3GPP TSG-RAN WG2 Meeting #116-e***R2-211xxxx***

Online, November 1-12, 2021

**Agenda item:** 8.11.5

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**Title:** Summary of Agenda Item 8.11.5: GNSS positioning integrity

**Document for:**  Discussion and Decision

# Introduction

This document summarizes the following contributions submitted for Agenda Item 8.11.5 on GNSS positioning integrity:

1. R[2-2109463](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2109463.zip) Discussion on positioning integrity ZTE discussion
2. R[2-2109920](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2109920.zip) On GNSS Integrity Ericsson discussion Rel-17
3. R[2-2109982](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2109982.zip) Discussion on open issues for GNSS positioning integrity vivo discussion Rel-17 NR\_pos\_enh-Core
4. R[2-2110102](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2110102.zip) Discussion on supporting positioing integrity in RAN OPPO discussion Rel-17 NR\_pos\_enh-Core
5. R[2-2110141](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2110141.zip) Discussion on GNSS Integrity Assistance Data Swift Navigation, Mitsubishi Electric Corporation, Intel Corporation, Ericsson discussion Rel-17
6. R[2-2110176](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2110176.zip) Remaining issues on positioning integrity Huawei, HiSilicon discussion NR\_pos\_enh-Core
7. R[2-2110246](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2110246.zip) UE-aided detection of threat to GNSS systems and assistance data signaling Fraunhofer IIS; Fraunhofer HHI; Ericsson; ESA discussion R2-2107147
8. R[2-2110445](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2110445.zip) On GNSS Positioning Integrity Nokia, Nokia Shanghai Bell discussion Rel-17 FS\_NR\_pos\_enh
9. R[2-2110933](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2110933.zip) Discussion on procedures and signalling for GNSS positioning integrity InterDigital, Inc. discussion NR\_pos\_enh
10. R[2-2111087](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2111087.zip) Consideration on the signalling design for Positioning Integrity Samsung Electronics discussion NR\_pos\_enh-Core
11. R[2-2111108](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2111108.zip) Discussion on GNSS positioning integrity Xiaomi discussion
12. R[2-2109807](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2109807.zip) Discussion RTCM reply to RAN2 on GNSS integrity coordination ESA, Intel Corporation discussion Rel-17 FS\_NR\_pos\_enh

# LMF-based/UE-assisted

## LMF-based/UE-assisted integrity

Multiple contributions discuss the methods for positioning integrity and the understanding on the LMF-based/ UE-assisted integrity. The company proposals related to this topic are summarized in the Table below.

|  |  |
| --- | --- |
| R2-2109463  ZTE | Proposal 1: Support LMF-based integrity for A-GNSS positioning integrity.  Proposal 2: Support to prioritize MT-LR and LMF-based integrity. |
| R2-2109920  Ericsson | Proposal 1: LMF based Integrity computation and reporting to the client is supported  Proposal 7: As baseline, use existing procedures, messages and information elements with extensions to accommodate positioning integrity. |
| R2-2109982  vivo | Proposal 2: LMF-based integrity should be supported.  Proposal 3: UE feared events are not to be considered for the LMF-based integrity. |
| R2-2110102  OPPO | Proposal 2: RAN2 to agree that LMF-based integrity approach should be supported in R17 5G NR, for the benefit of saving the UE power consumption for integrity result calculation, and limited RAN2 spec impact is foreseen. |
| R2-2110176  Huawei, HiSilicon | Proposal 1: Deprioritise the study of LMF-based positioning integrity in Rel-17. |
| R2-2110933  InterDigital | Proposal 1: For UE-assisted mode, transferring of UE feared events from UE to LMF as assistance data is not supported |
| R2-2111108  Xiaomi | Proposal 1: If the external corrections provider can provide indication to LMF when feared events in the GNSS Assistance Data is detected, the LMF can indicate UE not to use the GNSS assistance data any more.  Proposal 2: For the UE assisted positioning integrity, UE feared events should not be specified and should be left to UE implementation, UE can send an indication to LMF when the UE feared events is detected. |
| R2-2110246  Fraunhofer IIS; Fraunhofer HHI; Ericsson; ESA | Proposal 2 RAN2 shall support reporting by the UE integrity information relating to GNSS local environment feared events the information includes at least of:  • Timestamp  • Position estimate  • GNSS local environment feared event type (FFS)  • Specific GNSS local environment feared event information (FFS)  Proposal 3 : RAN2 shall specify a signaling mechanism to enable a configured UE to report the detected GNSS local environment feared events and to enable LMF to provide GNSS local environment feared event assistance data to UEs. |

