**3GPP TSG-RAN WG2 Meeting #116-e R2-2111378**

**Electronic Meeting, November 1 – 12, 2021**

**Agenda item:** 8.11.1

**Source:** InterDigital Inc.

**Title:** Email discussion report on [AT116-e][624][POS] 36.305 and 38.305 CRs for GNSS positioning integrity (InterDigital)

**Document for:**  Discussion

# 1. Introduction

This document summarizes the following email discussion:

* [AT116-e][624][POS] 36.305 and 38.305 CRs for GNSS positioning integrity (InterDigital)

Scope: Collect comments on the running CRs preparatory to endorsement.

Intended outcome: Updated CRs and report

Deadline: Tuesday 2021-11-09 0800 UTC

The discussion to be split in two phases:

**Phase 1**: To collect comments on the draft running CRs. The **deadline for Phase 1** of this email discussion is **Friday 2021-11-05, 11:59AM UTC.**

**Phase 2**: To review the updated version of the running CRs. The **deadline for Phase 2** of this email discussion is **Tuesday 2021-11-09, 08:00AM UTC**

The draft running CRs are attached with this email discussion.

Please provide the contact information in the following Table:

|  |  |  |
| --- | --- | --- |
| **Company** | **Point of contact** | **Email address** |
| Apple | Sasha Sirotkin | [ssirotkin@apple.com](mailto:ssirotkin@apple.com) |
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# 2. Discussion

The scope of this email discussion is to discuss the Stage 2 description to be included in the running CRs for TS 38.305 and TS 36.305, in [1] and [2], respectively. The text proposal provided in the running CRs are based on the descriptions discussed during the [Post115-e][614][POS] email discussion [3]. The previously submitted running CRs (prior to start of RAN2#116-e meeting) are R2-2111012 [4] and R2-2111013 [5].

## 2.1 Definition of Positioning Integrity

This section is intended to handle the discussion on the definition of positioning integrity.

From the previous email discussion in [3], the need for including a definition was clarified. From the rapporteur’s understanding, it is important to have the definition since the meaning behind “positioning integrity” should be clear in the specification. It was also discussed in [3], that the definition of positioning integrity may include aspects related to “measure of trust of in accuracy of position related data” and “the ability to send alert/warnings indication”. In light of the discussions, the definition of positioning integrity is revised from that provided in the previously submitted running CRs R2-2111012 [4] and R2-2111013 [5].

The revised definition of positioning integrity is proposed as follows:

**Positioning integrity:** A measure of the trust in the accuracy of the position-related data and the ability to provide timely warnings based on assistance data provided by the network

This definition is proposed to be included in both TS 38.305 and TS 36.305, under clause 3.1. The draft CRs containing the above definition are attached with this email discussion and provided in [1] and [2].

Q1: Do you agree with the revised definition of positioning integrity to be included in TS 38.305 and TS 36.305 as shown above? If you do not agree with the revised definition, please provide your suggested changes in the comments section.

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| **Company** | **Yes/No** | **Comments** |
| Apple | Yes, with comments | I think it would be sufficient to just write “A measure of the trust in the accuracy of the position-related data”. If “warnings” must be mentioned, we should say warnings about what and to whom. At any rate, no need to mention assistance data in the definition. |
| Nokia | Yes with modification | We prefer to just copy and paste what we have in TR 38.857, in order to keep the consistency.  **Positioning Integrity:** A measure of the trust in the accuracy of the position-related data provided by the positioning system and the ability to provide timely and valid warnings to the LCS client when the positioning system does not fulfil the condition for intended operation. |
| Qualcomm |  | Is the ability of providing timely warnings based on the assistance data? I think the integrity determination may be based on the assistance data, but the ability to provide warnings is more an application layer feature.  Also, some UEs may determine integrity without assistance data (as today).  But O.K. with the proposed definition if this is O.K. to everyone. |
| vivo |  | “based on assistance data provided by the network” seems to just cover the UE-based integrity. We need to update this definition if we support LMF-based integrity. Maybe “based on the integrity requirements” is better. |
| ZTE |  | Agree with vivo’s opinion and suggest to delete the ’ based on assistance data provided by the network’. |
| Huawei, HiSIlicon |  | Why we cannot directly reuse the definition in the TR 38875 and why we need to discuss it again?  **Positioning Integrity:** A measure of the trust in the accuracy of the position-related data provided by the positioning system and the ability to provide timely and valid warnings to the LCS client when the positioning system does not fulfil the condition for intended operation.  Additionally, we think it’s not proper to say “xxx based on assistance data provided by the network” since the assistance data can also be provided by UE or GNSS corrections provider (external source) for LMF-based positioning integrity. The definition should be adaptable to all the cases (i.e. UE-based and LMF-based positioning integrity). |
| OPPO |  | Prefer reusing the definition given in TR38.875. We should avoid unnecessary duplicated discussion. Also, agree with other companies that assistance data should take into account of the LMF-based positioning integrity case. |
| ESA |  | We favor Huawei´s proposal. We already have an agreed definition in TR 38.857. |
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Summary of companies’ views

