3GPP TSG-RAN WG2 Meeting #117-e ***R2-22xxxxx***

Electronic Meeting, February 21 – March 3, 2022

**Agenda item:** 8.11.1

**Source:** Qualcomm Incorporated

**Title:** Summary of [AT117-e][606][POS] LPP running CR (Qualcomm)

**Document for:**  Discussion

# 1. Introduction

This document summarizes the following email discussion:

* [AT117-e][606][POS] LPP running CR (Qualcomm)

      Scope: Review and update the CR in R2-2203310.

      Intended outcome: Endorsable CR

      Deadline:  Friday 2022-02-25 1000 UTC

##### References:

[1] R2-2203310, "Running LPP CR for NR positioning enhancements", Qualcomm Incorporated.

[2] R2-2201722, "Summary of [Post116bis-e][628][POS] 37.355 running CR (Qualcomm)".

[3] R2-2202604, "Summary of [Pre117-e][607][POS] Open issues on positioning latency enhancements (Huawei)" Huawei, HiSilicon.

[4] R2-2203524, "Email discussion report on [Pre117-e][609][POS] Open issues on positioning in RRC\_INACTIVE (InterDigital)", InterDigital Inc.

[5] R2-2202236, "Report of [Pre117-e][608][POS] Open issues on on-demand PRS", Lenovo, Motorola Mobility.

[6] R2-2203525, "Summary of [Pre117-e][610][POS] Open issues GNSS integrity (ESA)", ESA.

[7] R2-2202410, "Report of [Pre117-e][611][POS] Open issues on positioning accuracy enhancements (CATT)", CATT.

[8] R2-2202494, "Report of [Pre117-e][612][POS] Open issues on positioning UE capabilities (Intel)", Intel Corporation.

[9] R2-2203593, "[AT117-e][623][POS] Early discussion of integrity issues", ESA.

# 2. Open Issues List

Below is the status (next-to-last column) of the LPP open issues summarized in [2], as of beginning of RAN2#117-e.

The last colmumn provides the status of the at-meeting discussions.

## General

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| # | Item | Description | Affected IEs | Source | Status Pre-meeting | Status Update |
| R2-A1 | UE capabilities | Capabilities may need corrections based on RAN1/RAN4 input. | ProvideCapabilities | Rapporteur | Depends on conclusions on Proposals in [8].  Initial implementation of the TPs in v5 [1]. |  |
| R2-A2 | posSIB types | Confirmation on supported posSIB types | Section 7.2 | Rapporteur | Depends on conclusions on Proposals in [6]:  Proposal 13  Depends on conclusions on Proposals in [7]:  Proposal 6 | Agreement:  Adopt the mapping of GNSS Integrity IEs to posSIB as proposed in the table from below:  GNSS Common Assistance Data (clause 6.5.2.2)  posSibType1-9: GNSS-Integrity-ServiceParameters  posSibType1-10: GNSS-Integrity-ServiceAlert |
| R2-A3 | IE and field names | Some IE/field names may need improvements. |  | Huawei, Nokia, vivo | Not the highest priority for now. Postpone to ASN.1 review. (Note also, LPP normally follows the ASN.1 guidelines from 36.331 (not 38.331)). |  |
| R2-A4 | TRP TEG-Info | Association between DL-PRS assistance data and *NR-DL-PRS-TRP-TEG-Info* should be clarified.  This may apply to some similar Rel-16 elements as well. | NR-DL-PRS-TRP-TEG-Info-r17 | CATT | Depends on conclusions on Proposals in [7]:  Proposal 1 |  |