**Summary:**

From the submitted contributions which discuss this topic, the understanding on the LMF-based/UE-assisted is summarized as two aspects:

1. LMF-based/UE-assisted Mode

Seven companies discussed the LMF-based/UE-assisted mode.

* Option A: Support LMF-Based/UE-assisted mode in Rel-17
  + For the LCS client to be aware that PL < AL can still be useful
  + NW based integrity computation is to be able to collect local feared events and provide “Do not use flags” when necessary
  + ZTE, Ericsson, vivo, OPPO, InterDigital, Xiaomi, Fraunhofer IIS; Fraunhofer HHI; ESA
* Option B: Deprioritise LMF-Based in Rel-17
* Considering the limited time and excessive workload in Rel-17, LMF-based GNSS positioning integrity can be deprioritized.
* Huawei, HiSilicon

2. UE feared events for LMF-based/UE-assisted Mode

Companies discussed the UE feared events which should be considered for LMF-based/UE-assisted Mode or not:

* Do not take (commercial)UE feared events considered in assistance data
* It is difficult to define what are the specific hardware and software faults and GNSS receiver measurement errors.
* GNSS measurements error should be considered for the positioning and integrity computation ,so Xiaomi propose that UE can send an indication to LMF when the UE feared events is detected
* vivo, InterDigital, Xiaomi
* UE reports feared events to LMF
  + ZTE, OPPO,

Rapporteur's comments:

Some companies show interest on supporting LMF-based/UE-assisted Mode in Rel-17 at this meeting while companies discussed to deprioritise it at #115-e meeting. From requirement of perspective, LMF-based is raised by some companies. However one company shows the concern on the limited time and excessive workload in Rel-17, so they think LMF-based GNSS positioning integrity can be deprioritized.

The joint contribution [7] specifies how to support the LMF-based mode. We will discuss both requirement and candidate solution here together.

## How to support LMF-based/UE-assisted

Even though UE feared events such as HW fault or residual risk may not be known to the NW, still for the LCS client to be aware that PL < AL can still be useful. This is also useful for NW to understand that the AD that is being provided is useful. Another aspect of NW based integrity computation is to be able to collect local feared events and provide “Do not use flags” when necessary as details provided in [7].

Furthermore, in RAN2#113e, it was agreed that the UE could signal UE feared events and GNSS feared events to the LMF in UE-assisted mode. So the contribution [7] specifies how to support LMF-Based/UE-assisted.

|  |  |
| --- | --- |
| R2-2110246  Fraunhofer IIS; Fraunhofer HHI; Ericsson; ESA | Observation 1 Through GNSS-MeasurementList IE UE can indicate the magnitude of multipath detected: low, medium, high without being able to report the exact value nor a quality indicator.  Proposal 1 Add to GNSS-MeasurementList IE two new fields: multipath value with range from 0 to 50m and the standard deviation of the value.  Observation 2 : Since the measurements and observations are regional and localized, the UEs needs to be configured to report both measurements, obeservations or derived indications as one part, as well as positioning estimates as another part.  Observation 3: Based on crowd-sourced data, the location server can provide regionalized integrity information to UEs entering a specific region to inform about local GNSS and UE feared events  Observation 4: Multipath, jammers and spoofers are major threat for positioning integrity. Moving jammers and spoofers, and satellite movements cause the affected area to change dynamically.  Observation 5: Integrity event(s) can be bounded within a given area at a given occurrence time...  Observation 6: Detecting and signaling integrity events to an LCS client can be time critical depending on application..  Observation 7 A: UE can be a major source of detecting GNSS local environment feared events and can aid the network to monitor the GNSS local environment.  Observation 8: The device monitoring may be associated to specific capabilities.  Proposal 2 RAN2 shall support reporting by the UE integrity information relating to GNSS local environment feared events the information includes at least of:  • Timestamp  • Position estimate  • GNSS local environment feared event type (FFS)  • Specific GNSS local environment feared event information  Proposal 3 RAN2 shall specify a signaling mechanism to enable a configured UE to report the detected GNSS local environment feared events and to enable LMF to provide GNSS local environment feared event assistance data to UEs.  Proposal 4 RAN2 shall specify a signaling mechanism to enable LMF to provide GNSS local environment feared event AD to UEs. |

