3GPP TSG-RAN WG2 Meeting #115-e ***R2-2109102***

Electronic Meeting, August 16 – 27, 2021

**Agenda item:** 8.11.2

**Source:** Qualcomm Incorporated

**Title:** Summary of [AT115-e][614][POS] Reply LS to SA2 on capability storage (Qualcomm)

**Document for:**  Discussion

# 1. Introduction

This document summarizes the following email discussion:

* [AT115-e][614][POS] Reply LS to SA2 on capability storage (Qualcomm)

Scope: Reply to SA2 indicating that positioning capability is variable. We will give a finer-grained response e.g., which capabilities can vary only if consensus can be reached.

Intended outcome: Approvable LS in R2-2108945

Deadline: Tuesday 2021-08-24 0800 UTC

## 1.1 References

[1] [R2-2106971](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2106971.zip), "LS on storage of UE Positioning Capabilities (S2-2105153; contact: Qualcomm)" , SA2 LS in Rel17 5G\_eLCS\_ph2, To:RAN2 Cc:RAN3.

[2] [R2-2108378](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108378.zip), "[draft] Response LS on storage of UE Positioning Capabilities", Qualcomm Incorporated, LS out Rel-17 To:SA2, Cc:RAN3.

[3] [R2-2108377](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108377.zip), "LPP impacts for UE positioning capability storage", Qualcomm Incorporated.

# 2. Discussion

The incoming LS from SA2 [1] is copied below:

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| SA2 has agreed the attached CR to TS 23.273 to support storage of UE positioning capabilities in the 5GC, and thereby consider enabling some reduction in latency when positioning a UE.  In addition, SA2 would like to confirm with RAN2 that the following question:  1) Whether the UE positioning capability is variable or not? If yes, in which situation it is changed?  **To RAN2**  **ACTION:** SA2 kindly requests RAN2 to provide feedback on the above issue. SA2 also asks RAN2 to take the above CR into account in supporting positioning enhancements in Release 17, if necessary. |

Accordingly, this email discussion scope has two parts:

"Reply to SA2 indicating that positioning capability is variable" (see section 2.1 below).

"We will give a finer-grained response e.g., which capabilities can vary only if consensus can be reached" (see section 2.2 below).

## 2.1 Reply LS

A draft reply LS has been been provided in the drafts folder for this email discussion. The proposed text is copied below:

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| **1. Overall Description:**  RAN2 thanks SA2 for their LS and CR0176 (Rel-17, 'B') to TS 23.273 on storage of UE Positioning Capabilities.  Regarding the question from SA2 whether the UE positioning capability is variable or not, RAN2 would like to provide the following response:  The UE positioning capability can be variable.  RAN2 understanding is that this is also the case for UE radio capabilities which are stored in AMF.  As for the second question that in which situation it is changed? RAN2 would like to provide the following response:  TBC (based on discussions of 2.2)  **2. Actions:**  **To SA2 group.**  **ACTION:** RAN2 kindly asks SA2 to take the above information into account. |

**Question 1:** Do you have any comments on the proposed reply LS above?

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| **Company** | **Comments** |
| ZTE | SA2 has asked in what situation it is changed. The situations or examples of capability change should be also included in the reply LS, i.e., section 2.2. |
| Ericsson | We need to add  RAN2 understanding is that this is also the case for UE radio capabilities which are stored in AMF. |
| Apple | The LS as proposed by the rapporteur is fine. |
| CATT | Agree with Ericsson.  Moreover, RAN2 shall also include the situation that the capability may be changed based on the discussion of section 2.2. |
| Huawei, HiSilicon | RAN2 should also reply with the information on what capabilities are variable |
| vivo | RAN2 should also reply the variable capabilities and the corresponding situations. |
| Xiaomi | The situations on capability change should be included. |
| InterDigital | Ok with draft response proposed by rapporteur. The example of capabilities which may change as discussed in Section 2.2, are also to be included in response to SA2 question. |
| Lenovo, Motorola Mobility | Support the draft LS. |
| Intel | Agree with Ericsson. In addition, we should also mention “  RAN2 would like to clarify that in Rel-16, the UE positioning capability, e.g. SRS capability can be changed during positioning session since it is related to CA configuration.” |
| Qualcomm | O.K. with the basic response. A finer-grained response can be provided if there is consensus. |
| Nokia | The LS as proposed by the rapporteur is fine. Also, OK to add some examples. |

**Summary:**

- 12 companies replied.

- 8 companies think that RAN2 should also reply in which example situations the positioning capability may change (see also section 2.2 below)  
(ZTE, CATT, Huawei, vivo, Xiaomi, InterDigital, Intel, Nokia)

- 3 companies think that RAN2 should also reply that UE radio capabilities which are stored in an AMF may change. (Ericsson, CATT, Intel)  
However, the question from SA2 was whether the UE positioning capability may be variable and not the Radio Capabilities stored in an AMF.

- A possible finer-grained response is discussed in section 2.2.