## Latency Reduction

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| # | Item | Description | Affected IEs | Source | Status Pre-meeting | Status Update |
| R2-B1 | Response Time | Confirm 10-ms granularity | ResponseTime🡪unit-r15 | Rapporteur | Depends on conclusions on Proposals in [3]:  Proposal 15 | Agreement:  Adopt the 10 milliseconds granularity in the responseTime |
| R2-B2 | Area ID | Definition, signalling and procedures for Area ID in DL-PRS Assistance Data.  Is Area-ID information in the measurement report needed? | NR-DL-PRS-AssistanceData-r16🡪 Area-ID-r17 | Rapporteur  Fraunhofer / Ericsson, vivo | Depends on conclusions on Proposals in [3]:  Proposal 4, 5, 6  Question 1 in Section 4.2 | Agreement:  No need to report area ID along with PRS measurement to the LMF if the PRS AD is associated with area ID. |
| R2-B3 | Multiple instances of DL-PRS Assistance Data | How to provide/indicate multiple instances of DL-PRS assistance data | TBD | Rapporteur  Fraunhofer / Ericsson, vivo | Depends on conclusions on Proposals in [3]:  Proposal 7 |  |
| R2-B4 | Capability for scheduled location request | Differentiation between UE-based and UE-assisted support and indication of time bases supported. | OTDOA-ProvideCapabilities-->scheduledLocationRequest-r17  A-GNSS-ProvideCapabilities-->scheduledLocationRequest-r17  ECID-ProvideCapabilities-->scheduledLocationRequest-r17  TBS-ProvideCapabilities-r13-->scheduledLocationRequest-r17  Sensor-ProvideCapabilities-r13-->scheduledLocationRequest-r17  WLAN-ProvideCapabilities-r13-->scheduledLocationRequest-r17  BT-ProvideCapabilities-r13-->scheduledLocationRequest-r17  NR-ECID-ProvideCapabilities-r16-->scheduledLocationRequest-r17  NR-DL-TDOA-ProvideCapabilities-r16-->scheduledLocationRequest-r17  NR-DL-AoD-ProvideCapabilities-r16-->scheduledLocationRequest-r17  NR-Multi-RTT-ProvideCapabilities-r16-->scheduledLocationRequest-r17 | Huawei, vivo, Nokia | Depends on conclusions on Proposals in [3]:  Proposal 2 | Agreement:  Differentiate the UE capability of time bases for different positioning modes. (7/12) |
| R2-B5 | Time base(s) supported for scheduled location | Is a single time (e.g., UTC) enough for all methods? | OTDOA-ProvideCapabilities-->scheduledLocationRequest-r17  A-GNSS-ProvideCapabilities-->scheduledLocationRequest-r17  ECID-ProvideCapabilities-->scheduledLocationRequest-r17  TBS-ProvideCapabilities-r13-->scheduledLocationRequest-r17  Sensor-ProvideCapabilities-r13-->scheduledLocationRequest-r17  WLAN-ProvideCapabilities-r13-->scheduledLocationRequest-r17  BT-ProvideCapabilities-r13-->scheduledLocationRequest-r17  NR-ECID-ProvideCapabilities-r16-->scheduledLocationRequest-r17  NR-DL-TDOA-ProvideCapabilities-r16-->scheduledLocationRequest-r17  NR-DL-AoD-ProvideCapabilities-r16-->scheduledLocationRequest-r17  NR-Multi-RTT-ProvideCapabilities-r16-->scheduledLocationRequest-r17 | vivo, Nokia, ZTE | Depends on conclusions on Proposals in [3]:  Proposal 3 | Agreement:  The indication of scheduled location time can be based on different time bases. |

## On-demand DL-PRS

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| # | Item | Description | Affected IEs | Source | Status Pre-meeting | Status Update |
| R2-C1 | Pre-defined DL-PRS configurations | The information which defines a pre-defined DL-PRS configuration | NR-On-Demand-DL-PRS-Configurations-r17 | Rapporteur | Question 2 in Section 4.3 |  |
| R2-C2 | Number of Pre-defined DL-PRS configurations | How many pre-defined DL-PRS configurations can be provided? | maxDL-PRS-Configs-r17 | Rapporteur | Depends on conclusions on Proposals in [5]:  Proposal 11 |  |
| R2-C3 | Definition of DL-PRS Configuration ID | How to define a unique DL-PRS Configuration ID? | NR-On-Demand-DL-PRS-Configurations-r17🡪DL-PRS-Configuration-ID-r17 | Rapporteur, Huawei, ZTE | Depends on conclusions on Proposals in [5]:  Proposal 12 | Agreement:  The DL-PRS-Configuration ID is only defined by an identifier (ID). |
| R2-C4 | On-demand DL-PRS request for pre-defined configurations | Should the UE request include a single configuration, or a list of configurations in order of preference? | NR-On-Demand-DL-PRS-Request-r17🡪 dl-prs-configuration-id-PrefList-r17 | Huawei, vivo, Nokia | Depends on conclusions on Proposals in [5]:  Proposal 5 | Agreement:  The UE may indicate its preferred on-demand PRS pre-defined configuration via a list in decreasing order of preference (i.e., sorted from the UE’s most preferred to least preferred on-demand PRS configuration) |
| R2-C5 | Pre-defined On-demand DL-PRS configurations for multiple methods | In case of multiple ProvideAssistanceData for different methods, the *NR-On-Demand-DL-PRS-Configurations* need only to be provided once. | NR-DL-TDOA-ProvideAssistanceData-r16🡪 NR-On-Demand-DL-PRS-Configurations-r17  NR-DL-AoD-ProvideAssistanceData-r16🡪 NR-On-Demand-DL-PRS-Configurations-r17  NR-Multi-RTT-ProvideAssistanceData-r16🡪 NR-On-Demand-DL-PRS-Configurations-r17 | vivo | Question 3 in Section 4.3 | Agreement:  On-demand PRS configuration is at least provided per positioning method.  UE-initiated on-demand PRS capability information is independently requested/indicated per positioning method |