**The proposals on what should be reported from UE to LMF will be evaluated at first. After we reach the agreemtn on the LMF-based reporting from UE and LMF, the procedure can be discussed later.**

**Proposals for Discussion:**

**Proposal 1: RAN2 to discuss whether to support LMF-based/UE-assisted Integrity computation in Rel-17 or not.**

**Proposal 2:** **RAN2 to discuss not support UE report UE feared events information to LMF for LMF-based/UE-assisted mode in Rel-17.**

**Proposal 1-a: Add to GNSS-MeasurementList IE two new fields: multipath value with range from 0 to 50m and the standard deviation of the value.**

**Proposal 1-b: RAN2 to discuss the integrity information relating to GNSS local environment feared events reported by UE includes at least of:**

**• Timestamp**

**• Position estimate**

**• Specific GNSS local environment feared event information**

## LMF-based/UE-assisted Procedures

|  |  |
| --- | --- |
| R2-2109920  Ericsson | Proposal 6 Design signalling, procedures and information element additions/extensions with both GNSS and other positioning methods in mind.  Proposal 7 As baseline, use existing procedures, messages and information elements with extensions to accommodate positioning integrity. |
| R2-2111108  Xiaomi | Proposal 5：The signalling procedures for UE assisted GNSS positioning integrity in the above table should be considered. |
| R2-2109982  vivo | Proposal 4: For LMF-based integrity, the ProvideLocationInformation or ProvideCapabilities message can be enhanced to transfer integrity assistance information from UE to LMF.  Proposal 5: For MO-LR with LMF-based positioning integrity mode,  - LCS MO-LR Response or RequestLocationInfromation message can be enhanced to transfer integrity results from LMF to UE；  - ProvideLocationInformation LPP PDU contained by LCS MO-LR Request message can be enhanced to transfer KPI from UE to LMF. |

There is no specific procedure design for LMF-based procedure. Companies may further discuss the procedures based on the agreement of proposal 1, 1-a, 1-b, 2. So there is no proposal here.

# UE-based

## Location Information

|  |  |
| --- | --- |
| R2-2109463  ZTE | Proposal 3: Do not support to report achieved KPIs together with integrity results. |
| R2-2109920  Ericsson | Observation 3: Both modes 1 and 2 for integrity result reporting have merits and applies to different scenarios  Proposal 8: Support both mode 1 and 2 for integrity result reporting. |
| R2-2109982  vivo | Proposal 1: Mode 2 and the TIR, AL, TTA used in the integrity calculation won’t be reported in the integrity results. |
| R2-2110176  Huawei, HiSilicon | Proposal 2: Support Mode 2 for integrity results reporting.  Proposal 3: For Mode2, refine the integrity results to indicate the degrees of integrity risk (e.g. Extremely High/High/Low/No risk) with different alarm levels.  Proposal 4: No need to report TIR, AL, TTA used in the integrity calculation in the integrity results. |
| R2-2110445  Nokia, Nokia Shanghai Bell | Proposal 1: In addition to PL reporting, LPP should be enhanced also support the integrity result reporting mode of “integrity event flagging”. The LMF may indicate which reporting mode is enabled in the LPP message RequestLocationInformation.  Proposal 2: The positioning integrity requirement information (a.k.a. KPI) including AL, TTA, and TIR can be transferred to the UE via LPP message of RequestLocationInformation. Integrity Availability is not needed. |
| InterDigital(R2-2110933) | Proposal 2: For UE-based mode, the integrity KPIs transferred from LMF to UE using LPP ProvideLocationInformation message includes at least AL, TIR, TTA  Proposal 3: Support Mode 2 (i.e. integrity flag and TIR, AL, TTA used in the integrity calculation) for integrity result reporting for at least UE-based mode  Proposal 4: Support sending of Integrity Alerts/Warnings when detecting an integrity event (e.g. calculated PL > AL) at least for UE-based (MT-LR) mode  Proposal 5: LPP message ProvideLocationInformation is used to transfer integrity alerts/warnings, for GNSS positioning at least for UE-based (MT-LR) mode |
| R2-2111108  Xiaomi | Proposal 3: Mode 1 is sufficient for integrity result reporting and it will be more complicated when both Mode 1 and Mode 2 are supported.  Proposal 4：It is not necessary to report the TIR, AL, TTA which were used in the integrity calculation when reports the integrity results. |

