3GPP TSG-RAN WG2 #118-e R2-22xxxxx

Online Meeting, May 9th – May 20th, 2022

Agenda Item: 6.11.2.4

Source: Ericsson

Title: [AT118-e][639][POS] Collection of views on integrity proposals (Ericsson)

Document for: Discussion, Decision

# Introduction

This email discussion addresses the following contributions submitted for Agenda Item 6.11.2.4 on GNSS Positioning Integrity, with summary in R2-2206092.

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| [**R2-2204997**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2204997.zip) | Draft LS to SA1/SA2 on GNSS integrity | Huawei, HiSilicon | LS out |
| [**R2-2205017**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2205017.zip) | Correction to stage2 on service level support for GNSS integrity | Huawei, HiSilicon | CR |
| [**R2-2205488**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2205488.zip) | Corrections on Positioning Integrity parameter table | Samsung R&D Institute UK | draftCR |
| [**R2-2205815**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2205815.zip) | Remaining issues for integrity | Ericsson | discussion |
| [**R2-2206067**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2206067.zip) | [C002] Correction on the Note of the Protection Level (PL) | CATT | CR |

* [AT118-e][639][POS] Collection of views on integrity proposals (Ericsson)

 Scope: Take comments on the proposals from R2-2206092, focussing on which topics are critical to treat.

 Intended outcome: Report to Monday week 2 session in R2-2206260

 Deadline: Friday 2022-05-13 1800 UTC

#  Contact Information

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# Discussion

## Stage 3 Definition of PL in 37.355 NOTE (RIL C002 R2-2206037)

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| [**R2-2206067**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2206067.zip) | [C002] Correction on the Note of the Protection Level (PL) | CATT | CR |

CATT motivates a needed change of the note defining how to determine PL, where AL should not be part of the equation, but the equation shall be seen as an implicit definition of PL in consideration of the established positioning error distribution and the target integrity risk.

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| **Text proposal for TS 37.355, Section 6.4.2, *CommonIEsProvideLocationInformation* IE:**NOTE: The Protection Level (PL) is 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 PL , 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>PL*)) *for longer than TTA*] *< required TIR*An alert will be triggered if the PL, which is derived based on above inequality, is larger than AL, which is specified by applications.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. |
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Hence, there are three options to define PL in relation to TIR and possibly AL:

* **Option 1**, as is,
	+ *Prob per unit of time* [((*PE>AL*) & (*PL<=AL*)) *for longer than TTA*] *< required TIR*
* **Option 2**, as proposed in R2-2206067
	+ *Prob per unit of time* [((*PE>PL*)) *for longer than TTA*] *< required TIR*
* **Option 3,** a proposed alternative definition of PL - use the comments field

Question 1 Which PL definition option do you prefer?

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| --- | --- | --- |
| Company | Preferred option 1-3 | Comments |
| Swift Navigation | Option 1 | Option 1 is correct and should not be modified as this is the industry accepted definition of integrity (see TR 38.857). In the case the AL is not available\* the inequality can be interpreted to be valid for all values of AL, which simplifies to the case of AL=PL and therefore corresponds with Option 2 already. To help clarify this point, one suggestion is to retain the inequality in Option 1 but notate that if the AL is not provided then the inequality must be satisfied for all values of AL.\* RAN2 previously decided not to send the AL KPI for the UE-based MT-LR case, but this would also be a valid option (refer to earlier proposals by Swift and others). |
| Huawei, HiSilcon | Option1 |  |
| Intel | Option 1 |  |
| Apple  | Option 1 |  |
| CATT | Option 2  | There is implementation issue with inequality in option1, since AL is not provided to UE, how can UE calculate the PL without AL according to Prob per unit of time [((PE>AL) & (PL<=AL)) for longer than TTA] < required TIR?  |
| Qualcomm | Option 1 | Current text seems correct, and no changes are needed. However, prefer to move the whole Note to Stage 2. Looks a bit misplaced in LPP. |
| InterDigital | Option 1 |  |
| vivo | Option 1 | The inequality is a criterion that aligns with the definition of integrity and is used to check whether the obtained integrity information can be used for location information validation. And the clarification of Swift makes sense that Option2 has been covered in Option 1. Therefore, we contend to retain the description in Option 1.Besides, we tend to agree with QC that the Note shall be removed to Stage 2 spec. |
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Proposal based on email discussion.