## GNSS Integrity

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| # | Item | Description | Affected IEs | Source | Status Pre-meeting | Status Update |
| R2-D1 | Integrity Request Information | The information required for an integrity request | CommonIEsRequestLocationInformation🡪 IntegrityInformationRequest-r17 | Rapporteur | Depends on conclusions on Proposals in [6]:  Proposal 14, 15 | Agreement:  Add HPL and VPL to the IntegrityInfo IE. The value range of these two parameters covers 0 – 500m interval. Resolution is 1cm.  Note: HPL representation e.g., 2D ellipse or Alon-Cross track pair is based on input from Stage 3 rapporteur. |
| R2-D2 | Integrity Information Result | The information required for an integrity report,  Encoding of protection level | CommonIEsProvideLocationInformation🡪IntegrityInfo-r17 | Rapporteur | Depends on conclusions on Proposals in [6]:  Proposal 15, 17, 18, 19, 20 | Agreement:  Release 17 supports only Reporting Mode 1 (PL reporting). Reporting Mode 2 can be revisited in future releases.  For reporting Mode 1, TTA is not needed.  Provide achievable TIR as optional parameter in the Integrity Information Result |
| R2-D3 | Periodic Assistance Data | Which integrity information need to be provided periodically | GNSS-PeriodicAssistData-r15 | Rapporteur | Depends on conclusions on Proposals in [6]:  Proposal 10, 11 | Agreement:  Agree to enable periodic transmission of assistance data for GNSS integrity.  Add gnss-Integrity-PeriodicServiceAlert-r17 to the list of periodic GNSS assistance data. FFS if other IEs need to be added |
| R2-D4 | Integrity Service Parameters | Confirm the proposed encoding | GNSS-Integrity-ServiceParameters-r17 | Rapporteur | Depends on conclusions on Proposals in [6]:  Proposal 21, 22 | Agreement:  Adopt the proposed encoding for GNSS-Integrity-ServiceParameter in Stage 3. |
| R2-D5 | Code Bias Bounds | Confirm the proposed encoding | GNSS-SSR-CodeBias-r15🡪SSR-IntegrityCodeBiasBounds-r17 | Rapporteur | Depends on conclusions on Proposals in [6]:  Proposal 23 | Agreement:  Adopt the proposed encoding of the SSR-IntegrityCodeBiasBounds. |
| R2-D6 | Phase Bias Bounds | Confirm the proposed encoding | GNSS-SSR-PhaseBias-r16🡪 SSR-IntegrityPhaseBiasBounds-r17 | Rapporteur | Depends on conclusions on Proposals in [6]:  Proposal 26 | Agreement:  Adopt the proposed encoding of the SSR-IntegrityPhaseBiasBounds. |
| R2-D7 | STEC Integrity | Confirm the proposed encoding | GNSS-SSR-STEC-Correction-r16🡪 STEC-IntegrityParameters-r17  STEC-IntegrityErrorBounds-r17 | Rapporteur | Depends on conclusions on Proposals in [6]:  Proposal 25 | Agreement:  Adopt the proposed encoding for the STEC-IntegrityParameters-r17 and STEC-IntegrityErrorBounds-r17 |
| R2-D8 | Gridded Correction Integrity | Confirm the proposed encoding | GNSS-SSR-GriddedCorrection-r16🡪 SSR-GriddedCorrectionIntegrityParameters-r17  TropoDelayIntegrityErrorBounds-r17 | Rapporteur | Depends on conclusions on Proposals in [6]:  Proposal 26 | Agreement:  Adopt the proposed encoding for the SSR-GriddedCorrectionIntegrityParameters-r17 and TropoDelayIntegrityErrorBounds-r17. |

## RAN1/RAN4 General

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| # | Item | Description | Affected IEs | Source | Status Pre-meeting | Status Update |
| R1-A1 | Report mapping of DL PRS-RSRPP |  | NR-AdditionalPath-r16🡪nr-DL-PRS-RSRPP-r17  NR-DL-TDOA-MeasElement-r16🡪 nr-DL-PRS-FirstPathRSRP-Result-r17  NR-DL-AoD-MeasElement-r16🡪 nr-DL-PRS-FirstPathRSRP-Result-r17  NR-Multi-RTT-MeasElement-r16🡪 nr-DL-PRS-FirstPathRSRP-Result-r17 | Rapporteur | Depends on conclusions on Proposals in [7]:  Proposal 19 |  |
| R1-A2 | Relative DL-PRS Resource power in antenna beam pattern information | Value range/resolution of the relative power of the DL-PRS Resources | NR-TRP-BeamAntennaInfo-r17🡪nr-dl-prs-RelativePower-r17 | Rapporteur | Depends on conclusions on Proposals in [7]:  Proposal 17 |  |
| R1-A3 | Providing multiple measurement instances of a measurement report | Need to decide how this should be implemented. The simplest seem to be a SEQUENCE ((SIZE(1..N)) for each measurement information (e.g., NR-DL-TDOA-SignalMeasurementInformation-r16) | NR-DL-TDOA-SignalMeasurementInformation-r16  NR-DL-AoD-SignalMeasurementInformation-r16  NR-Multi-RTT-SignalMeasurementInformation-r16 | Rapporteur | Awaiting further input from RAN1. |  |
| R1-A4 | Uncertainty range of expected angle assistance | Could probably be decided by RAN2; e.g., simply cover +/-45 deg range. | NR-DL-AoD-ExpectedAngleAssistance-r17 | Rapporteur | Depends on conclusions on Proposals in [7]:  Proposal 22 |  |
| R1-A5 | Multiplicity and type constraint values | Confirmation/checking of the value ranges. |  | Rapporteur |  |  |

