, RAN1.

[2] R2-2302409 (R1-2302146), "LS Reply on PRU Procedures (R1-2302146; contact Qualcomm)", RAN1 LS in REl-18 NR\_pos\_enh2-Core, 5G\_eLCS\_Ph3 To: SA2 Cc: RAN2, RAN3.

[3] R2-2211130, "LS Out on Positioning Reference Units (S2-2209590; contact: CATT)", SA2 LS in Rel-18 FS\_eLCS\_Ph3 To:RAN1 Cc:RAN2, RAN3.

[4] R2-2300009, "Reply LS on Positioning Reference Units (R1-2212715; contact: CATT)", RAN1 LS in Rel-18 FS\_eLCS\_Ph3 To:SA2 Cc:RAN2, RAN3.

[5] R2-2302875, "PRU Procedures (draft response LS to R2-2301939 (S2-2303861)) ", Qualcomm Incorporated.

[6] R2-2302957, "Discussion and draft LS reply on PRU procedures", vivo.

[7] R2-2303707, "On the Positioning Reference Units aspects", Ericsson.

[8] 3GPP TS 38.305: "Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".