1. TBW

## Stage 2 Corrections [R2-2205017](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2205017.zip) and [R2-2205488](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2205488.zip)

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| [**R2-2205017**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2205017.zip) | Correction to stage2 on service level support for GNSS integrity | Huawei, HiSilicon | CR |

Huawei notes that any service level description for GNSS integrity is missing. In the description, there is a need to clarify that the target integrity risk comes from the service layer along with the LCS request. And the protection level and achievable target integrity risk need to be transferred back to the service layer as the results of the positioning procedure. The following additions are proposed:

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| **TS 38.305, Section 7.3.2:**The AMF sends a location request to the LMF for a target UE and may include associated QoS, the scheduled location time, target integrity risk and the UE LPP positioning capabilities when available, as described in TS 23.273 [35].2. The LMF may obtain location related information from the UE and/or from the serving NG-RAN Node. In the former case, the LMF instigates one or more LPP procedures to transfer UE positioning capabilities, provide assistance data to the UE and/or obtain location information from the UE. The UE may also instigate one or more LPP procedures after the first LPP message is received from the LMF (e.g., to request assistance data from the LMF). If a scheduled location time is provided in step 1, the LMF may schedule location measurements by the UE to occur at or near to the scheduled location time. The LPP procedures to transfer UE LPP positioning capabilities may be skipped if the LMF already obtained the UE positioning capabilities from the AMF in step 1.3. If the LMF needs location related information for the UE from the NG-RAN, the LMF instigates one or more NRPPa procedures. Step 3 is not necessarily serialised with step 2; if the LMF and NG-RAN Node have the information to determine what procedures need to take place for the location service, step 3 could precede or overlap with step 2. If a scheduled location time is provided in step 1, the LMF may schedule location measurements by the NG-RAN to occur at or near to the scheduled location time.4. The LMF returns a location response to the AMF with any location estimate, protection level and achievable target integrity risk obtained as a result of steps 2 and 3. The LMF may also return the LPP UE capabilities as described in TS 23.273 [35]. |
| **TS 38.305, Section 7.3.3:**5. The LMF invokes the Nlmf Determine Location Response service operation towards the AMF as specified in TS 29.572 [33] which includes any location estimate, protection level and achievable target integrity risk obtained as a result of steps 3 and 4. The LMF may also return the LPP UE capabilities as described in TS 23.273 [35].6. If the UE requested location transfer to a third party the AMF transfers the location, protection level and achievable target integrity risk received from the LMF in step 5 to the third party as defined in TS 23.273 [35].7. The AMF sends an MO-LR location service response message included in a DL NAS TRANSPORT message as specified in TS 24.501 [29]. |
| **TS 38.305, Section 7.3.4:**1. The UE sends a supplementary services event report message to the LMF as described in TS 24.571 [41] which is transferred via the serving AMF and is delivered to the LMF using an Namf\_Communication\_N1MessageNotify service operation. The event report may indicate the type of event being reported and may include an embedded positioning message which includes any location measurements or location estimate, protection level and achievable target integrity risk.2. If LMF determines no positioning procedure is needed, steps 3 and 4 are skipped.3. The LMF may utilize any location information received in step 1. The LMF may also retrieve location related information from the UE and/or from the serving NG-RAN Node. In the former case, the LMF instigates one or more LPP procedures to provide assistance data to the UE and/or obtain location information from the UE. The UE may also instigate one or more LPP procedures after the first LPP message is received from the LMF (e.g., to request assistance data from the LMF).4. If the LMF needs location related information for the UE from the NG-RAN, the LMF instigates one or more NRPPa procedures. Step 3 is not necessarily serialised with step 2; if the LMF and NG-RAN Node have the information to determine what procedures need to take place for the location service, step 3 could precede or overlap with step 2.5. The LMF invokes an Nlmf\_Location\_EventNotify service operation towards the GMLC with an indication of the type of event being reported and any location estimate, protection level and achievable target integrity risk obtained as a result of steps 2 and 3. |

Question 2 Do you agree to the proposed stage-2 changes suggested in R2-2205017?