## RAN1 Parameter List

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| # | Item | Description | Affected IEs | Source | Status Pre-meeting | Status Update |
| R1-1 | UE RxTx TEG-Info | Should we move the SRS-TxTEG association out of the per-TRP meas. Info (e.g., at top level NR-Multi-RTT-SignalMeasurementInformation-r16)?  Need to also consider the change of Tx TEG association, e.g., via a time stamp.  Are there multiple pairs of {nr-UE-Tx-TEG-ID, nr-UE-Rx-TEG-ID} needed for one nr-UE-RxTx-TEG-ID? | NR-Multi-RTT-SignalMeasurementInformation-r16🡪 NR-UE-RxTx-TEG-Info-r17 | Huawei(8)  Nokia(8) | Depends on conclusions on Proposals in [7]:  Proposal 1, 9 |  |
| R1-2 | Assistance Data Request and capabilities for position calculation assistance | Should we have a bit for each assistance data element (incl. the Rel-16 ones)? Should the bit map/request be different for DL-TDOA and DL-AoD?  Same for capabilities. | NR-DL-TDOA-RequestAssistanceData-r16🡪 nr-PosCalcAssistanceRequest-r17  NR-DL-AoD-RequestAssistanceData-r16🡪 nr-PosCalcAssistanceRequest-r17  NR-DL-TDOA-ProvideCapabilities-r16🡪 nr-PosCalcAssistanceSupport-r17  NR-DL-AoD-ProvideCapabilities-r16🡪nr-PosCalcAssistanceSupport-r17 | Huawei(78,103,170)  vivo(78, 170) | Depends on conclusions on Proposals in [7]:  Proposal 10, 11, 12, 13 |  |
| R1-3 | TRP Beam Antenna Information | Should the beam pattern info be included in Rel-16 NR-DL-PRS-BeamInfo?  Any changes needed to support linear arrays? | NR-PositionCalculationAssistance-r16🡪 NR-TRP-BeamAntennaInfo-r17 | Huawei(79) | Depends on conclusions on Proposals in [7]:  Proposal 14, 15 |  |
| R1-4 | DL-AoD positioning with RSRPP only | Do we need a DL-AoD variant which supports the Rel-17 RSRPP measurement only? | Several IEs in 6.5.11 (NR DL-AoD Positioning). | Huawei(85) | Depends on conclusions on Proposals in [7]:  Proposal 18 |  |
| R1-5 | Expected Angle Assistance | Needs to be per TRP.  Should this be included in NR-DL-PRS-AssistanceDataPerTRP-r16 (like expected RSTD and expected RSTD uncertainty)?  Value ranges are FFS and may be decided by RAN1. | NR-DL-AoD-ExpectedAngleAssistance-r17 | Huawei(89)  vivo(89) | Depends on conclusions on Proposals in [7]:  Proposal 20, 21, 22 |  |
| R1-6 | DL-PRS Resource Priority List | Should this be included in NR-DL-PRS-Resource-r16 IE?  Any further description of UE behaviour needed?  General encoding of the IE could be improved? | NR-DL-PRS-ResourcePriorityList-r17 | Huawei(104)  Nokia(85)  vivo(103) | Depends on conclusions on Proposals in [7]:  Proposal 23, 24 |  |
| R1-7 | Capability for 10ms Response Time | Do we need a capability for all methods? | ResponseTime --> unit-r15 --> ten-milli-seconds-r17 | Huawei(110)  vivo(110) | Depends on conclusions in [8]:  Proposal 3.2.1-1 |  |
| R1-8 | UE LOS/NLOS indicator | Should the LOS/NLOS indicator for the UE measurements have a per resource indicator and a per TRP indicator? | NR-DL-TDOA-RequestLocationInformation-r16-->nr-los-nlos-IndicatorRequest-r17  NR-DL-TDOA-SignalMeasurementInformation-r16-->LOS-NLOS-Indicator-r17  NR-DL-TDOA-ProvideCapabilities-r16-->nr-los-nlos-IndicatorSupport-r17  NR-DL-AoD-RequestLocationInformation-r16-->nr-los-nlos-IndicatorRequest-r17  NR-DL-AoD-SignalMeasurementInformation-r16-->LOS-NLOS-Indicator-r17  NR-DL-AoD-ProvideCapabilities-r16-->nr-los-nlos-IndicatorSupport-r17 | Huawei(129)  Nokia(129) | Depends on conclusions on Proposals in [7]:  Proposal 25 |  |
| R1-9 | On-demand PRS information for UE-initiated on-demand DL PRS requests | Should the FR be mandatory?  Is a PointA/startPRB missing?  Should the CHOICE between the two options for indication of DL PRS QCL-Info be removed?  Option 2 need to be per resource set per positioning frequency layer per FR. | NR-On-Demand-DL-PRS-Request-r17 | Huawei(144) | Question 4 in Section 4.4 |  |
| R1-10 | QCL sources recommended by UE | The DL-PRS Resource ID may not be needed in NR-DL-PRS-ResourceElement-r17. | DL-PRS-QCL-InformationRec-17🡪 DL-PRS-QCL-InformationRecPerTRP-r17🡪 dl-prs-QCL-InformationRecSet-r17🡪 DL-PRS-QCL-InfoRec-r17🡪 R-DL-PRS-ResourceElement-r17 | Huawei(147) | Question 4 in Section 4.4 |  |
| R1-11 | On-demand PRS start/end time | Best way for indicating the on-demand DL-PRS start and end time?  Should we use a specific start/end time, e.g., UTC?  Should we assume RAN1 will define this? | NR-On-Demand-DL-PRS-Request-r17 | Huawei(149)  Nokia(149) | Question 5 in Section 4.5 |  |
| R1-12 | TRP TEG info | Could this be moved into NR-RTD-Info-r16? | NR-DL-PRS-TRP-TEG-Info-r17 | Huawei(169) | Depends on conclusions on Proposals in [7]:  Proposal 6 |  |
| R1-13 | The maximum number of DL PRS resources per target TRP in a measurement report is still limited to 4. | For the NR-DL-TDOA-AdditionalMeasurementsExt-r17, the maximum number of DL PRS resources per target TRP in a measurement report is still limited to 4. How to restrict the PRS number shall be discussed. | NR-DL-TDOA-AdditionalMeasurementsExt-r17 | vivo(132) | Depends on conclusions on Proposals in [7]:  Proposal 7 |  |