- 4 companies [Nokia, Huawei, Oppo, ESA] have suggested to use the definition in TR, which includes aspects of “measure of trust” and “ability to provide warnings”.

- 6 companies [Apple, Qualcomm, vivo, ZTE, Huawei, Oppo] have indicated concerns regarding the need and applicability of “based on assistance data provided by network” (for UE-based and LMF-based modes) in previous version of definition.

- 1 company [Apple] has indicated to use “A measure of the trust in the accuracy of the position-related data”

### Rapporteur’s view (after the 1st round)

The discussion on definition of positioning integrity has been going on for 3 rounds, and in many instances in circles (e.g., the first proposal during the first round in [3] was to use the definition from TR).

From the comments and suggested changes provided by companies in this round and in previous rounds of discussion, our view is that definition should adhere to at least the following criteria:

- Includes the aspects of “measure of trust” and “ability to provide warnings”.

- Generic and can be applicable for both UE-based and LMF-based (e.g. remove use of “assistance data”)

- Avoids any unclear terms (e.g. “positioning system”, “valid warnings”, “condition for intended operation”)

- Mindful of providing “warnings to the LCS Client” as it involves other NW interfaces. There has been no work in SA2/SA1 on this, which would allow the delivery of warnings to an LCS Client.

In light of the above, we think a definition that is close to the definition in TR (discussed during previous round in [3]) and provides a good compromise is as follows:

**Positioning integrity:** A measure of the trust in the accuracy of the position-related data and the ability to provide associated warning messages

The definition above will be captured in the updated version of the running CRs in the Phase 2 discussion (attached with the discussion).

## 2.2 General description on GNSS Positioning Integrity

This section is intended to handle the discussion on the TP for general description on positioning integrity for GNSS based on descriptions discussed in previous email discussion [3].

The description proposed to be included under clause 8.1.1 (GNSS positioning methods: General) of TS 38.305 is as follows:

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| When GNSS is designed to inter-work with the NG-RAN, the network assists the UE GNSS receiver to improve the performance in several respects. These performance improvements will:  ……  - allow the UE to compute and report its positioning integrity results (i.e. metrics that characterize the trust in the accuracy of its position estimate); the UE can use the integrity requirements and assistance data obtained via NG-RAN, together with its own measurements, to compute its positioning integrity results  ……  The assistance data signalled to the UE can be broadly classified into:  …….  *-    data providing means for positioning integrity results calculation* |

The description proposed to be included under clause 8.1.1 (GNSS positioning methods: General) of TS 36.305 is as follows:

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| When GNSS is designed to inter-work with the E-UTRAN, the network assists the UE GNSS receiver to improve the performance in several respects. These performance improvements will:  ……  - allow the UE to compute and report its positioning integrity results (i.e. metrics that characterize the trust in the accuracy of its position estimate); the UE can use the integrity requirements and assistance data obtained via E-UTRAN, together with its own measurements, to compute its positioning integrity results  …..  The assistance data signalled to the UE can be broadly classified into:  ……  *-    data providing means for positioning integrity results calculation* |

Q2: Do you agree with the TP on general description of positioning integrity for GNSS to be included in TS 38.305 and TS 36.305 as shown above? If you do not agree with the TP, please provide your suggested changes in the comments section.