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| --- | --- | --- |
| Company | Yes/No | Comments |
| Huawei, HiSIlicon(proponent) | Yes |  |
| Intel | Yes |  |
| Apple | Yes |  |
| CATT | Only step1 in 7.3.4 | Any corrections on the **interface between AMF(GMLC) and LMF** should not be captured so far because CT4 doesn’t define integrity yet. We should postpone any corrections which will be defined by CT4 actually.Step 1 and step4 in 7.3.2 should not be captured unless it is clearly defined by CT4.Step 5,6 in 7.3.3 should not be captured, especially step 6 (transfer to 3rd Party)which should not be defined by RAN2. Step 5 in 7.3.4 should not be captured for the same reason.  |
| Qualcomm | No | Same view as CATT. The proposed description is not supported in the AMF service operation. |
| InterDigital | Yes (with comments) | Generally ok to include the integrity results descriptions in TS 38.305. However, since PL is not defined in TS 38.305, we are wondering if it can be included (at least in step 1 of 7.3.4) without defining it in 38.305. Should the proposed changes in 38.305 include a reference to 37.355 where PL is currently defined?  |
| vivo |  | Although we think the change requests are right, they should be captured into the stage2 spec after the IEs are introduced between AMF and LMF by SA&CT. |
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Proposal based on email discussion.

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| [**R2-2205488**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2205488.zip) | Corrections on Positioning Integrity parameter table | Samsung R&D Institute UK | draftCR |

Samsung points out that the stage-2 Table 8.1.2.1b-1: Mapping of Integrity Parameters is not aligned with LPP.

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| **TS 38.305, Table 8.1.2.1b-1:****Table 8.1.2.1b-1: Mapping of Integrity Parameters**

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| **Error** | **GNSS Assistance Data** | **Integrity Fields** |
| **Integrity Alerts** | **Integrity Bounds (Mean)** | **Integrity Bounds (StdDev)** | **Residual Risks** | **Integrity Correlation Times** |
| Orbit | SSR Orbit Corrections | Real-Time Integrity(see Section 8.1.2.1.8) | Mean Orbit ErrorMean Orbit Rate Error | Variance Orbit ErrorVariance Orbit Rate Error(using this values for deriving StdDev) | Probability of Onset of Constellation FaultProbability of Onset of Satellite FaultMean Constellation Fault DurationMean Satellite Fault Duration | Orbit Range Error Correlation TimeOrbit Range Rate Error Correlation Time |
| Clock | SSR Clock Corrections | Mean Clock Error Mean Clock Rate Error | Standard Deviation Clock ErrorStandard Deviation Clock Rate Error |  | Clock Range Error Correlation TimeClock Range Rate Error Correlation Time |
| Code Bias | SSR Code Bias | Mean Code Bias Error Mean Code Bias Rate Error | Standard Deviation Code Bias Error Standard Deviation Code Bias Rate Error |  |  |
| Phase Bias | SSR Phase Bias | Mean Phase Bias Error Mean Phase Bias Rate Error | Standard Deviation Phase Bias ErrorStandard Deviation Phase Bias Rate Error |
| Ionosphere | SSR STEC Correction | Ionosphere DNU | Mean Ionospherre Error Mean Ionospherre Rate Error | Standard Deviation Ionosphere ErrorStandard Deviation Ionosphere Rate Error | Probability of Onset of Ionosphere FaultMean Ionosphere Fault Duration | Ionosphere Range Error Correlation TimeIonosphere Range Rate Error Correlation Time |
| Troposphere Vertical Hydro Static Delay | SSR Gridded Corrections | Troposphere DNU | Mean Troposphere Vertical Hydro Static Delay ErrorMean Troposphere Vertical Hydro Static Delay Rate Error | Standard Deviation Troposphere Vertical Hydro Static Delay ErrorStandard Deviation Troposphere Vertical Hydro Static Delay Rate Error | Probability of Onset of Troposphere FaultMean Troposphere Fault Duration | Troposphere Range Error Correlation TimeTroposphere Range Rate Error Correlation Time |
| TroposphereVertical WetDelay | Mean Troposphere Vertical Wet Delay ErrorMean Troposphere Vertical Wet Delay Rate Error | Standard Deviation Troposphere Vertical Wet Delay ErrorStandard Deviation Troposphere Vertical Wet Delay Rate Error |

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Question 3 Do you agree to the proposed changes in R2-2205488 to TS 38.305, Table 8.1.2.1b-1?

