3GPP TSG-RAN WG2 #119-e R2-22xxxxx

Online Meeting, Aug 17th – 29th, 2022

Agenda Item: 6.11.2.4

Source: Ericsson

Title: [AT119-e][425][POS] UE-based integrity assessment (Ericsson)

Document for: Discussion, Decision

# Introduction

This document is to gather input for below email discussion.

* [AT119-e][425][POS] UE-based integrity assessment (Ericsson)

 Scope: Evaluate the proposal in R2-2208075 from the standpoint of determining if it is an essential correction. New functionality will not be introduced and the discussion should determine if there is support for this change as a correction in Rel-17.

 Intended outcome: Report to CB session

 Deadline: Tuesday 2022-08-23 1200 UTC

The email discussion is related to the contribution

1. R2-2208075 Provisioning of missing integrity requirements , Ericsson

#  Contact Information

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# Discussion

## Background

The WID on NR positioning enhancements [3] includes the following objective

* Specify the signalling, and procedures to support GNSS positioning integrity determination, including [RAN2, RAN3]:
	+ The assistance information that will be used to support integrity determination
	+ The information that will be used to provide the positioning integrity KPIs and integrity results
	+ Support of integrity for UE-based and UE-assisted A-GNSS positioning.

Note: This objective is applicable to NR and E-UTRA.

Most of this objective has been completed already in Rel 17, but as raised in [1], the support of integrity for UE-based A-GNSS positioning still has some remaining parts.

To put integrity in UE-assisted and UE-based positioning context, the following was provided in [1]

* **UE-assisted integrity** **assessment**, where LMF configures the device with TIR to enable the device to determine PL, report PL to LMF, which LMF compares to AL, possibly in consideration of TTA to make integrity assessments.
* **UE-based integrity assessment**, where LMF configures the device with TIR, AL and TTA to enable the device to determine PL, compare to AL, possibly in consideration of TTA to make integrity assessments. A typical beneficiary of the integrity assessments is higher layers in the device, which becomes aware of whether reliable positioning estimates are available or not.

In comparison, we already have UE-assisted and UE-based positioning for several positioning methods including A-GNSS

* **UE-assisted positioning**, where LMF configures the device with assistance data to enable the device to determine positioning measurements, report positioning measurements to LMF, which LMF uses together with additional information such as TRP or SV locations to estimate the device position.
* **UE-based positioning**, where LMF configures the device with assistance data to enable the device to determine positioning measurements, using additional information such as TRP or SV locations from the assistance data to estimate the device position. A typical beneficiary of the position estimates is higher layers in the device, which becomes aware of the device position.

Since online time is limited, we will in this email discussion pick up the issues and concerns brought up during the brief online discussion. These comments relate to UE-assisted and UE-based integrity assessments, and therefore, the email discussion will be separated accordingly.

## UE-assisted integrity assessments

With the RAN2#118-e agreement “Keep the definition of PL, and clarify in a NOTE that the PL inequality is valid for all values of the AL.”, the definition of PL in 36.305/38.305 now reads

**Protection Level (PL):** A statistical upper-bound of the Positioning Error (PE) that ensures that, the probability per unit of time of the true error being greater than the AL and the PL being less than or equal to the AL, for longer than the TTA, is less than the required TIR, i.e., the PL satisfies the following inequality:
 *Prob per unit of time* [((*PE>AL*) & (*PL<=AL*)) *for longer than TTA*] *< required TIR*
When the PL bounds the positioning error in the horizontal plane or on the vertical axis then it is called Horizontal Protection Level (HPL) or Vertical Protection Level (VPL) respectively.
A specific equation for the PL is not specified as this is implementation-defined. For the PL to be considered valid, it must simply satisfy the inequality above.

NOTE: the PL inequality is valid for all values of the AL.

This definition is intended to both define the protection level as a concept as well as a measurement that the UE can be requested to report to the location server as part of UE-assisted integrity assessments.

Since several companies raise the issue about whether AL is needed to compute PL, it could be relevant to define how the PL *that is reported* to the location server shall be determined and that definition does not include AL, or at least marginalize AL.