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| **Company** | **Yes/No** | **Comments** |
| Apple | Yes, with comments | Since we are going to have the definition of integrity, the text in parenthesis (“.i.e. metrics…”) is not needed. |
| Nokia | Yes with modification | The sentence:  *data providing means for positioning integrity results calculation*  could be modified as:  *data ~~providing means for~~ facilitating the positioning integrity results calculation*  We think this is more correct as we have agreed that how integrity result is derived is an implementation issue, and so there could be cases where the integrity results are calculated without using specific assistance data. But certainly the calculation will be much easier/better with some appropriate assistance data, so we think “facilitate” is a more precise word here. |
| Qualcomm | Yes with modification | - allow the UE to compute and report its positioning integrity results (i.e. metrics that characterize the trust in the accuracy of its position estimate); the UE can use the integrity requirements and assistance data obtained via E-UTRAN, together with its own measurements, to compute its positioning integrity results  Could be modified as:  - allow the UE to determine the integrity of the computed position; the UE can use the integrity requirements and assistance data obtained via E-UTRAN, together with its own measurements, to determine the integrity of the computed position  *data providing means for positioning integrity results calculation*  could be modified as  *data facilitating the integrity determination of the computed position*. |
| vivo | Yes |  |
| ZTE | Yes with comments | Agree with QC on the 2 modifications |
| Huawei, HiSilicon | Yes, with comments | Please find the comments below:  1) For the first one (performance improvement), we suggest to add:  *- allow the UE to report or receive timely warnings when the positioning integrity requirements are not fulfilled.*  2) For the second one (assistance data), we think the assistance data signalled to the UE should also support relevant measurements for integrity calculation (e.g. PL calculation).  *- measurements related assistance data for positioning integrity results calculation* |
| OPPO | Yes |  |
| ESA | Yes | We agree with QC proposal, it´s the clearest. |
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Summary of companies’ views

- 3 companies [Qualcomm, ZTE, ESA] have provided modifications or are ok with modifications to text related to performance improvement and assistance data on “determining integrity of computed position”

- 2 companies [Apple, Qualcomm] have indicated to remove “metrics that characterize the trust..” from the text related to performance improvement

- 2 companies [Nokia, Qualcomm] suggested to change the text related to assistance data from “providing means” to “facilitating”

- 1 company [Huawei] has provided modifications to include “allow the UE to report and receive timely warning” and “measurements related to assistance data” in the texts

- 2 companies [vivo, Oppo] are ok with the current text

### Rapporteur’s view (after the 1st round)

From the comments and suggested changes provided by companies, we are ok to include some changes to the text related to performance improvement and assistance data under clause 8.1.1.

The Rapporteur thanks the companies for providing comments and suggested changes. The following are our responses to the companies’ inputs/comments:

* Response to Apple: We agree that the text on “metrics that characterize the trust..” is not needed due to definition
* Response top Nokia: We made modifications to the text (shown below) related to assistance data to include “facilitating”. We hope the change is acceptable.
* Response to Qualcomm: We are ok for making the modification. We also think that reporting of integrity results, for aligning with the following RAN2 agreement [9] and discussed in previous round, is an important aspect that should be included in the description.

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| Agreements:  Proposal 4 (modified): RAN2 confirms that LPP messages RequestLocationInformation and ProvideLocationInformation are used to transfer integrity KPIs/results, respectively, for GNSS positioning at least for UE-based mode. |

* Response to HW: We are unable to include the proposed text on UE to report or receive timely warnings at this stage. This may be reconsidered at a later stage if agreements are made. On assistance data, we made modifications to the text (shown below) related to assistance data to facilitate integrity determination. We hope the change is acceptable.

Based on the inputs provided by companies and the above reasoning, we have updated the text under clause 8.1.1 as follows:

* allow the UE to determine and report the integrity of the computed position; the UE can use the integrity requirements and assistance data obtained via NG-RAN, together with its own measurements, to determine the integrity of the computed position.
* *data facilitating the integrity determination of the computed position.*

The descriptions above will be captured in the updated version of the running CRs in the Phase 2 discussion (attached with the discussion).

## 2.3 Supporting GNSS positioning integrity with LPP

This section is intended to handle the discussion on the TP for supporting GNSS positioning integrity with LPP based on descriptions discussed in previous email discussion [3].