# 3. Updates made in Version v5 of running CR [1]

Initial implementation of some [Pre117-e] email discussion issues.

(Note: changes have been made as Word User "v5". To see the changes in v5 only, go to menu "Review"🡪"Show Markup"🡪"Specific People" and select "v5" only.)

[607] (latency) [3]:

Editor's Note on Response Time granularity is removed (use 10ms) (Question 11).

[608] (on-demand PRS) [5]:

"ConfigurationName" is removed from DL-PRS-Configuration-ID-r17 (Question 14).

[610] (GNSS integrity) [6]:

PL is split into horizontal and vertical component. Value range of 0-500m with 1cm resolution is proposed (Question 15).

Editor's Notes on the confirmation of the encoding of the new assistance data are removed (Questions in section 4.10).

[611] (accuracy) [7]:

Tx TEGs for Multi-RTT are moved to highest IE level. Encoding is aligned with RRC proposal (FFS) (Question 2).

NR-UE-RxTx-TEG-Info-r17 in NR-Multi-RTT-SignalMeasurementInformation-r16 is aligned accordingly (FFS) (Question 12).

NR-DL-AoD-ExpectedAngleAssistance is provided per TRP (Question 22)

[612] (capability) [8]

Initial TPs from [612] are implemented, some required small adjustments.

Other changes:

IE NR-On-Demand-DL-PRS-Support is moved to common IEs (6.4.3) since same content for all DL-PRS methods.

*nr-los-nlos-IndicatorRequest-r17* in 'method'-RequestLocationInformation is split into 'per-trp' and 'per resource' (to align with corresponding capability).

# 4. Phase 1 Discussion

## 4.1 Comments on v5 [1]

The main changes made in v5 [1] were related to the Capability Discussion and TPs in [8]. Although, this depends on the conclusions on the proposals and TPs in [8], an initial implementation of the TPs was made before the meeting in v5, and companies are invited to review the updated capabilities in v5.

Please provide any comments on the additions/changes made in v5 [1] of the LPP running CR in the Table below.

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## 4.2 Open Issue: Area ID – Issue R2-B2

According to [3], Proposal 4:

*How to define the area ID for pre-configured PRS should be addressed based on the companies’ contribution.*

(Text) proposals on how to define the Area ID were submitted in the following contributions:

**[a] R2-2202408, "Discussion and TP on areaID for Latency enhancements", CATT.**

Proposal 1: RAN2 to agree to area ID as a INTEGER (0 .. 255) .

Proposal 2: RAN2 to agree to add “The associated NR-DL-PRS-AssistanceDataPerTRPs with the same area-ID are available in the concerned area.” in the description of area-ID.

Proposal 3: RAN2 to agree to capture the TP in the annex for area-ID in running CR of TS37.355.

**[b] R2-2202487, "On Latency Reduction open issues", Intel Corporation.**

Proposal 1: An area based identifier should be defined to associate pre-configured DL-PRS assistance data to validity area in order to meet the validity area based criterion.

Proposal 2a: A new area ID field (i.e. ValidityAreaID) shall be defined for association with pre-configured DL-PRS assistance data and can be signaled alongside in LPP signaling to determine if a pre-configured AD is considered valid.

**[c] R2-2202592, "On remaining issues for latency improvements", Apple**

Proposal 1: Area ID is specified as a list of NCGIs a UE is camped on.