Question UEA-1: Companies are requested to provide their view about whether a specific PL definition shall be agreed, specifically for the PL value to be reported by the device to the location server upon request. Suggestions of such a specific PL definition for PL reporting are encouraged.

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| Company | Specific PL definition for PL reporting Yes/No | Comments, suggested specific PL definition |
| CATT | No | The inequality below is used for assessments but not for the operation of calculating PL. the PL satisfies the following inequality:  *Prob per unit of time* [((*PE>AL*) & (*PL<=AL*)) *for longer than TTA*] *< required TIR*So an example of how to calculate PL will be helpful to understand the PL. |
| InterDigital | No (with comments) | The definition of PL currently captured in TS 37.355 is reasonable, generic and is based on the definition that was discussed during Rel-17 SI. We do not see the need for modifying the definition at this late stage. Perhaps any clarification to the definition can be discussed during Rel-18. |
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The discussion about KPI and integrity result report was held several meetings ago, concerning mode 1 (only PL reporting) and mode 2 (integrity event flagging), and only mode 1 was agreed. Just to straight out confusion, it can be good to confirm what the mode 1 agreement means.

Question UEA-2: Do you agree that the mode 1 agreement concerns device reporting of integrity results upon request from the location server – i.e. part of UE-assisted integrity assessment?

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| Company | Yes/No | Comments |
| CATT | Yes | The calculated/estimated PL is part of integrity assessment. |
| InterDigital | With comments | The description of “UE-assisted integrity assessment” provided in the background is somewhat confusing. Does it refer to LPP Location Information procedure with LPP request and provide messages? From our understanding Mode 1 reporting specified during Rel-17 applies for UE-based positioning integrity mode for services such as MT-LR. |
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## UE-based integrity assessment

UE-based integrity assessment means that the device compares PL to AL in consideration of TTA to determine availability of the location estimate within the device itself. The AL and TTA can be provided to the device in many different ways such as provided by the location server, provided by some application on the device side or pre-configured in the device.

If the AL and TTA, together with TIR would be provided by the location server as part of the assistance data to support UE-based integrity, one question raised was if the device is required to use it.

As comparison, we have UE-based positioning where the device is provided with assistance data from the location server to support UE-based positioning. It is up to device implementation if and how the device is using different parts of the assistance data for UE-based positioning.

Question UEB-1: Do companies agree that if AL and TTA, together with TIR is provided as part of assistance data from the location server to enable UE-based integrity assessment, it is up to device implementation if and how the information is used for integrity assessment, if information from higher layers in the device is used etc ?

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| Company | Yes/No | Comments |
| CATT | Yes | If location can be estimated by device, the integrity alert of estimated location from UE is acceptable. But it seems that UE-based integrity assessment is a new feature introduced to device, not a correction on Rel-17. |
| InterDigital | Yes (with comments) | From previous discussions during WI stage the UE could calculate PL when provided with TIR in the assistance data. Given this late stage into the discussion and that no foreseeable issue with support for GNSS integrity, we think any discussion related to providing AL and TTA in assistance data should not be handled as correction. However, the topic could be considered in Rel-18.  |
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The contribution [1] provides a text proposal with the few changes needed to enable the support of integrity for UE-based and A-GNSS positioning which is the remaining part of the WID objective [3].

Question UEB-2: Do companies agree to the text proposal in [1] with the few changes needed to enable the support of integrity for UE-based and A-GNSS positioning which is the remaining part of the WID objective ?

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| Company | Yes/No | Comments |
| CATT | Yes, but | There will be an extra requirement to device if the support of integrity for UE-based and A-GNSS positioning is enabled. We’d like to follow the views of devices.It’s good to have it if there is no big concern from device vendors. |
| InterDigital | No | Similar to our comments to question UEB-1, providing integrity requirements (i.e. AL and TTA) in assistance data should not be handled as correction. |
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Question UEB-3: Any other question or comment concerning UE-based integrity assessment?

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# Conclusion

TBD

# References

[1] R2-2208075 Provisioning of missing integrity requirements, Ericsson

[2] AI 6.11.2.4

[3] RP-210903, WID on NR Positioning Enhancements