The descriptions proposed to be included under clauses 8.1.3.1, 8.1.3.2 and 8.1.3.3 (Assisted-GNSS Positioning Procedures) of TS 38.305 are as follows:

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| 8.1.3 Assisted-GNSS Positioning Procedures  8.1.3.1 Capability Transfer Procedure  The Capability Transfer procedure for Assisted-GNSS positioning is described in clause 7.1.2.1.  The Capability Transfer procedure can be used to transfer capability information for positioning integrity.  8.1.3.2 Assistance Data Transfer Procedure  The purpose of this procedure is to enable the LMF to provide assistance data to the UE (e.g., as part of a positioning procedure) and the UE to request assistance data from the LMF (e.g., as part of a positioning procedure). In the case of high-accuracy GNSS positioning techniques (e.g., RTK), the LMF can provide unsolicited periodic assistance data to the UE and the UE can request periodic assistance data from the LMF.  The Assistance Data Transfer procedure can be used to transfer the assistance data for positioning integrity for UE-based mode.  **…..**  8.1.3.3 Location Information Transfer Procedure  The purpose of this procedure is to enable the LMF to request position measurements or location estimate from the UE, or to enable the UE to provide location measurements to the LMF for position calculation.  The Location Information Transfer procedure can be used to transfer integrity requirements and integrity results for positioning integrity for UE-based mode. |

The description proposed to be included under clauses 8.1.3.1, 8.1.3.2 and 8.1.3.3 (Assisted-GNSS Positioning Procedures) of TS 36.305 are as follows:

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| 8.1.3 Assisted-GNSS Positioning Procedures  8.1.3.1 Capability Transfer Procedure  The Capability Transfer procedure for Assisted-GNSS positioning is described in clause 7.1.2.1.  The Capability Transfer procedure can be used to transfer capability information for positioning integrity.  8.1.3.1.1 Void  8.1.3.2 Assistance Data Transfer Procedure  The purpose of this procedure is to enable the E-SMLC to provide assistance data to the UE (e.g., as part of a positioning procedure) and the UE to request assistance data from the E-SMLC (e.g., as part of a positioning procedure or for autonomous self location (i.e., UE determines its own location)). In the case of high-accuracy GNSS positioning techniques (e.g., RTK), the E-SMLC can provide unsolicited periodic assistance data to the UE and the UE can request periodic assistance data from the E-SMLC.  The Assistance Data Transfer procedure can be used to transfer the assistance data for positioning integrity for UE-based mode.  …..  8.1.3.3 Location Information Transfer Procedure  The purpose of this procedure is to enable the E-SMLC to request position measurements or location estimate from the UE, or to enable the UE to provide location measurements to the E-SMLC for position calculation (e.g., in case of basic self location where the UE requests its own location).  The Location Information Transfer procedure can be used to transfer integrity requirements and integrity results for positioning integrity for UE-based mode. |

Q3: Do you agree with the TP on supporting GNSS positioning integrity with LPP to be included in TS 38.305 and TS 36.305 as shown above? If you do not agree with the TP, please provide your suggested changes in the comments section.

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| **Company** | **Yes/No** | **Comments** |
| Apple | No | It would be very strange if integrity is the only thing called out explicitly in otherwise very high level description of these procedures. |
| Nokia | Yes with modifications | Some suggestions:  ……  The Capability Transfer procedure can be used to transfer capability information for positioning integrity support.  ……  The Assistance Data Transfer procedure can be used to transfer the assistance data to facilitate positioning integrity support in UE-based mode.  ……  This procedure can be used to for the LMF to provide positioning integrity requirements to the UE, or for the UE to report positioning integrity results to the LMF, in UE-based mode.  ……  In RAN2#115e we have agreed that “**LPP messages RequestLocationInformation and ProvideLocationInformation are used to transfer integrity KPIs/results, respectively, for GNSS positioning at least for UE-based mode**.” , so we think it is sufficient in stage-2 to highlight that integrity requirement is from LMF to UE, and the integrity result is from UE to LMF, at least for UE-based mode. |
| Qualcomm | No | The Capability/Assistance Data/Location Information Transfer procedures are used for all (GNSS) positioning capabilities/assistance data/location information anyhow. No need to explicitely point out that they are used also for integrity.  Integrity should be incorporated into the description where appropriate. For example:  Assistance Data:  8.1.3.2.1: Step (1) already specifies: "This message may include any of the GNSS assistance data defined in clause 8.1.2.1."  The Integrity Assistance Data will have to be described in clause 8.1.2.1, and therefore, no need to mention that the Assistance Data Transfer procedure is also used for Integrity Assistance Data.  Location Information:  8.1.3.3.1: Step (1) and (2) could be updated to include integrity:  (1)The E-SMLC sends a LPP Request Location Information message to the UE for invocation of A-GNSS positioning. This request includes positioning instructions such as the GNSS mode (UE-assisted, UE-based, UE-based preferred but UE-assisted allowed, UE-assisted preferred, but UE-based allowed, standalone), positioning methods (GPS, Galileo, GLONASS, BDS, NavIC, etc. and possibly non-GNSS methods, such as downlink positioning or E-CID), specific UE measurements requested if any, such as fine time assistance measurements, velocity, carrier phase, multi-frequency measurements, and quality of service parameters (accuracy, response time), and possibly an indication whether integrity of the location estimate is requested.  (2) The UE performs the requested measurements and possibly calculates its own location. The UE may also determine the integrity of the calculated location. The UE sends an LPP Provide Location Information message to the E-SMLC before the Response Time provided in step (1) elapsed. If the UE is unable to perform the requested measurements, or if the Response Time provided in step 1 elapsed before any of the requested measurements have been obtained, the UE returns any information that can be provided in an LPP message of type Provide Location Information which includes a cause indication for the not provided location information. |
| vivo | Yes |  |
| ZTE | No | Agree with QC and Apple |
| Huawei, HiSilicon | Yes with comments | We suggest to use “and/or” for the location information transfer since there may be either of integrity requirements and integrity results transferred in the Location Information Transfer procedure.  *The Location Information Transfer procedure can be used to transfer integrity requirements and/or integrity results for positioning integrity for UE-based mode.* |
| OPPO | Generally OK, but | Shall we allow to transfer the assistance data, i.e., the feared events from the UE towards the network using assistance Data Transfer Procedure for supporting LMF-based integrity approach? |
| ESA | No | We agree with QC´s reasoning |
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Summary of companies’ views