**Summary:**

From the submitted contributions which discuss this topic, the understanding on integrity report is summarized as two aspects:

Based on the discussion at RAN2#115-e meeting, Mode 1 (PL Reporting) has been agreed while Mode 2 (Integrity Event Flagging) remains FFS. It is FFS whether Mode 2 and the TIR, AL, TTA that were used in the integrity calculation will also be reported in the integrity results.

1. KPIs report in integrity results

* Four companies prefer not to report achieved KPIs (TIR, AL, TTA) together with integrity results.

- ZTE, vivo, Huawei, HiSilicon, Xiaomi

* One company prefer to report TIR, AL, TTA used in the integrity calculation

- InterDigital

1. Integrity flag report in integrity results

* Support integrity flag

- Ericsson, Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, InterDigital

- Nokia proposed that the LMF may indicate which reporting mode is enabled in the LPP message RequestLocationInformation.

* Not support integrity flag

- vivo, Xiaomi

1. Transfer the KPIs and Integrity Results

Two contributions proposed how to transfer the KPIs and Integrity results.

* The LMF may indicate which reporting mode is enabled in the LPP message RequestLocationInformation.
* The positioning integrity requirement information (a.k.a. KPI) including AL, TTA, and TIR can be transferred to the UE via LPP message of RequestLocationInformation.
* LPP message ProvideLocationInformation is used to transfer integrity alerts/warnings, for GNSS positioning at least for UE-based (MT-LR) mode

Rapporteur's comments:

Some of proposals above follow the agreement at #115-e.

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.

**Proposals for Discussion:**

**Proposal 3: RAN2 to agree not to report achieved KPIs (TIR, AL, TTA) together with integrity results.**

**Proposal 4:** **RAN2 to agree to report integrity flag** **for at least UE-based mode.**

**Proposal 4-a: RAN2 to agree the LMF may indicate which reporting mode is enabled in the LPP message RequestLocationInformation for at least UE-based mode.**

## Assistance Data

1. The content of Assistance Data

One contribution discussed the assistance data in detail.

|  |  |
| --- | --- |
| R2-2110141  Swift Navigation, Mitsubishi Electric Corporation, Intel Corporation, Ericsson | *Validity / Applicability aspect*  Proposal 1: Agree that epochTime, validityPeriod, iod-ssr and (where applicable) svID, correctionPointSetID and gridList fields are provided in the integrity assistance data to provide the possibility to check applicability with respect to the positioning assistance data.  *Alerts aspect*  Proposal 2: Agree to provide “DNU” flags in separate Alert IE(s).  *Integrity Bounds & Residual Risks aspect*  Proposal 3: Agree to adopt in TS 38.305 the proposed text on ‘Integrity Service Alert’.  Proposal 4: Agree to adopt in TS 38.305 the proposed text on ‘Integrity Principle of Operation’.  Proposal 5: Agree to adopt in TS 38.305 the proposed text on ‘Integrity Bounds’.  Proposal 6: Agree to adopt in TS 38.305 the proposed text on ‘Integrity Service Parameters’.  *Correlation Times aspect*  Proposal 7: Agree to include parameters to allow the use of time-based estimation techniques (e.g. Kalman Filtering) in addition to snapshot based techniques.  Proposal 8: Agree to adopt in TS 38.305 the proposed text on ‘Integrity Correlation Times’. |
| R2-2111108  Xiaomi | Proposal 1: If the external corrections provider can provide indication to LMF when feared events in the GNSS Assistance Data is detected, the LMF can indicate UE not to use the GNSS assistance data any more. |