**[d]** **R2-2203042, "Way forward for preconfigured assistance data", Fraunhofer IIS, Fraunhofer HHI, Ericsson**

Proposal 1: A single instance of AD is identified by an unique identifier ( for example, an AreaID).

Proposal 2: The validity area, indicated by an AreaID, in Rel. 17, consists of a group of cells where the UE is camped/connected.

Proposal 7: RAN2 shall endorse the TP in Section 3 for inclusion in the running CR for TS 37.355.

**[e] R2-2203088, "Discussion on latency enhancement", vivo.**

Proposal 1: The validity area associated with each pre-configured assistance data can be a list of cells that the target UE may camp on.

**[f] R2-2203181, "Discussion on open issues of positioning latency enhancements", ZTE, Sanechips.**

Proposal 5: Support to introduce a new IE to contain multiple instances of pre-configured ADs, each instances of pre-configured ADs should have its corresponding identifier, and each identifier can be associated with one or more area ID.

**[g] R2- 2203211, "Discussion of positioning latency enhancement open issues", OPPO.**

Proposal 1: kindly propose RAN2 to agree that the validity area of pre-configured assistance data could consist of a group of cell IDs or RAN area IDs (to be broadcast by the involved cells).

Proposal 2: kindly propose RAN2 to agree that only one area ID to be attached with one preconfigured assistance data instance.

Proposal 3: kindly propose RAN2 to agree that one cell could be associated with more than one area IDs, so that the UE under the coverage of such cell could apply more than one instances of pre-configured assistance data for performing positioning.

There were 5 Text Proposals on the definition of Area ID submitted. Some TPs also propose other changes related to "multiple instances" of assistance data, etc., which however were also discussed in [Pre117-e][607] and depends on the conclusions on issue #R2-B3.

##### **Text proposal 1 from [a] (CATT)**

(see [a] for further background and discussion)

– *NR-DL-PRS-AssistanceData*

The IE *NR-DL-PRS-AssistanceData* is used by the location server to provide DL-PRS assistance data.

NOTE 1: The location server should include at least one TRP for which the SFN can be obtained by the target device, e.g. the serving TRP.

NOTE 2: The *nr-DL-PRS-ReferenceInfo* defines the "assistance data reference" TRP whose DL-PRS configuration is included in *nr-DL-PRS-AssistanceDataList*. The *nr-DL-PRS-SFN0-Offset's* and *nr-DL-PRS-expectedRSTD's* in *nr-DL-PRS-AssistanceDataList* are provided relative to the "assistance data reference" TRP.

NOTE 3: The network signals a value of zero for the *nr-DL-PRS-SFN0-Offset*, *nr-DL-PRS-expectedRSTD*, and *nr-DL-PRS-expectedRSTD-uncertainty* of the "assistance data reference" TRP in *nr-DL-PRS-AssistanceDataList*.

NOTE 4: For NR DL-TDOA positioning (see clause 6.5.10) the *nr-DL-PRS-ReferenceInfo* defines also the requested "RSTD reference".

For DL-PRS processing, the LPP layer may inform lower layers to start performing DL-PRS measurements and provide to lower layers the information about the location of DL-PRS, e.g. DL-PRS-PointA, DL-PRS Positioning occasion information.

-- ASN1START

NR-DL-PRS-AssistanceData-r16 ::= SEQUENCE {

nr-DL-PRS-ReferenceInfo-r16 DL-PRS-ID-Info-r16,

nr-DL-PRS-AssistanceDataList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-DL-PRS-AssistanceDataPerFreq-r16,

nr-SSB-Config-r16 SEQUENCE (SIZE (1..nrMaxTRPs-r16)) OF

NR-SSB-Config-r16 OPTIONAL, -- Need ON

...

}

NR-DL-PRS-AssistanceDataPerFreq-r16 ::= SEQUENCE {

nr-DL-PRS-PositioningFrequencyLayer-r16

NR-DL-PRS-PositioningFrequencyLayer-r16,

nr-DL-PRS-AssistanceDataPerFreq-r16 SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

NR-DL-PRS-AssistanceDataPerTRP-r16,

...

}

NR-DL-PRS-AssistanceDataPerTRP-r16 ::= SEQUENCE {

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

nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL, -- Need ON

nr-CellGlobalID-r16 NCGI-r15 OPTIONAL, -- Need ON

nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON

nr-DL-PRS-SFN0-Offset-r16 NR-DL-PRS-SFN0-Offset-r16,

nr-DL-PRS-ExpectedRSTD-r16 INTEGER (-3841..3841),

nr-DL-PRS-ExpectedRSTD-Uncertainty-r16

INTEGER (0..246),

nr-DL-PRS-Info-r16 NR-DL-PRS-Info-r16,

...,

[[

prs-OnlyTP-r16 ENUMERATED { true } OPTIONAL -- Need ON

]],

[[

area-ID-r17 Area-ID-r17 OPTIONAL -- Need ON

]]

}

NR-DL-PRS-PositioningFrequencyLayer-r16 ::= SEQUENCE {

dl-PRS-SubcarrierSpacing-r16 ENUMERATED {kHz15, kHz30, kHz60, kHz120, ...},

dl-PRS-ResourceBandwidth-r16 INTEGER (1..63),

dl-PRS-StartPRB-r16 INTEGER (0..2176),

dl-PRS-PointA-r16 ARFCN-ValueNR-r15,

dl-PRS-CombSizeN-r16 ENUMERATED {n2, n4, n6, n12, ...},

dl-PRS-CyclicPrefix-r16 ENUMERATED {normal, extended, ...},

...