- 4 companies [Apple, Qualcomm, ZTE, ESA] have indicated there is no need to include text under each of the clauses related to Assisted-GNSS Positioning Procedures

- 1 company [Qualcomm] proposed text to be updated under clause 8.1.3.3.1 (LMF initiated Location Information Transfer Procedure)

- 1 company [Nokia] proposed modification to text and mentioned to highlight that integrity requirement is (transferred) from LMF to UE and the integrity result is (transferred) from UE to LMF, at least for UE-based mode

- 1 company [Huawei] suggested text change for including “and/or” in Location Information Transfer procedure

- 2 companies [vivo, Oppo] are generally ok with the current text, with Oppo questioning on whether to allow the transfer of feared events from UE to network using assistance data transfer procedure for LMF-based mode

### Rapporteur’s view (after the 1st round)

The Rapporteur thanks the companies for providing comments and suggested changes. The following are our responses to the companies’ inputs/comments:

* Response to Apple: We made modifications (as shown below) to remove the previous text under the procedures.
* Response to Nokia: We made modification to the descriptions (as shown below) by removing the previous text under procedures. The suggested changes to capture the descriptions on transferring integrity requirements and results using location information transfer procedure are to be included under clause 8.1.3.3.1. We hope the changes are acceptable.
* Response to Qualcomm: We are ok with the proposed changes and understand that there is no need to explicitly mention applicability of the procedures for integrity. In the description where integrity is included, under clause 8.1.3.3.1 (LMF initiated Location Information Transfer Procedure), we think it can be changed to include “integrity requirements” (as shown below) to align with the following RAN2 agreement [9]:

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| Agreements:  Proposal 4 (modified): RAN2 confirms that LPP messages RequestLocationInformation and ProvideLocationInformation are used to transfer integrity KPIs/results, respectively, for GNSS positioning at least for UE-based mode. |

* Response to Huawei: We made modification to the descriptions (as shown below) as per the suggestion. With the modifications, the description for transferring integrity requirements and/or integrity results using location information transfer procedure are captured. We hope the changes are acceptable.
* Response to Oppo: We can consider including descriptions on assistance data transfer from UE to LMF at later stage if corresponding agreements are made for supporting LMF-based mode.

Based on the inputs provided by companies and the above reasoning, we removed the previous descriptions under clauses 8.1.3.1, 8.1.3.2 and 8.1.3.3, and have updated the steps under clause 8.1.3.3.1 as follows:

(1)The E-SMLC sends a LPP Request Location Information message to the UE for invocation of A-GNSS positioning. This request includes positioning instructions such as the GNSS mode (UE-assisted, UE-based, UE-based preferred but UE-assisted allowed, UE-assisted preferred, but UE-based allowed, standalone), positioning methods (GPS, Galileo, GLONASS, BDS, NavIC, etc. and possibly non-GNSS methods, such as downlink positioning or E-CID), specific UE measurements requested if any, such as fine time assistance measurements, velocity, carrier phase, multi-frequency measurements, and quality of service parameters (accuracy, response time), and possibly integrity requirements.