## 2.2 Finer-grained response

Some example situations in which the UE positioning capability may change were discussed in [3].

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| - **LMF dependency:** A UE would not report capabilities that are not requested by an LMF. Thus, if a PLMN uses LMFs from different vendors or dedicated to different user cases (e.g., regulatory versus commercial), different capabilities could be reported.  - **Radio configuration dependency:** Positioning capabilities based on current/active radio configuration are obviously not static (e.g., the *srs‑PosResourceConfigCA-BandList* [8] is provided for the current configured CA band combination).  - **Power Savings:** A (e.g., IoT) UE whose battery level is low may switch off positioning support in order to conserve battery power for more important tasks such as communicating with an external server or may report lower processing capabilities (e.g., lower DL-PRS processing capabilities, or single-frequency GNSS capabilities instead of dual-frequency, or single-GNSS instead of multi-GNSS capabilities, etc.).  - **Processing Resources Constraints:** The available processing resources (processors, memory, etc.) may be shared between "communication" and "positioning operations". If the "communication operation" requires increased processing resources (for example, a large number of carriers to aggregate), the resources allocated to the "positioning operation" may temporarily be reduced (e.g., lower DL-PRS processing capabilities, or single-frequency GNSS capabilities instead of dual-frequency, or single-GNSS instead of multi-GNSS capabilities, etc.).  - **Privacy / User Interaction:** A user may be allowed to disable location support for non-regulatory services (e.g. for a location request from an external non-regulatory LCS Client). In that case, when an LMF requests the positioning capabilities of the UE, the UE may reply with no positioning capabilities or with some limited minimal set of capabilities. An exception would be if the UE is aware of an emergency services call when the UE would provide its full capability set to an LMF.  NOTE: The examples and scenarios above may not be supported on all UEs and may not always need to be supported. However, a UE vendor may still offer users some form of control over UE location capability as described above. |

**Question 2:** Should RAN2 provide example situations in which the UE positioning capability may change or not? If your answer is "YES", do you have any comments on the above list, e.g., any additions, etc.?

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| Company | Answer  YES/NO | Comments |
| ZTE | Yes |  |
| Ericsson | No | UE can always send an unsolicited updated capability which LMF can override with the one retrieved from AMF storage  Further, privacy and storing positioning capability has no relations. This is exclusive anyways. The UE can notify change of UE’s privacy profile  TS 23.271 says 7.4.3 LCS Privacy Profile Update notification The LCS Privacy Profile Update notification is sent to the H-GMLC from the PPR in order to notify the H-GMLC about the change of UEs privacy profile.  - Target UE identity, (one or both of MSISDN and IMSI);  - Indication on the changed UEs privacy profile |
| Apple |  | We prefer to provide a short reply. Having said that, since SA2 did ask about details, we would also be OK to provide some examples – as long as the text is clear that those are just examples and not an exhaustive list. |
| CATT | Yes | But without LMF dependency and Privacy / User Interaction. |
| Huawei, HiSilicon | No | We do acknowledge that the current spec is not that clear whether the UE is required to reply with all the requested capabilities or the UE can reply by its own preference.  C:\Users\y00397895\AppData\Roaming\eSpace_Desktop\UserData\y00397895\imagefiles\FC29DD00-15F2-4FFC-B503-9A458ECFAD65.png  We think reporting the full capability will be more useful for the functionality of AMF storage of positioning capability, since the intention of AMF storage of positioning capability is to reduce the signalling interchanges btw the LMF and the UE. If the LMF knows a certain capability is variable and do not know what is the supported capability of the UE at the time, the LMF needs to request the UE capability again, which does not have any latency gain. |
| vivo | Yes | RAN2 should reply the situation as that’s what they asked, i.e., “in which situation it is changed”  As to the situation,   * LMF dependency shall be removed as it is irrelevant to the variability. The LMF shall request the capability not included in the one provided by the AMF. * Privacy / User Interaction shall be removed as it is irrelevant to the variability. If the UE denies the privacy check, the AMF will return an error response and no LMF will be chosen, and of course there is no capability info exchange.   How to maintain the UE location capability stored in AMF is out of RAN2 scope. E.g. whether the AMF shall inform LMF to request for a full one and send it to AMF. |
| Xiaomi | Yes | The privacy/user interaction should not be included.  Moreover, We are wondering whether the GNSS signal quality change can be treated as the UE capability change. For example, UE has the A-GNSS capability and reports it to the network, but when UE moves to somewhere without GNSS signal coverage, the UE can’t receive GNSS signal, so LMF can’t use A-GNSS to locate UE. |
| InterDigital | Yes | Same view with Apple. We are ok for providing some of the example scenarios (as listed above) where the UE capabilities may change. |
| Lenovo, Motorola Mobility | Yes | Support listing 2 or 3 examples where the UE positioning capabilities may change, e.g., LMF dependency, Resource Configuration, Processing resource constraints. |
| Intel | See comments | **LMF dependency:** This is not the new issue. We have same problem for AS capability.  - **Radio configuration dependency:** Yes, agree. It can be contained. But we should clarify that “in Rel-16, the UE positioning capability, e.g. SRS capability can be changed during positioning session since it is related to CA configuration.” ”  - **Power Savings:** We are not quite sure about this. But should not this exist for legacy positioning, and the UE could have this problem even during the positioning session.  - **Processing Resources Constraints:** We are not quite sure about this. But should not this exist for legacy positioning, and the UE could have this problem even during the positioning session.  - **Privacy / User Interaction:** We are not quite sure about this. But should not this exist for legacy positioning, and the UE could have this problem even during the positioning session. |
| Qualcomm | Yes | All examples listed are possible cases in different UE implementations. We don't agree that only "radio capabilities" can be variable; the positioning capability can be variable. |
| Nokia | Yes | Except for the LMF dependency, others are OK. The LMF dependency example seems different from the other in that it is based on what the LMF requests and which LMF requests it. The other cases may result in the UE sending unsolicited the capability upon change in capability. |