}

NR-DL-PRS-SFN0-Offset-r16 ::= SEQUENCE {

sfn-Offset-r16 INTEGER (0..1023),

integerSubframeOffset-r16 INTEGER (0..9),

...}

Area-ID-r17 ::= INTEGER (0..255)

}

-- ASN1STOP

| *NR-DL-PRS-AssistanceData* field descriptions |
| --- |
| ***nr-DL-PRS-ReferenceInfo***  This field specifies the IDs of the assistance data reference TRP. |
| ***nr-DL-PRS-AssistanceDataList***  This field specifies the DL-PRS resources for each frequency layer. |
| ***nr-SSB-Config***  This field specifies the SSB configuration of the TRPs. |
| ***nr-DL-PRS-PositioningFrequencyLayer***  This field specifies the Positioning Frequency Layer for the *nr-DL-PRS-AssistanceDataPerFreq* field. |
| ***nr-DL-PRS-AssistanceDataPerFreq***  This field specifies the DL-PRS Resources for the TRPs within the Positioning Frequency Layer. |
| ***dl-PRS-ID***  This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resource ID to uniquely identify a DL-PRS Resource, and is associated with a single TRP. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the TRP. When the field *prs-OnlyTP* is included, this field is not included. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, as defined in TS 38.331 [35]. When the field *prs-OnlyTP* is included, this field is not included. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. When the field *prs-OnlyTP* is included, this field is not included. |
| ***nr-DL-PRS-SFN0-Offset***  This field specifies the time offset of the SFN#0 slot#0 for the given TRP with respect to SFN#0 slot#0 of the assistance data reference TRP and comprises the following subfields:  - ***sfn-Offset*** specifies the SFN offset at the TRP antenna location between the assistance data reference TRP and this neighbour TRP.  The offset corresponds to the number of full radio frames counted from the beginning of a radio frame #0 of the assistance data reference TRP to the beginning of the closest subsequent radio frame #0 of this neighbour TRP.  - ***integerSubframeOffset*** specifies the frame boundary offset at the TRP antenna location between the assistance data reference TRP and this neighbour TRP counted in full subframes.  The offset is counted from the beginning of a subframe #0 of the assistance data reference TRP to the beginning of the closest subsequent subframe #0 of this neighbour TRP, rounded down to multiples of subframes. |
| ***nr-DL-PRS-ExpectedRSTD***  This field indicates the RSTD value that the target device is expected to measure between this TRP and the assistance data reference TRP. The *nr-DL-PRS-ExpectedRSTD* field takes into account the expected propagation time difference as well as transmit time difference of PRS positioning occasions between the two TRPs. The resolution is 4×Ts, with Ts=1/(15000\*2048) seconds. |
| ***nr-DL-PRS-ExpectedRSTD-Uncertainty***  This field indicates the uncertainty in *nr-DL-PRS-ExpectedRSTD* value.The uncertainty is related to the location server′s a‑priori estimate of the target device location. The *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty* togetherdefine the search window for the target device.  The resolution R is  - Ts if all PRS resources are in frequency range 2,  - 4×Ts otherwise,  with Ts=1/(15000\*2048) seconds.  The target device may assume that the beginning of the subframe for the PRS of this TRP is received within the search window of size  - [*-nr-*DL*-PRS-ExpectedRSTD-Uncertainty*×R *;* *nr-DL-PRS-ExpectedRSTD-Uncertainty*×R] centred at TREF*+*1 millisecond×N+*nr-DL-PRS-ExpectedRSTD*×4×Ts,  where TREF is the reception time of the beginning of the subframe for the PRS of the assistance data reference TRP at the target device antenna connector, and N can be calculated based on  - *nr-DL-PRS-SFN0-Offset*  - *dl-PRS-Periodicity-and-ResourceSetSlotOffset*  - *dl-PRS-ResourceSlotOffset.* |
| ***nr-DL-PRS-Info***  This field specifies the PRS configuration of the TRP. |
| ***dl-PRS-SubcarrierSpacing***  This field specifies the subcarrier spacing of the DL-PRS Resource. 15, 30, 60 kHz for FR1; 60, 120 kHz for FR2. All DL-PRS Resources and DL-PRS Resource Sets in the same Positioning Frequency layer have the same value of *dl-PRS-SubcarrierSpacing*. |
| ***dl-PRS-ResourceBandwidth***  This field specifies the number of PRBs allocated for the DL-PRS Resource (allocated DL-PRS bandwidth) in multiples of 4 PRBs. All DL-PRS Resources of the DL-PRS Resource Set have the same bandwidth. All DL-PRS Resource Sets belonging to the same Positioning Frequency Layer have the same value of DL-PRS Bandwidth and Start PRB.  Integer value 1 corresponds to 24 PRBs, value 2 corresponds to 28 PRBs, value 3 corresponds to 32 PRBs and so on. |
| ***dl-PRS-StartPRB***  This field specifies the start PRB index defined as offset with respect to reference DL-PRS Point A for the Positioning Frequency Layer. All DL-PRS Resources Sets belonging to the same Positioning Frequency Layer have the same value of *dl-PRS-StartPRB*. |
| ***dl-PRS-PointA***  This field specifies the absolute frequency of the reference resource block for the DL-PRS. Its lowest subcarrier is also known as DL-PRS Point A. A single DL-PRS Point A for DL-PRS Resource allocation is provided per Positioning Frequency Layer. All DL-PRS Resources belonging to the same DL-PRS Resource Set have the same DL-PRS Point A. |
| ***dl-PRS-CombSizeN***  This field specifies the Resource Element spacing in each symbol of the DL-PRS Resource. All DL-PRS Resource Sets belonging to the same Positioning Frequency Layer have the same value of comb size N. |
| ***dl-PRS-CyclicPrefix***  This field specifies the Cyclic Prefix length of the DL-PRS Resource. All DL-PRS Resources Sets belonging to the same Positioning Frequency Layer have the same value of *dl-PRS-CyclicPrefix*. |
| ***prs-OnlyTP***  This field, if present, indicates that the *NR-DL-PRS-AssistanceData* is provided for a PRS-only TP. Whether the field is present or absent should be the same for all the *NR-DL-PRS-AssistanceData* of all the PRS transmitted under the same TP.  The target device shall not assume that any other signals or physical channels are present for the TRP other than DL-PRS. |
| ***area-ID***  This field, if present, specifies the Area ID of the network area to which the TRP for which the *NR-DL-PRS-AssistanceDataPerTRP* is provided belongs to. The associated NR-DL-PRS-AssistanceDataPerTRPs with the same area-ID are available in the concerned area. |