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| Company | Yes/No | Comments |
| Swift Navigation | Partly | 1. Agree with listing the fields in the Integrity Bounds columns (Mean & StdDev) but suggest the following text additions to the orbit row (there was a numbering issue with the initial equation but it’s important to reference the proper equation (8.1.2.1.21-1) because it converts the along-track, cross-track and radial components into the line-of-sight vector).

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| --- | --- |
| **Integrity Bounds (Mean)** | **Integrity Bounds (StdDev)** |
| Mean Orbit ErrorMean Orbit Rate Error(Calculated according to Equation 8.1.2.1.21-1) | Variance Orbit ErrorVariance Orbit Rate Error(Calculated according to Equation 8.1.2.1.21-1) |

1. Disagree with the proposed changes to the Residual Risk column. The existing table is correct because all four residual risk parameters apply to the Orbit, Clock, Code Bias and Phase Bias errors together (i.e. the satellite and constellation residual risks are the aggregated residual risk for the satellite and/or constellation and contain the sum of the residual risks for orbit, clock and biases). Although the parameters do not correspond to just the orbit, in LPP the decision was made in RAN2 to include them in the Orbit LPP message to avoid introducing a new LPP stand-alone message.
 |
| Intel | Partly | Agree the changes from Swift |
| Apple |  | Agree with Swift |
| InterDigital |  | Agree with Swift on the changes under Integrity Bounds (Mean and StdDev) in Table 8.1.2.1b-1 |
| vivo |  | Agree with Swift |
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Proposal based on email discussion.

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## LS to SA and CT groups: R2-2204997 and R2-2205815

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| [**R2-2204997**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2204997.zip) | Draft LS to SA1/SA2 on GNSS integrity | Huawei, HiSilicon | LS out |

Huawei has provided a draft LS to SA1 and SA2 about GNSS integrity and KPIs as well as some procedural changes to RAN2 stage-2 (TS 38.305).

Question 4 Do you agree to send an LS and do you have comments to the LS receivers (SA1/SA2) and LS text in R2-2204997.?

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| --- | --- | --- | --- |
| Company | Agree to send an LS? | LS recipient(s) | Comments |
| Huawei, HiSlicon | Yes | SA2,SA1 | The right protocol is taht we send an LS to SA1/2 to take care of the stage1/2 part and let SA2 to trigger CT to handle the Stage3 parts.  |
| Intel | Yes | SA2, SA1 |  |
| Apple | Yes |  |  |
| CATT | o.k. | SA1, SA2 |  |
| Qualcomm |  |  | O.K. to send an LS, but should not be needed, since companies can contribute in SA1/2 anyhow. But if RAN2 should send an LS, it should just state the facts and not tell them what they must do. There is also no need to copy 3GPP specification text into an LS; corresponding reference would be enough. |
| InterDigital | Yes | SA1, SA2 |  |
| vivo | Yes | To: SA2, SA1CC: CT4 |  |
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Proposal based on email discussion.

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| **[R2-2205815](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_118-e/Docs/R2-2205815.zip)** | Remaining issues for integrity | Ericsson | discussion |

Ericsson notes that QoS and requirements signalling from AMF to LMF is defined in TS 29.572 which CT4 is responsible group. Furthermore, the GLMC interface in TS 29.515 is also impacted to introduce support for interactions with network applications. Thus, RAN2 needs to liase with CT4 to define the integrity requirements and results signalling.

SA2 should also investigate impacts on the stage 2 description. For example, the integrity requirements and results may influence TS 23.273.

Question 5 Do you agree to send an LS and do you have comments to the LS receivers (SA2/CT4) and LS text in R2-2205815.?

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| Company | Agree to send an LS? | LS recipient(s) | Comments |
| Huawei,HiSilicon |  |  | See the comments above |
| Intel | Yes | SA2, CT4 | Assume there two LSs can be merged. |
| Apple | Yes |  |  |
| CATT |  | To SA1, SA2, CC CT4 | CT4 is triggered by SA2. |
| Qualcomm |  |  | O.K. to send an LS, but should not be needed, since companies can contribute in SA1/2 anyhow. But if RAN2 should send an LS, it should just state the facts and not tell them what they must do. Agree with CATT. On CT4 comment. SA1 and SA2 need to update their specifications first. |
| vivo | Merge the two LSs | To: SA2, SA1CC: CT4 |  |
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Proposal based on email discussion.

1. TBW

# Conclusion

Based on the discussion, the following is proposed: