3GPP TSG-RAN WG2 #118-e R2-2206260

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

As agreed online, the email discussion continues in Section 4 below until Thursday 2022-05-19 0400 UTC to discuss

Proposal 2 Add horizontal and vertical AL as optional parameters to IntegrityInformationRequest-r17

Agreement:

Keep the definition of PL, and clarify in a NOTE that the PL inequality is valid for all values of the AL.

Extend discussion to Thursday 2022-05-19 0400 UTC to discuss whether P2 is needed.

The background is that the Alert Limit in two different contexts:

1. The Alert Limit is part of the formal definition of the Protection Limit. Despite that fact, the device can determine a PL to report to LMF without the AL. It was also agreed that the device will not report AL to the LMF. The report enables LMF to assess positioning availability by comparing a PL reported by a device to an AL – can be ssen as UE-assisted integrity.
2. The Alert Limit as well as the Target Integrity Risk is configured by a network application for a set of devices associated to a use case. The AL and TIR are provided as part of the assistance data to the device to enable the device to determine PL, compare to AL and assess positioning availability – can be seen as UE-based integrity.

So far, the discussion in RAN2 has not fully addressed context 2, and this is the focus in phase 2 of the email discussion, see Section 4.

# Contact Information

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| Swift Navigation | Grant Hausler (grant@swiftnav.com) |
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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.

|  |
| --- |
| **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. |
|  |

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. |
| Ericsson | Option 1 | Option 1 is correct, but we miss the means for the network to configure AL. AL was agreed to be excluded from the KPIs, but is not really discussed how to include that in the AD.  It is naturally added to the TIR in the *CommonIEsRequestLocationInformation* IE as  IntegrityInformationRequest-r17 ::= SEQUENCE {      targetIntegrityRisk-r17     INTEGER (10..90),      horizontalAlertLimit-r17             FFS                OPTIONAL,      verticalAlertLimit-r17             FFS                OPTIONAL,      ...  } |
| OPPO | Option 1 | The condition 2, PE>PL, cannnot be interpreted to condition 1, PE>AL & AL>=PL. They are not equivalent. Under condition 2, there could be possibility that PL>AL and this could be easily detected by the system and not lead to critical failure of the positioning system. The probility of occurrence of such event (PE>PL>AL) is unnecessarily to be limited to be lower than TIR. We do think AlertLimit as a criterion is needed for the UE based method. |
| ZTE | Option 1 | Option 1 is the correct equation from 38.857 |
| Xiaomi | Option 1 |  |
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11 of the 12 companies that provided comments are in favor of Option 1, while one company favors Option 2. Several companies also commented that AL can be considered needed given the definition, and therefore, the possibility to provide AL as part of the AD needs to be discussed. There are also several companies suggesting to move the note to stage 2 instead for stage 3.

Proposal based on email discussion.

1. Support Option 1 – keep the existing definition of PL
2. Add horizontal and vertical AL as optional parameters to *IntegrityInformationRequest-r17*
3. Move the PL definition to TS 38.305

## 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. |
| Ericsson | Partly yes | Yes to all eventually, but we should first send the LS to SA2/CT4 for some parts. |
| OPPO | Yes but | We agree with CATT |
| ZTE |  | Agree with CATT |
| Xiaomi |  | Agree with CATT |
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From the comments, 7 or 10 responding companies thinks that some of the changes regarding non RAN2-interfaces are premature, and needs to be discussed in SA2/CT4 first

1. Support appending “protection level and achievable target integrity risk” to 38.305 Section 7.3.4, step 1 paragraph

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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**   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **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 Error  Mean Orbit Rate Error | Variance Orbit Error  Variance Orbit Rate Error  (using this values for deriving StdDev) | Probability of Onset of Constellation Fault  Probability of Onset of Satellite Fault  Mean Constellation Fault Duration  Mean Satellite Fault Duration | Orbit Range Error Correlation Time  Orbit Range Rate Error Correlation Time | | Clock | SSR Clock Corrections | Mean Clock Error  Mean Clock Rate Error | Standard Deviation Clock Error  Standard Deviation Clock Rate Error |  | Clock Range Error Correlation Time  Clock 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 Error  Standard Deviation Phase Bias Rate Error | | Ionosphere | SSR STEC Correction | Ionosphere DNU | Mean Ionospherre Error  Mean Ionospherre Rate Error | Standard Deviation Ionosphere Error  Standard Deviation Ionosphere Rate Error | Probability of Onset of Ionosphere Fault  Mean Ionosphere Fault Duration | Ionosphere Range Error Correlation Time  Ionosphere Range Rate Error Correlation Time | | Troposphere Vertical Hydro Static Delay | SSR Gridded Corrections | Troposphere DNU | Mean Troposphere Vertical Hydro Static Delay Error  Mean Troposphere Vertical Hydro Static Delay Rate Error | Standard Deviation Troposphere Vertical Hydro Static Delay Error  Standard Deviation Troposphere Vertical Hydro Static Delay Rate Error | Probability of Onset of Troposphere Fault  Mean Troposphere Fault Duration | Troposphere Range Error Correlation Time  Troposphere Range Rate Error Correlation Time | | TroposphereVertical WetDelay | Mean Troposphere Vertical Wet Delay Error  Mean Troposphere Vertical Wet Delay Rate Error | Standard Deviation Troposphere Vertical Wet Delay Error  Standard Deviation Troposphere Vertical Wet Delay Rate Error | |

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).  |  |  | | --- | --- | | **Integrity Bounds (Mean)** | **Integrity Bounds (StdDev)** | | Mean Orbit Error  Mean Orbit Rate Error  (Calculated according to Equation 8.1.2.1.21-1) | Variance Orbit Error  Variance 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 |
| Ericsson |  | Agree with Swift |
| OPPO |  | Agree with Swift |
| ZTE |  | Agree with Swift |
| Xiaomi |  | Agree with Swift |
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All companies agrees with the proposed change by Samsung including the suggested revised edit of Table 8.1.2.1b-1 by Swift.

1. Support the suggested change to Table 8.1.2.1b-1.

## 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, SA1  CC: CT4 |  |
| Ericsson |  | Not to SA1 | SA1 has started to work with Rel-19. There is no possibility to add a CR for Rel-17. The RAN TR can still be viewed as document which captures the requirements.  Further, SA1 in TS22.261 section which says  22.261:  6.27 Positioning services  6.27.2 Requirements  ……….  The 5G system shall be able to determine the reliability, and the uncertainty or confidence level, of the position-related data.  Hence reference to TR 38.857 And SA1 above could be also be sufficient. |
| OPPO | Yes |  |  |
| ZTE | Yes | SA1, SA2 |  |
| Xiaomi | Yes |  |  |
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All companies are fine with sending an LS informing about the RAN2 agreements. There are some different opinions about the reciptient WGs, where majority favors SA1/SA2.

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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, SA1  CC: CT4 |  |
| Ericsson |  | To: SA2, CC CT4 |  |
| OPPO | Yes |  |  |
| ZTE | Yes |  |  |
| Xiaomi | Yes |  |  |
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All companies are fine with sending an LS informing about the RAN2 agreements. There are some different opinions about the reciptient WGs.

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1. Support the suggestion in R2-2204997 and R2-2205815 to send an LS to relevant WGs about the agreements for integrity

# Discussion Phase 2

Question 6.Do you agree that in order to support UE-based integrity, the device needs to be configured by LMF with both TIR and AL as part of the assistance data?

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| Company | Comments |
| Swift Navigation | It’s helpful to consider the MT-LR and MO-LR cases separately. In both cases we are UE-based for the integrity computation but there is a difference in how the AL is handled.  In the MO-LR case, everything is internal to the UE. LPP procedures aren't needed to transfer the AL/KPIs; the UE knows its internal AL and other KPIs so it is able to determine its own availability. All that is needed is the integrity assistance data. This case is handled well today in the current CR.  The MT-LR case is more difficult. In this case the LMF knows the KPIs. If we do not send the AL to the UE, then the UE must assume the worst case AL in its PL computation (AL=PL). It then returns this PL back to the LMF (Mode 1). The UE has not determined availability as it does not know the AL, it simply computes the PL. Now the LMF has the job of computing availability by comparing the returned PL to its internal AL, as per Mode 1. As the LMF is responsible for the availability computation, it is ok for the UE not to know the AL.  Given this, we don’t think it is mandatory to send the AL to the UE, however it would be beneifical because it gives greater flexibility at the UE rather than needing to assume the worst case condition of AL=PL (which places a hard constraint on the UE).  If the AL is to be included then we believe it should be in the *CommonIEsRequestLocationInformation* where we have included the TIR already, not in the assistance data. |
| CATT | It seems it is not mandatory to send the AL to the UE since UE assumes the worst case AL in its PL computation (AL=PL). So we don’t think AL is required. Shall we clarify the situation that when AL is not available for UE in the note? |
| Ericsson | Note that for “UE-based integrity”, the device gets AL and TIR either from its higher layers or from LMF, but that latter needs to be introduced signaling for. This category is not about computation and reporting PL to LMF. Instead, this is about the ability of the UE to request integrity requirements in terms of TIR and AL from LMF and LMF to provide TIR and AL as part of th assistance data (can be unsolicited)  Therefore, this part is about whether there should be an addition to the common request/provide AD for this. |
| vivo | We are fine to not have the AL in the RequestLocationInformation as only mode 1 is supported in R17.  But if preferred by the majority and agreed to be introduced, we agree with Swift that the AL shall be in the *CommonIEsRequestLocationInformation* instead of AD.  Besides, we think the PL is calculated based on the assistance information (feared event) and TIR, and the AL in the inequality is only to identify whether the integrity KPI are satisfied but not used to calculate the PL. So we agree with CATT to clarify it with a Note in the stage2 spec. |