(2) The UE performs the requested measurements and possibly calculates its own location. The UE may also determine the integrity of the calculated location. The UE sends an LPP Provide Location Information message to the E-SMLC before the Response Time provided in step (1) elapsed. If the UE is unable to perform the requested measurements, or if the Response Time provided in step 1 elapsed before any of the requested measurements have been obtained, the UE returns any information that can be provided in an LPP message of type Provide Location Information which includes a cause indication for the not provided location information.

# 3. Phase 2 Discussion

The scope of Phase 2 is to review the updated version of the running CRs for TS 38.305 [3] and TS 36.305 [4].

Please note that TPs corresponding to 2.1 and 2.2 are shown in the corresponding subsections above in Phase 1.

## 3.1 Supporting GNSS positioning integrity with LPP

This section is intended to handle Phase 2 discussion on the TP for supporting GNSS positioning integrity with LPP, given that previous descriptions under clauses 8.1.3.1, 8.1.3.2 and 8.1.3.3 (discussed during previous round in [3]) are removed and a modified text is included under clause 8.1.3.3.1.

The revised descriptions proposed to be included under clauses 8.1.3.3.1 of TS 38.305 are as follows:

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| 8.1.3.3.1 LMF initiated Location Information Transfer Procedure  Figure 8.1.3.3.1-1 shows the Location Information Transfer operations for the network-assisted GNSS method when the procedure is initiated by the LMF.    Figure 8.1.3.3.1-1: LMF-initiated Location Information Transfer Procedure  (1)The E-SMLC sends a LPP Request Location Information message to the UE for invocation of A-GNSS positioning. This request includes positioning instructions such as the GNSS mode (UE-assisted, UE-based, UE-based preferred but UE-assisted allowed, UE-assisted preferred, but UE-based allowed, standalone), positioning methods (GPS, Galileo, GLONASS, BDS, NavIC, etc. and possibly non-GNSS methods, such as downlink positioning or E-CID), specific UE measurements requested if any, such as fine time assistance measurements, velocity, carrier phase, multi-frequency measurements, and quality of service parameters (accuracy, response time), and possibly integrity requirements.  (2) The UE performs the requested measurements and possibly calculates its own location. The UE may also determine the integrity of the calculated location. The UE sends an LPP Provide Location Information message to the E-SMLC before the Response Time provided in step (1) elapsed. If the UE is unable to perform the requested measurements, or if the Response Time provided in step 1 elapsed before any of the requested measurements have been obtained, the UE returns any information that can be provided in an LPP message of type Provide Location Information which includes a cause indication for the not provided location information. |

The revised descriptions proposed to be included under clauses 8.1.3.3.1 of TS 36.305 are as follows:

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| 8.1.3.3.1 E-SMLC initiated Location Information Transfer Procedure  Figure 8.1.3.3.1-1 shows the Location Information Transfer operations for the network-assisted GNSS method when the procedure is initiated by the E-SMLC.    Figure 8.1.3.3.1-1: E-SMLC-initiated Location Information Transfer Procedure  (1)The E-SMLC sends a LPP Request Location Information message to the UE for invocation of A-GNSS positioning. This request includes positioning instructions such as the GNSS mode (UE-assisted, UE-based, UE-based preferred but UE-assisted allowed, UE-assisted preferred, but UE-based allowed, standalone), positioning methods (GPS, Galileo, GLONASS, BDS, NavIC, etc. and possibly non-GNSS methods, such as downlink positioning or E-CID), specific UE measurements requested if any, such as fine time assistance measurements, velocity, carrier phase, multi-frequency measurements, and quality of service parameters (accuracy, response time), and possibly integrity requirements.  (2) The UE performs the requested measurements and possibly calculates its own location. The UE may also determine the integrity of the calculated location. The UE sends an LPP Provide Location Information message to the E-SMLC before the Response Time provided in step (1) elapsed. If the UE is unable to perform the requested measurements, or if the Response Time provided in step 1 elapsed before any of the requested measurements have been obtained, the UE returns any information that can be provided in an LPP message of type Provide Location Information which includes a cause indication for the not provided location information. |

Q1: Do you agree with the TP to be included in TS 38.305 and TS 36.305 as shown above? If you do not agree with the TP, please provide your suggested changes in the comments section.