**Summary:**

- 12 companies replied.

- 2 companies think that RAN2 should not provide example situations in which the UE positioning capability may change (Ericsson, Huawei).

- 9 companies think that RAN2 should provide example situations in which the UE positioning capability may change (ZTE, CATT, vivo, Xiaomi, InterDigital, Lenovo, Intel, Qualcomm, Nokia).  
  
However, there are different views in which situation the UE positioning capability may change.

With reference to the example list provided:

- LMF Dependency: ZTE, CATT, Xiaomi, InterDigital, Lenovo, Qualcomm

- Radio configuration dependency: ZTE, CATT, vivo, Xiaomi, InterDigital, Lenovo, Intel, Qualcomm, Nokia

- Power Savings: ZTE, CATT, vivo, Xiaomi, InterDigital, Qualcomm, Nokia

- Processing Resources Constraints: ZTE, CATT, vivo, Xiaomi, InterDigital, Lenovo, Qualcomm, Nokia

- Privacy / User Interaction: ZTE, InterDigital, Qualcomm, Nokia

- Additional potential scenarios:

- Environment dependency: Xiaomi

- There is no general consensus that RAN2 should provide example situations in which the UE positioning capability may change.

- However, there seems a majority view (9:2) that at least some examples could be mentioned, if it is made clear that these are just examples.

- Lenovo suggested listing 2 or 3 examples where the UE positioning capabilities may change.

**Proposed Way Forward:**

- List the 3 example situations in which the UE positioning capability may change which have most support, but point out in the response LS that these are just examples:

- Radio configuration dependency (9)

- Power Savings (7)

- Processing Resources Constraints (8)

# 3. Proposed Conclusion

A response LS is provided in R2-2108945 based on the Proposed Way Forward summarized in section 2.2 above.

The propsed response LS is repeated below.

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| **3GPP TSG-RAN WG2 Meeting #115-eR2-2108945**  **Electronic Meeting, August 16 – 27, 2021**  **Title: [draft] Response LS on storage of UE Positioning Capabilities**  **Response to: R2-2106971 (S2-2105153) Response LS on storage of UE Positioning Capabilities**  **Release:** Rel-17  **Work Item:** NR\_pos\_enh  **Source:** Qualcomm Incorporated (to be RAN2)  **To:** SA2  **Cc:** RAN3  **Contact Person:**  **Name:** Sven Fischer  **E-mail Address:**   **[sfischer@qti.qualcomm.com](mailto:sfischer@qti.qualcomm.com)**  **1. Overall Description:**  RAN2 thanks SA2 for their LS and CR0176 (Rel-17, 'B') to TS 23.273 on storage of UE Positioning Capabilities.  Regarding the question from SA2:  "Whether the UE positioning capability is variable or not? If yes, in which situation it is changed?"  RAN2 would like to provide the following response:  The UE positioning capability can be variable. Example situations where the UE positioning capability may change include:  - Radio configuration dependency: Positioning capabilities based on current/active radio configuration are not static (e.g., the *srs-PosResourceConfigCA-BandList* in TS 37.355 is provided for the current configured CA band combination).  - Power Savings: A (e.g., IoT) UE whose battery level is low may switch off positioning support in order to conserve battery power for more important tasks such as communicating with an external server or may report lower processing capabilities.  - Processing Resources Constraints: The available processing resources (processors, memory, etc.) may be shared between "communication" and "positioning operations". If the "communication operation" requires increased processing resources, the resources allocated to the "positioning operation" may temporarily be reduced.  RAN2 would like to point out that the above are examples and there may be other situations in which the UE positioning capability may change. Also, the examples may not be supported on all UEs and may not always need to be supported.  **2. Actions:**  **To SA2 group.**  **ACTION:** RAN2 kindly asks SA2 to take the above information into account.  **3. Date of Next TSG-RAN2 Meetings:**  TSG-RAN2 Meeting #116-e 1-12 November 2021 Electronic Meeting  TSG-RAN2 Meeting #117-e 17-26 January 2022 Electronic Meeting |