**Summary:**

There was an email discussion [Post115-e][607][POS] Integrity assistance data (Huawei), The TP on ‘Integrity Service Alert’, ‘Integrity Correlation Times’ and ‘Integrity Service Parameters’ in R2-2110141 aligns with Proposal2-10, Proposal1-5, and Proposal1-7 in [Post115-e][607][POS].

The below TPs in R2-2110141 also have been discussed in [Post115-e][607][POS] but there is no conclusion yet:

- There is no conclusion on the TP ‘Integrity Principle of Operation’ which doesn't align with the Conclusions of Phase II, e.g. the proposed IEs high light with red below. These IEs needs FFS.

- There is no conclusion on the TP ‘Integrity Bounds’ after discussion in the [Post115-e][607][POS], e.g. the formula. The TP needs FFS.

**Table 8.1.2.1b-1: Mapping of Integrity Parameters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Error** | **GNSS Assistance Data (Existing LPP IEs)** | **DNUs (Proposed IEs)** | **Bound Mean**  **(Proposed IEs)** | **Bound StdDev**  **(Proposed IEs)** | **Residual Risk (Proposed IEs)** | **Time Correlation (Proposed IEs)** |
| Orbit | *GNSS-SSR-OrbitCorrections* | *serviceDoNotUse*  *constellationDoNotUse*  *svDoNotUse* | *orbitClockErrorMeanShapeVector*  *orbitClockRateErrorMeanShapeVector*  *orbitClockErrorMeanScaleFactor*  *orbitClockRateErrorMeanScaleFactor* | *orbitClockErrorCovarianceShapeMatrix*  *orbitClockRateErrorCovarianceShapeMatrix*  *orbitClockErrorCovarianceScaleFactor*  *orbitClockRateErrorCovScaleFactor* | *pConstellation*  *pSatellite* | *tCorrelationRangeOrbit*  *tCorrelationRangeRateOrbit* |
| Clock | *GNSS-SSR-ClockCorrections* | *tCorrelationRangeClock*  *tCorrelationRangeRateClock* |
| Code Bias | *GNSS-SSR-CodeBias* | *meanCodeBias*  *meanCodeBiasRate* | *stdDevCodeBias*  *stdDevCodeBiasRate* |  |
| Phase Bias | *GNSS-SSR-PhaseBias* | *meanPhaseBias*  *meanPhaseBiasRate* | *stdDevPhaseBias*  *stdDevPhaseBiasRate* |
| Ionosphere | *GNSS-SSR-STEC-Correction*  *GNSS-SSR-GriddedCorrection* | *serviceDoNotUse*  *ionosphereDoNotUse* | *meanIonosphere*  *meanIonosphereRate* | *stdDevIonosphere*  *stdDevIonosphereRate* | *pIonosphereFault* | *tCorrelationIonosphere* |
| Troposphere Vertical HydroStatic Delay | *GNSS-SSR-GriddedCorrection* | *serviceDoNotUse*  *troposphereDoNotUse* | *meanTroposphereVerticalHydroStaticDelay*  *meanTroposphereVerticalHydroStaticDelayRate* | *stdDevTroposphereVerticalHydroStaticDelay*  *stdDevTroposphereVerticalHydroStaticDelayRate* | *pTroposphereFault* | *tCorrelationTroposphere* |
| TroposphereVerticalWetDelay | *meanTroposphereVerticalWetStaticDelay*  *meanTroposphereVerticalWetDelayRate* | *stdDevTroposphereVerticalWetStaticDelay*  *stdDevTroposphereVerticalWetDelayRate* |