The AL can be provided to the device via the assistance data for integrity configuration together with the TIR. Most naturally, it is part of the common assistance data request as outlined in the text proposal in Appendix.

Question 7. Do you agree to the text proposal in Appendix to introduce the alert limit and TIR in the assistance data

|  |  |
| --- | --- |
| Company | Comments |
| Swift Navigation | No, we prefer to add the AL in the *CommonIEsRequestLocationInformation* where the TIR for the request is already included today. Moving this to the Assistance Data isn’t part of the procedures that have been discussed or agreed to date and we aren’t sure how it would be used in this context. |
| CATT | Please see the comment of Q6. |
| Ericsson | So it seems that the AL can be an optional field in the common request loc info from LMF to the device to support the device with flexibility to compute the PL and report back.  There is a separate thing about whether the device shall also be able to request the integrity requirements as part of the AD request. It seems natural to include that in order to have a complete integrity scope in LPP.  We added also the needed parts below in the text proposal for the common request allocation information to allow device flexibility when calculating PL by providing AL |
| vivo | No, taking QoS as a reference, the UE also does not request QoS parameters from the LMF as AD. |

# Conclusion

Based on the discussion, the following is proposed:

Phase 1 proposals:

[**Proposal 1 Support Option 1 – keep the existing definition of PL**](#_Toc103582970)

[**Proposal 2 Add horizontal and vertical AL as optional parameters to *IntegrityInformationRequest-r17***](#_Toc103582971)

[**Proposal 3 Move the PL definition to TS 38.305**](#_Toc103582972)

[**Proposal 4 Support appending “protection level and achievable target integrity risk” to 38.305 Section 7.3.4, step 1 paragraph**](#_Toc103582973)

[**Proposal 5 Support the suggested change to Table 8.1.2.1b-1.**](#_Toc103582974)

[**Proposal 6 Support the suggestion in R2-2204997 and R2-2205815 to send an LS to relevant WGs about the agreements for integrity**](#_Toc103582975)

# Appendix – Text Proposal to 37.355

6.4.2 Common Positioning

*[…]*

– *CommonIEsRequestAssistanceData*

The *CommonIEsRequestAssistanceData* carries common IEs for a Request Assistance Data LPP message Type.

-- ASN1START

CommonIEsRequestAssistanceData ::= SEQUENCE {

primaryCellID ECGI OPTIONAL, -- Cond EUTRA

...,

[[

segmentationInfo-r14 SegmentationInfo-r14 OPTIONAL -- Cond Segmentation

]],

[[

periodicAssistanceDataReq-r15

PeriodicAssistanceDataControlParameters-r15

OPTIONAL, -- Cond PerADreq

primaryCellID-r15 NCGI-r15 OPTIONAL -- Cond NR

]],

[[

integrityRequirementsReq-r17 NULL OPTIONAL

]]

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *EUTRA* | The field is mandatory present for E-UTRA or NB-IoT access. The field shall be omitted for non-EUTRA and non-NB-IoT user plane support. |
| *Segmentation* | This field is optionally present, need OP, if *lpp-message-segmentation-req* has been received from the location server with bit 1 (*targetToServer*) set to value 1. The field shall be omitted if *lpp‑message‑segmentation-req* has not been received in this location session, or has been received with bit 1 (*targetToServer*) set to value 0. |
| *PerADreq* | The field is mandatory present if the target device requests periodic assistance data delivery. Otherwise it is not present. |
| *NR* | The field is mandatory present for NR access. The field shall be omitted for non-NR user plane support. |

| ***CommonIEsRequestAssistanceData* field descriptions** |
| --- |
| ***primaryCellID***  This parameter identifies the current primary cell for the target device. |
| ***segmentationInfo***  This field indicates whether this *RequestAssistanceData* message is one of many segments, as specified in clause 4.3.5. |
| ***periodicAssistanceDataReq***  This field indicates a request for periodic assistance data delivery, as specified in clause 5.2.1a. |
| ***integrityRequirementsReq***  This field, if present, indicates a request for integrity requirements.. |

– *CommonIEsProvideAssistanceData*

The *CommonIEsProvideAssistanceData* carries common IEs for a Provide Assistance Data LPP message Type.

-- ASN1START

CommonIEsProvideAssistanceData ::= SEQUENCE {

...,

[[

segmentationInfo-r14 SegmentationInfo-r14 OPTIONAL -- Need ON

]],

[[

periodicAssistanceData-r15 PeriodicAssistanceDataControlParameters-r15

OPTIONAL -- Cond PerAD

]],

[[

integrityRequirements-r17 IntegrityRequirements-r17 OPTIONAL

]]

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *PerAD* | The field is mandatory present in a periodic assistance data delivery session. Otherwise it is not present. |

| ***CommonIEsRequestAssistanceData* field descriptions** |
| --- |
| ***segmentationInfo***  This field indicates whether this *ProvideAssistanceData* message is one of many segments, as specified in clause 4.3.5. |
| ***periodicAssistanceData***  This field indicates a periodic assistance data delivery, as specified in clauses 5.2.1a and 5.2.2a. |

*[…]*

– *CommonIEsRequestLocationInformation*

The *CommonIEsRequestLocationInformation* carries common IEs for a Request Location Information LPP message Type.

-- ASN1START

CommonIEsRequestLocationInformation ::= SEQUENCE {

locationInformationType LocationInformationType,

triggeredReporting TriggeredReportingCriteria OPTIONAL, -- Cond ECID

periodicalReporting PeriodicalReportingCriteria OPTIONAL, -- Need ON

additionalInformation AdditionalInformation OPTIONAL, -- Need ON

qos QoS OPTIONAL, -- Need ON

environment Environment OPTIONAL, -- Need ON

locationCoordinateTypes LocationCoordinateTypes OPTIONAL, -- Need ON

velocityTypes VelocityTypes OPTIONAL, -- Need ON

...,

[[

messageSizeLimitNB-r14 MessageSizeLimitNB-r14 OPTIONAL -- Need ON

]],

[[

segmentationInfo-r14 SegmentationInfo-r14 OPTIONAL -- Need ON

]],

[[

scheduledLocationRequest-r17

ScheduledLocationRequest-r17

OPTIONAL, -- Need ON

integrityInformationRequest-r17

IntegrityInformationRequest-r17

OPTIONAL -- Need ON

]]

}

LocationInformationType ::= ENUMERATED {

locationEstimateRequired,

locationMeasurementsRequired,

locationEstimatePreferred,

locationMeasurementsPreferred,

...

}

PeriodicalReportingCriteria ::= SEQUENCE {

reportingAmount ENUMERATED {

ra1, ra2, ra4, ra8, ra16, ra32,

ra64, ra-Infinity

} DEFAULT ra-Infinity,

reportingInterval ENUMERATED {

noPeriodicalReporting, ri0-25,

ri0-5, ri1, ri2, ri4, ri8, ri16, ri32, ri64

}

}

TriggeredReportingCriteria ::= SEQUENCE {

cellChange BOOLEAN,

reportingDuration ReportingDuration,

...

}

ReportingDuration ::= INTEGER (0..255)

AdditionalInformation ::= ENUMERATED {

onlyReturnInformationRequested,

mayReturnAditionalInformation,

...

}

QoS ::= SEQUENCE {

horizontalAccuracy HorizontalAccuracy OPTIONAL, -- Need ON

verticalCoordinateRequest BOOLEAN,

verticalAccuracy VerticalAccuracy OPTIONAL, -- Need ON

responseTime ResponseTime OPTIONAL, -- Need ON

velocityRequest BOOLEAN,

...,

[[ responseTimeNB-r14 ResponseTimeNB-r14 OPTIONAL -- Need ON

]],

[[ horizontalAccuracyExt-r15 HorizontalAccuracyExt-r15 OPTIONAL, -- Need ON

verticalAccuracyExt-r15 VerticalAccuracyExt-r15 OPTIONAL -- Need ON

]]

}

HorizontalAccuracy ::= SEQUENCE {

accuracy INTEGER(0..127),

confidence INTEGER(0..100),

...

}

VerticalAccuracy ::= SEQUENCE {

accuracy INTEGER(0..127),

confidence INTEGER(0..100),

...

}

HorizontalAccuracyExt-r15 ::= SEQUENCE {

accuracyExt-r15 INTEGER(0..255),

confidence-r15 INTEGER(0..100),

...

}

VerticalAccuracyExt-r15 ::= SEQUENCE {

accuracyExt-r15 INTEGER(0..255),

confidence-r15 INTEGER(0..100),

...

}

ResponseTime ::= SEQUENCE {

time INTEGER (1..128),

...,

[[ responseTimeEarlyFix-r12 INTEGER (1..128) OPTIONAL -- Need ON

]],

[[ unit-r15 ENUMERATED { ten-seconds, ... , ten-milli-seconds-r17 } OPTIONAL -- Need ON

]]

}

ResponseTimeNB-r14 ::= SEQUENCE {

timeNB-r14 INTEGER (1..512),

responseTimeEarlyFixNB-r14 INTEGER (1..512) OPTIONAL, -- Need ON

...,

[[ unitNB-r15 ENUMERATED { ten-seconds, ... } OPTIONAL -- Need ON

]]

}

Environment ::= ENUMERATED {

badArea,

notBadArea,

mixedArea,

...

}

MessageSizeLimitNB-r14 ::= SEQUENCE {

measurementLimit-r14 INTEGER (1..512) OPTIONAL, -- Need ON

...

}

ScheduledLocationRequest-r17 ::= SEQUENCE {

scheduledLocationTime-r17 ScheduledLocationTime-r17,

...

}

ScheduledLocationTime-r17 ::= SEQUENCE {

utcTime-r17 UTCTime,

gnssTime-r17 SEQUENCE {

gnss-TOD-msec-r17 INTEGER (0..3599999),

gnss-TimeID-r17 GNSS-ID

},

networkTime-r17 CHOICE {

e-utraTime-r17 SEQUENCE {

lte-physCellId-r17 INTEGER (0..503),

lte-arfcnEUTRA-r17 ARFCN-ValueEUTRA,

lte-cellGlobalId-r17 CellGlobalIdEUTRA-AndUTRA

OPTIONAL, -- Need ON

lte-systemFrameNumber-r17 INTEGER (0..1023)

},

nrTime-r17 SEQUENCE {

nr-PhysCellID-r17 NR-PhysCellID-r16,

nr-ARFCN-r17 ARFCN-ValueNR-r15,

nr-CellGlobalID-r17 NCGI-r15 OPTIONAL, -- Need ON

nr-SFN-r17 INTEGER (0..1023),

nr-Slot-r17 CHOICE {

scs15-r17 INTEGER (0..9),

scs30-r17 INTEGER (0..19),

scs60-r17 INTEGER (0..39),

scs120-r17 INTEGER (0..79)

} OPTIONAL -- Need ON

},

...

},

relativeTime-r17 INTEGER (1..1024),

...

}

IntegrityInformationRequest-r17 ::= SEQUENCE {

targetIntegrityRisk-r17 INTEGER (10..90),

horizontalAlertLimit-r17 INTEGER (0..50000) OPTIONAL, -- Need ON

verticalAlertLimit-r17 INTEGER (0..50000) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *ECID* | The field is optionally present, need ON, if E-CID or NR E-CID is requested. Otherwise it is not present. |

| ***CommonIEsRequestLocationInformation* field descriptions** |
| --- |
| ***locationInformationType***  This IE indicates whether the server requires a location estimate or measurements. For '*locationEstimateRequired*', the target device shall return a location estimate if possible, or indicate a location error if not possible. For '*locationMeasurementsRequired*', the target device shall return measurements if possible, or indicate a location error if not possible. For '*locationEstimatePreferred*', the target device shall return a location estimate if possible, but may also or instead return measurements for any requested position methods for which a location estimate is not possible. For '*locationMeasurementsPreferred*', the target device shall return location measurements if possible, but may also or instead return a location estimate for any requested position methods for which return of location measurements is not possible. |
| ***triggeredReporting***  This IE indicates that triggered reporting is requested and comprises the following subfields:  - ***cellChange***: If this field is set to TRUE, the target device provides requested location information each time the primary cell has changed.  - ***reportingDuration***: Maximum duration of triggered reporting in seconds. A value of zero is interpreted to mean an unlimited (i.e. "infinite") duration. The target device should continue triggered reporting for the *reportingDuration* or until an LPP *Abort* or *LPP Error* message is received.  The *triggeredReporting* field should not be included by the location server and shall be ignored by the target device if the *periodicalReporting* IE or *responseTime* IE or *responseTimeNB* IE is included in *CommonIEsRequestLocationInformation.* |
| ***periodicalReporting***  This IE indicates that periodic reporting is requested and comprises the following subfields:  - ***reportingAmount*** indicates the number of periodic location information reports requested. Enumerated values correspond to 1, 2, 4, 8, 16, 32, 64, or infinite/indefinite number of reports. If the *reportingAmount* is '*infinite/indefinite'*, the target device shou-ld continue periodic reporting until an LPP *Abort* message is received. The value '*ra1*' shall not be used by a sender.  - ***reportingInterval*** indicates the interval between location information reports and the response time requirement for the first location information report. Enumerated values ri0-25, ri0-5, ri1, ri2, ri4, ri8, ri16, ri32, ri64 correspond to reporting intervals of 1, 2, 4, 8, 10, 16, 20, 32, and 64 seconds, respectively. Measurement reports containing no measurements or no location estimate are required when a *reportingInterval* expires before a target device is able to obtain new measurements or obtain a new location estimate. The value '*noPeriodicalReporting*' shall not be used by a sender. |
| ***additionalInformation***  This IE indicates whether a target device is allowed to return additional information to that requested. If this IE indicates '*onlyReturnInformationRequested'* then the target device shall not return any additional information to that requested by the server. If this IE indicates '*mayReturnAdditionalInformation'* then the target device may return additional information to that requested by the server. If a location estimate is returned, any additional information is restricted to that associated with a location estimate (e.g. might include velocity if velocity was not requested but cannot include measurements). If measurements are returned, any additional information is restricted to additional measurements (e.g. might include E-CID measurements if A-GNSS measurements were requested but not E-CID measurements). |
| ***qos***  This IE indicates the quality of service and comprises a number of sub-fields. In the case of measurements, some of the sub-fields apply to the location estimate that could be obtained by the server from the measurements provided by the target device assuming that the measurements are the only sources of error. Fields are as follows:  - ***horizontalAccuracy*** indicates the maximum horizontal error in the location estimate at an indicated confidence level. The '*accuracy*' corresponds to the encoded uncertainty as defined in TS 23.032 [15] and '*confidence*' corresponds to confidence as defined in TS 23.032 [15].  - ***verticalCoordinateRequest*** indicates whether a vertical coordinate is required (TRUE) or not (FALSE)  - ***verticalAccuracy*** indicates the maximum vertical error in the location estimate at an indicated confidence level and is only applicable when a vertical coordinate is requested. The '*accuracy*' corresponds to the encoded uncertainty altitude as defined in TS 23.032 [15] and '*confidence*' corresponds to confidence as defined in TS 23.032 [15].  - ***responseTime***  - ***time*** indicates the maximum response time as measured between receipt of the *RequestLocationInformation* and transmission of a *ProvideLocationInformation*. If the *unit* field is absent, this is given as an integer number of seconds between 1 and 128. If the *unit* field is present with enumerated value '*ten-seconds*', the maximum response time is given in units of 10-seconds, between 10 and 1280 seconds. If the *unit* field is present with enumerated value '*ten-milli-seconds*', the maximum response time is given in units of 10-milli-seconds, between 0.01 and 1.28 seconds. If the *periodicalReporting* IE is included in *CommonIEsRequestLocationInformation*, this field should not be included by the location server and shall be ignored by the target device (if included).  - ***responseTimeEarlyFix*** indicates the maximum response time as measured between receipt of the *RequestLocationInformation* and transmission of a *ProvideLocationInformation* containing early location measurements or an early location estimate. If the *unit* field is absent, this is given as an integer number of seconds between 1 and 128. If the *unit* field is present with enumerated value '*ten-seconds*', the maximum response time is given in units of 10-seconds, between 10 and 1280 seconds. If the *unit* field is present with enumerated value '*ten-milli-seconds*', the maximum response time is given in units of 10-milli-seconds, between 0.01 and 1.28 seconds. When this IE is included, a target should send a *ProvideLocationInformation* (or more than one *ProvideLocationInformation* if location information will not fit into a single message) containing early location information according to the *responseTimeEarlyFix* IE and a subsequent *ProvideLocationInformation* (or more than one *ProvideLocationInformation* if location information will not fit into a single message) containing final location information according to the *time* IE. A target shallomit sending a *ProvideLocationInformation* if the early location information is not available at the expiration of the time value in the *responseTimeEarlyFix* IE. A server should set the *responseTimeEarlyFix* IE to a value less than that for the *time* IE. A target shall ignore the *responseTimeEarlyFix* IE if its value is not less than that for the *time* IE.  - ***unit*** indicates the unit of the *time* and *responseTimeEarlyFix* fields. Enumerated value '*ten-seconds*' corresponds to a resolution of 10 seconds. Enumerated value '*ten-milli-seconds*' corresponds to a resolution of 0.01 seconds. If this field is absent, the unit/resolution is 1 second. Enumerated value '*ten-milli-seconds*' is only applicable for NR E-CID Positioning, NR DL-TDOA Positioning, NR DL-AoD Positioning, and NR Multi-RTT Positioning.  - ***velocityRequest*** indicates whether velocity (or measurements related to velocity) is requested (TRUE) or not (FALSE).  - ***responseTimeNB*** If the *periodicalReporting* IE or *responseTime* IE is included in *CommonIEsRequestLocationInformation*, this field should not be included by the location server and shall be ignored by the target device (if included).  - ***timeNB*** indicates the maximum response time as measured between receipt of the *RequestLocationInformation* and transmission of a *ProvideLocationInformation*. If the *unitNB* field is absent, this is given as an integer number of seconds between 1 and 512. If the *unitNB* field is present, the maximum response time is given in units of 10-seconds, between 10 and 5120 seconds.  - ***responseTimeEarlyFixNB*** indicates the maximum response time as measured between receipt of the *RequestLocationInformation* and transmission of a *ProvideLocationInformation* containing early location measurements or an early location estimate. If the *unitNB* field is absent, this is given as an integer number of seconds between 1 and 512. If the *unitNB* field is present, the maximum response time is given in units of 10-seconds, between 10 and 5120 seconds. When this IE is included, a target should send a *ProvideLocationInformation* (or more than one *ProvideLocationInformation* if location information will not fit into a single message) containing early location information according to the *responseTimeEarlyFixNB* IE and a subsequent *ProvideLocationInformation* (or more than one *ProvideLocationInformation* if location information will not fit into a single message) containing final location information according to the *timeNB* IE. A target shall omit sending a *ProvideLocationInformation* if the early location information is not available at the expiration of the time value in the *responseTimeEarlyFixNB* IE. A server should set the *responseTimeEarlyFixNB* IE to a value less than that for the *timeNB* IE. A target shall ignore the *responseTimeEarlyFixNB* IE if its value is not less than that for the *timeNB* IE.  - ***unitNB*** indicates the unit of the *timeNB* and *responseTimeEarlyFixNB* fields. Enumerated value '*ten-second*' corresponds to a resolution of 10 seconds. If this field is absent, the unit/resolution is 1 second.  - ***horizontalAccuracyExt*** indicates the maximum horizontal error in the location estimate at an indicated confidence level. The '*accuracyExt*' corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and 'confidence' corresponds to confidence as defined in TS 23.032 [15]. This field should not be included by the location server and shall be ignored by the target device if the *horizontalAccuracy* field is included in QoS.  - ***verticalAccuracyExt*** indicates the maximum vertical error in the location estimate at an indicated confidence level and is only applicable when a vertical coordinate is requested. The '*accuracyExt*' corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and '*confidence*' corresponds to confidence as defined in TS 23.032 [15]. This field should not be included by the location server and shall be ignored by the target device if the *verticalAccuracy* field is included in QoS.  All QoS requirements shall be obtained by the target device to the degree possible but it is permitted to return a response that does not fulfill all QoS requirements if some were not attainable. The single exception is *time* and *timeNB* which shall always be fulfilled – even if that means not fulfilling other QoS requirements.  A target device supporting NB-IoT access shall support the *responseTimeNB* IE*.*  A target device supporting HA GNSS shall support the *HorizontalAccuracyExt*, *VerticalAccuracyEx*, and *unit* fields with enumerated value '*ten-seconds*'.  A target device supporting NB-IoT access and HA GNSS shall support the *unitNB* field. |
| ***environment***  This field provides the target device with information about expected multipath and non line of sight (NLOS) in the current area. The following values are defined:  - badArea: possibly heavy multipath and NLOS conditions (e.g. bad urban or urban).  - notBadArea: no or light multipath and usually LOS conditions (e.g. suburban or rural).  - mixedArea: environment that is mixed or not defined.  If this field is absent, a default value of 'mixedArea' applies. |
| ***locationCoordinateTypes***  This field provides a list of the types of location estimate that the target device may return when a location estimate is obtained by the target. |
| ***velocityTypes***  This fields provides a list of the types of velocity estimate that the target device may return when a velocity estimate is obtained by the target. |
| ***messageSizeLimitNB***  This field provides an octet limit on the amount of location information a target device can return.  - ***measurementLimit*** indicates the maximum amount of location information the target device should return in response to the *RequestLocationInformation* message received from the location server. The limit applies to the overall size of the LPP message at LPP level (LPP Provide Location Information), and is specified in steps of 100 octets. The message size limit is then given by the value provided in *measurementLimit* times 100 octets. |
| ***segmentationInfo***  This field indicates whether this *RequestLocationInformation* message is one of many segments, as specified in clause 4.3.5 |
| ***scheduledLocationRequest***  This field indicates that the target device is requested to obtain location measurements or location estimate valid at the *scheduledLocationTime* *T* and comprises the following subfields:  - ***scheduledLocationTime*** indicates the time *T* when the location measurements or location estimate is to be obtained.  - ***utcTime*** provides *T* in UTC in the form of YYMMDDhhmmssZ.  - ***gnssTime*** provides *T* in GNSS system time of the GNSS indicated by *gnss-TimeID*.  - ***gnss-TOD-msec*** specifies the GNSS TOD in 1-milli-second resolution rounded down to the nearest millisecond unit.  - ***networkTime*** provides *T* in E-UTRA or NR network time.  - ***lte-physCellId, lte-arfcnEUTRA, lte-cellGlobalId*** identifies the reference cell (E-UTRA) that is used for the network time.  - ***lte-systemFrameNumber*** specifies the system frame number in E-UTRA.  - ***nr-PhysCellID***, ***nr-ARFCN*** , ***nr-CellGlobalID*** identifies the reference cell (NR) that is used for the network time.  - ***nr-SFN*** specifies the system frame number in NR.  - ***nr-Slot*** specifies the slot number in NR for the indicated subcarrier spacing (SCS). The total NR network time is given by *nr-SFN* + *nr-Slot*.  - ***relativeTime*** provides *T* in seconds from current time, where current time is defined as the time the *CommonIEsRequestLocationInformation* was received.  NOTE: A location estimate returned to an LCS Client, AF or UE for a scheduled location time can be treated by the LCS Client, AF or UE as an estimate of the location of the UE at the scheduled location time (see TS 23.273 [42]). |
| ***integrityInformationRequest***  This field, if present, indicates that the target device is requested to report integrity information for the location estimate and comprises the following integrity requirements:   * - ***targetIntegrityRisk*** indicates the Target Integrity Risk (TIR) for which the Protection Level (PL) is requested. The TIR is given by *P*=10-0.1*n* [hour-1] where *n* is the value of *targetIntegrityRisk* and the range is 10-1 to 10-9 per hour.***horizontalAlertLimit***   This field indicates the horizontal alert limit along the semi-major axis of the error ellipse provided for device flexibility to determine HPL. Scale factor 0.01 metre; range 0 – 500 metres.   * ***verticalAlertLimit***   This field indicates the vertical alert limit provided for device flexibility to determine VPL. Scale factor 0.01 metre; range 0 – 500 metres. |

*[…]*

6.4.3 Common NR Positioning Information Elements

*[…]*

– *DL-PRS-ID-Info*

The IE *DL-PRS-ID-Info* provides the IDs of the reference TRPs' DL-PRS Resources.

-- ASN1START

DL-PRS-ID-Info-r16 ::= SEQUENCE {

dl-PRS-ID-r16 INTEGER (0..255),

nr-DL-PRS-ResourceID-List-r16 SEQUENCE (SIZE (1..nrMaxResourceIDs-r16)) OF

NR-DL-PRS-ResourceID-r16

OPTIONAL, -- Need ON

nr-DL-PRS-ResourceSetID-r16 NR-DL-PRS-ResourceSetID-r16

OPTIONAL -- Need ON

}

-- ASN1STOP

| ***DL-PRS-ID-Info* field descriptions** |
| --- |
| ***nr-DL-PRS-ResourceID-List***  This field provides a list of DL-PRS Resource IDs under the same DL-PRS Resource Set. |

– *IntegrityRequirements*

The IE *IntegrityRequirements* provides the the requirement parameters the device needs to assess positioning integrity

-- ASN1START

IntegrityRequirements-r17 ::= SEQUENCE {

targetIntegrityRisk-r17 INTEGER (10..90),

horizontalAlertLimit-r17 INTEGER (0..50000),

verticalAlertLimit-r17 INTEGER (0..50000) OPTIONAL, -- Need ON

...

-- ASN1STOP

| ***IntegrityRequirements* field descriptions** |
| --- |
| ***targetIntegrityRisk***  This field indicates the Target Integrity Risk (TIR) for the integrity principle of operation by the device. The TIR is given by *P*=10-0.1*n* [hour-1] where *n* is the value of *targetIntegrityRisk* and the range is 10-1 to 10-9 per hour. |
| ***horizontalAlertLimit***  This field indicates the horizontal alert limit for the integrity principle of operation by the device along the semi-major axis of the error ellipse. Scale factor 0.01 metre; range 0 – 500 metres. To be compared to the horizontal protection level determined by the device. |
| ***verticalAlertLimit***  This field indicates the vertical alert limit for the integrity principle of operation by the device. Scale factor 0.01 metre; range 0 – 500 metres. To be compared to the horizontal protection level determined by the device. To be compared to the vertical protection level determined by the device. |