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| **Company** | **Yes/No** | **Comments** |
| CATT | Yes with comments | 1. The baseline of clauses 8.1.3.3.1 of TS 38.305 seems incorrect since the “E-SMLC” is found here. But it is fine because the running CR is correct.  2. Polish the wording as below:  such as fine time assistance measurements, velocity, carrier phase, multi-frequency measurements, quality of service parameters (accuracy, response time), and possibly integrity requirements. |
| ZTE | Yes | Agree with the TP |
| Xiaomi | Yes |  |
| Nokia | Yes | Agree with CATT |
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Summary of companies’ views

- 4 companies [CATT, ZTE, Xiaomi, Nokia] are ok with the TP, with some changes to the description.

### Rapporteur’s view (after the 2nd round)

The Rapporteur thanks the companies for providing comments and suggested changes. The following are our responses to the companies’ inputs/comments:

* Response to CATT: We made modifications (as shown below) based on provided comments.

We also modified the description in Step 2 of the procedure in clause 8.1.3.3.1 from “integrity to “integrity results” to be consistent with RAN2 agreements and changes made to clause 8.1.1. The following are the changes proposed for the descriptions under clause 8.1.3.3.1 of TS 38.305.

(1) The LMF sends a LPP Request Location Information message to the UE for invocation of A-GNSS positioning. This request includes positioning instructions such as the GNSS mode (UE-assisted, UE-based, UE-based preferred but UE-assisted allowed, UE-assisted preferred, but UE-based allowed, standalone), positioning methods (GPS, Galileo, GLONASS, BDS, etc. and possibly non-GNSS methods, such as OTDOA positioning or E-CID positioning), specific UE measurements requested if any, such as fine time assistance measurements, velocity, carrier phase, multi-frequency measurements, ~~and~~ quality of service parameters (accuracy, response time), and possibly integrity requirements.

(2) The UE performs the requested measurements and possibly calculates its own location. The UE may also determine the integrity results of the calculated location. The UE sends an LPP Provide Location Information message to the LMF before the Response Time provided in step (1) elapsed. If the UE is unable to perform the requested measurements, or if the Response Time provided in step 1 elapsed before any of the requested measurements have been obtained, the UE returns any information that can be provided in an LPP message of type Provide Location Information which includes a cause indication for the not provided location information.

The same changes are proposed to the descriptions under clause 8.1.3.3.1 of TS 36.305.

# 3 Summary

The following is the summary containing the companies and rapporteur’s views derived from the discussion above:

### **Summary from Q1: Definition of Positioning Integrity**

From the inputs/comments provided by companies, the following is the summary from Phase 1 and Phase 2 discussion:

- 4 companies [Nokia, Huawei, Oppo, ESA] have suggested to use the definition in TR, which includes aspects of “measure of trust” and “ability to provide warnings”.

- 6 companies [Apple, Qualcomm, vivo, ZTE, Huawei, Oppo] have indicated concerns regarding the need and applicability of “based on assistance data provided by network” (for UE-based and LMF-based modes) in previous version of definition.

- 1 company [Apple] has indicated to use “A measure of the trust in the accuracy of the position-related data”

Given the inputs from companies, a definition is proposed that is close to the definition in TR as follows:

**Positioning integrity:** A measure of the trust in the accuracy of the position-related data and the ability to provide associated warning messages

The definition above is captured in the updated version of the running CRs.

### **Summary from Q2: General description on GNSS Positioning Integrity**

From the inputs/comments provided by companies, the following is the summary from the discussion:

**Summary from Phase 1:**

- 3 companies [Qualcomm, ZTE, ESA] have provided modifications or are ok with modifications to text related to performance improvement and assistance data on “determining integrity of computed position”

- 2 companies [Apple, Qualcomm] have indicated to remove “metrics that characterize the trust..” from the text related to performance improvement

- 2 companies [Nokia, Qualcomm] suggested to change the text related to assistance data from “providing means” to “facilitating”

- 1 company [Huawei] has provided modifications to include “allow the UE to report and receive timely warning” and “measurements related to assistance data” in the texts

- 2 companies [vivo, Oppo] are ok with the current text

**Summary from Phase 2:**

- 1 company [CATT] mentioned to change the description from “computed position” to “calculated location” for consistency

- 1 company [Nokia] mentioned to change the description from “integrity” to “integrity metrics” or “integrity results”.