**Proposals for Discussion:**

**Proposal 5: RAN2 to agree the TP of ‘Integrity Service Alert’, ‘Integrity Correlation Times’ and ‘Integrity Service Parameters’** **in R2-2110141.**

**Proposal 6: RAN2 to further discuss the TP of ‘Integrity Principle of Operation’ in R2-2110141, especially the proposed IEs: constellationDoNotUse, svDoNotUse, orbitClockRateErrorMeanShapeVector, orbitClockErrorMeanScaleFactor, etc.**

**Proposal 7: RAN2 to further discuss the TP of ‘Integrity Bounds’ in R2-2110141, e.g. the formula *Bound = mean + K \* stdDev, K = normInv(IRallocation / 2), irMinimum <= IRallocation <= irMaximum***

## Enhancement and new mechanism

These enhancements are proposed by companies as below.

1. Mechanism for recovering from potential integrity failure condition

|  |  |
| --- | --- |
| R2-2110933  InterDigital | Proposal 6: Support providing a recovery time duration to UE for recovering from integrity events/failure conditions for UE-based mode |

2. Neighbor Cell information to ensure reliability of AD

|  |  |
| --- | --- |
| R2-2109920  Ericsson | Proposal 2 RAN2 to agree on TP provided in Annex to improve reliability of retrieving accurate Assistance Data. |

3. Quality indicators for integrity assessment

|  |  |
| --- | --- |
| R2-2109920  Ericsson | Proposal 9 Add an optional indicator in the IE GNSS-RTK-Observations-r15 for the attribute resolution of the origin MSM message.  Proposal 10 RAN2 to discuss whether the existing SSR quality indicators are sufficient for protection level assessments as part of integrity procedures. |



The enhancement and new mechanism should be discussed when the first priority issues are addressed. So there is no proposal here so far.

# Way forward on collaborating with RTCM

|  |  |
| --- | --- |
| R2-2110445  Nokia | Proposal 4: RAN2 may only aim to provide basic GNSS positioning integrity support in Rel-17, in cases RTCM cannot provide their conclusions within Rel-17 time frame. |
| R2-2109807  ESA, Intel Corporation | Proposal 1. RAN2 shall continue working on GNSS integrity during Rel17.  Proposal 2. RAN2 to align its specs with RTCM via TEI17 once first RTCM integrity standard is available (foreseen for Q2 2022).  Proposal 3. RAN2 to send a new LS to RTCM SC134 including agreements recorded during RAN2 116. |

Two contributions discuss the way forward in case RTCM cannot provide their conclusions within Rel-17 time frame.

RAN2 shall continue working on GNSS integrity during Rel-17 but FFS the basic or the whole solution of A-GNSS positioning integrity. TEI17 has the same time frame as Positioning of Rel-17, so perhaps RAN2 will align its specs with RTCM in Rel-18 if RTCM integrity standard is not available in Rel-17 time frame.

**Proposals for Discussion:**

**Proposal 8: RAN2 to agree to continue working on GNSS integrity during Rel-17 and a new LS to RTCM SC134 including agreements at RAN2#116-e. FFS the plan how to align its specs with RTCM if RTCM integrity standard is not available in Rel-17 time frame.**

# Alignment with Other WGs

|  |  |
| --- | --- |
| R2-2109920  Ericsson | Proposal 3 RAN2 to agree on defining integrity level classification for integrity support. The UE and the network may report their supported levels in the signalling with associated QoS.  Proposal 4 RAN2 to liase with SA1, SA2 and CT4 to provide signalling of Integrity based upon associated QoS.  Proposal 5 RAN2 to allow a generic Integrity description to be captured by SA1, SA2 and CT4 specification. |
| R2-2110176  Huawei, HiSilicon | Proposal 6: Send the stage 2 baseline agreements, including the integrity results reporting to SA2 and the QoS requirement to SA1. |

The integrity level aspect has been discussed before and proposed at #115-e meeting. However, the aspect of whether to involve SA1 in the discussion or not has not been resolved. Companies may go on discussing this issue if time is permitted.

**Proposals for Discussion:**

**Proposal 9: Send an LS to SA1 requesting them to study and evaluate any potential LCS Quality of Service aspects for positioning integrity support.**

# Summary of Proposals for Discussion

The contributions discussed GNSS positioning integrity and proposals may be discussed online as below aspects:

Location Information (UE-based):

**Proposal 3: RAN2 to agree not to report achieved KPIs (TIR, AL, TTA) together with integrity results.**

**Proposal 4:** **RAN2 to agree to report integrity flag** **for at least UE-based mode.**

**Proposal 4-a: RAN2 to agree the LMF may indicate which reporting mode is enabled in the LPP message RequestLocationInformation for at least UE-based mode.**

Assistance Data (UE-based):

**Proposal 5: RAN2 to agree the TP of ‘Integrity Service Alert’, ‘Integrity Correlation Times’ and ‘Integrity Service Parameters’ in R2-2110141.**

**Proposal 6: RAN2 to further discuss the TP of ‘Integrity Principle of Operation’ in R2-2110141, especially the proposed IEs: constellationDoNotUse, svDoNotUse, orbitClockRateErrorMeanShapeVector, orbitClockErrorMeanScaleFactor, etc.**

**Proposal 7: RAN2 to further discuss the TP of ‘Integrity Bounds’ in R2-2110141, e.g. the formula *Bound = mean + K \* stdDev, K = normInv(IRallocation / 2), irMinimum <= IRallocation <= irMaximum***

LMF-based/UE-assisted integrity:

**Proposal 1: RAN2 to discuss whether to support LMF-based/UE-assisted Integrity computation in Rel-17 or not.**

**Proposal 2:** **RAN2 to discuss not support UE report UE feared events information to LMF for LMF-based/UE-assisted mode in Rel-17.**

**Proposal 1-a: Add to GNSS-MeasurementList IE two new fields: multipath value with range from 0 to 50m and the standard deviation of the value.**

**Proposal 1-b: RAN2 to discuss the integrity information relating to GNSS local environment feared events reported by UE includes at least of:**

**• Timestamp**

**• Position estimate**

**• Specific GNSS local environment feared event information**

Way forward on collaborating with RTCM:

**Proposal 8: RAN2 to agree to continue working on GNSS integrity during Rel-17 and a new LS to RTCM SC134 including agreements at RAN2#116-e. FFS the plan how to align its specs with RTCM if RTCM integrity standard is not available in Rel-17 time frame.**

Alignment with Other WGs:

**Proposal 9: Send an LS to SA1 requesting them to study and evaluate any potential LCS Quality of Service aspects for positioning integrity support.**

# References

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7. R[2-2110246](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2110246.zip) UE-aided detection of threat to GNSS systems and assistance data signaling Fraunhofer IIS; Fraunhofer HHI; Ericsson; ESA discussion R2-2107147
8. R[2-2110445](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2110445.zip) On GNSS Positioning Integrity Nokia, Nokia Shanghai Bell discussion Rel-17 FS\_NR\_pos\_enh
9. R[2-2110933](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2110933.zip) Discussion on procedures and signalling for GNSS positioning integrity InterDigital, Inc. discussion NR\_pos\_enh
10. R[2-2111087](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2111087.zip) Consideration on the signalling design for Positioning Integrity Samsung Electronics discussion NR\_pos\_enh-Core
11. R[2-2111108](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2111108.zip) Discussion on GNSS positioning integrity Xiaomi discussion
12. R[2-2109392](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2109392.zip) Liaison Note to 3GPP RAN 2, Reply comments to letter R2-2106596 (RTCM Paper 2021-SC134-0113) RTCM LS in To:RAN2
13. R[2-2109807](file:///E:\WORK\1%203GPP\Meeting\RAN2%20116-e\2%20During\Docs\R2-2109807.zip) Discussion RTCM reply to RAN2 on GNSS integrity coordination ESA, Intel Corporation discussion Rel-17 FS\_NR\_pos\_enh