Given the inputs from the companies, the description under clause 8.1.1 is updated as follows:

* allow the UE to determine and report the integrity results of the calculated location ~~computed position~~; the UE can use the integrity requirements and assistance data obtained via NG-RAN, together with its own measurements, to determine the integrity results of the calculated location. ~~computed position~~.
* *data facilitating the integrity results determination of the calculated location.* *~~computed position.~~*

The above revised description is captured in clause 8.1.1 of the updated version of the running CRs.

### **Summary from Q3: Supporting GNSS positioning integrity with LPP**

From the inputs/comments provided by companies, the following is the summary from the discussion:

**Summary from Phase 1:**

- 4 companies [Apple, Qualcomm, ZTE, ESA] have indicated there is no need to include text under each of the clauses related to Assisted-GNSS Positioning Procedures

- 1 company [Qualcomm] proposed text to be updated under clause 8.1.3.3.1 (LMF initiated Location Information Transfer Procedure)

- 1 company [Nokia] proposed modification to text and mentioned to highlight that integrity requirement is (transferred) from LMF to UE and the integrity result is (transferred) from UE to LMF, at least for UE-based mode

- 1 company [Huawei] suggested text change for including “and/or” in Location Information Transfer procedure

- 2 companies [vivo, Oppo] are generally ok with the current text, with Oppo questioning on whether to allow the transfer of feared events from UE to network using assistance data transfer procedure for LMF-based mode

**Summary from Phase 2:**

- 4 companies [CATT, ZTE, Xiaomi, Nokia] are ok with the TP, with some changes to the description.

Given the inputs from the companies, the description under clause 8.1.3.3.1 of TS 38.305 CR is updated as follows:

(1) The LMF sends a LPP Request Location Information message to the UE for invocation of A-GNSS positioning. This request includes positioning instructions such as the GNSS mode (UE-assisted, UE-based, UE-based preferred but UE-assisted allowed, UE-assisted preferred, but UE-based allowed, standalone), positioning methods (GPS, Galileo, GLONASS, BDS, etc. and possibly non-GNSS methods, such as OTDOA positioning or E-CID positioning), specific UE measurements requested if any, such as fine time assistance measurements, velocity, carrier phase, multi-frequency measurements, ~~and~~ quality of service parameters (accuracy, response time), and possibly integrity requirements.

(2) The UE performs the requested measurements and possibly calculates its own location. The UE may also determine the integrity results of the calculated location. The UE sends an LPP Provide Location Information message to the LMF before the Response Time provided in step (1) elapsed. If the UE is unable to perform the requested measurements, or if the Response Time provided in step 1 elapsed before any of the requested measurements have been obtained, the UE returns any information that can be provided in an LPP message of type Provide Location Information which includes a cause indication for the not provided location information.

The same changes are made to the descriptions under clause 8.1.3.3.1 of CR for TS 36.305.

### **Proposals**

Based on inputs from companies and the changes described above, the following are the proposals for the running CRs:

**Proposal 1:** To agree CRs for 38.305 and 36.305 for adding the following definition:

**Positioning integrity:** A measure of the trust in the accuracy of the position-related data and the ability to provide associated warning messages

**Proposal 2:** To agree CRs for 38.305 and 36.305 with the following changes:

* Add updated general description on GNSS positioning integrity under clause 8.1.1
* Add description on supporting GNSS positioning integrity with LPP under clause 8.1.3.3.1

# 4 Reference

1. R2-2111377, Running CR of 38.305 GNSS Positioning Integrity (InterDigital, Inc), Nov 2021
2. R2-2111376, Running CR of 36.305 GNSS Positioning Integrity (InterDigital, Inc), Nov 2021
3. R2-2110997, Email discussion report on [614][POS] GNSS Positioning Integrity Stage 2 CR (InterDigital)
4. R2-2111012, Running CR of 38.305 for GNSS Positioning Integrity (InterDigital, Inc), Nov 2021
5. R2-2111013, Running CR of 36.305 for GNSS Positioning Integrity (InterDigital, Inc), Nov 2021
6. 3GPP TR 38.305 NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN (Release 16), v2.0.0 Mar 2021
7. 3GPP TR 36.305 Stage 2 functional specification of User Equipment (UE) positioning in E-UTRAN (Release 16), v16.6.0 September 2021
8. RAN2 chairman notes RAN2#114-e, May 2021
9. RAN2 chairman notes RAN2#115-e, October 2021