##### **Text proposal 2 from [c] (Apple)**

(see [c] for further background and discussion)

-- ASN1START

Area-ID-r17 ::= SEQUENCE (SIZE(1..maxAreaIDs-r17)) OF NCGI-r15

-- ASN1STOP

| *NR-DL-PRS-AssistanceData* field descriptions |
| --- |
| ***area-ID***  This field, if present, specifies the Area ID of the network area to which the TRP for which the *NR-DL-PRS-AssistanceDataPerTRP* is provided belongs to in terms of list of cells a UE is camped on. |

##### **Text proposal 3 from [d] (Fraunhofer, Ericsson)**

(see [d] for further background and discussion)

– *NR-DL-TDOA-ProvideCapabilities*

The IE *NR-DL-TDOA-ProvideCapabilities* is used by the target device to indicate its capability to support NR DL-TDOA and to provide its NR DL-TDOA positioning capabilities to the location server.

-- ASN1START

NR-DL-TDOA-ProvideCapabilities-r16 ::= SEQUENCE {

nr-DL-TDOA-Mode-r16 PositioningModes,

nr-DL-TDOA-PRS-Capability-r16 NR-DL-PRS-ResourcesCapability-r16,

nr-DL-TDOA-MeasurementCapability-r16 NR-DL-TDOA-MeasurementCapability-r16,

nr-DL-PRS-QCL-ProcessingCapability-r16 NR-DL-PRS-QCL-ProcessingCapability-r16,

nr-DL-PRS-ProcessingCapability-r16 NR-DL-PRS-ProcessingCapability-r16,

additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

periodicalReporting-r16 PositioningModes OPTIONAL,

...,

[[

ten-ms-unit-ResponseTime-r17 PositioningModes OPTIONAL,

nr-PosCalcAssistanceSupport-r17 BIT STRING { trpLocSup (0),

beamInfoSup (1),

rtdInfoSup (2),

beamAntInfoSup (3),

losNlosInfoSup (4),

trpTEG-InfoSup (5)

} (SIZE (1..8)) OPTIONAL,

nr-DL-TDOA-On-Demand-DL-PRS-Support-r17 NR-DL-TDOA-On-Demand-DL-PRS-Support-r17 OPTIONAL,

nr-UE-Rx-TEG-ID-Support-r17 INTEGER (1..maxNumOfRxTEGs-r17) OPTIONAL,

nr-los-nlos-IndicatorSupport-r17 BIT STRING { case1 (0),

case2 (1)

} (SIZE(1..8)) OPTIONAL,

additionalPathsExtSupport-r17 INTEGER (3..8) OPTIONAL,

additionalPathsPowerSupport-r17 ENUMERATED { supported } OPTIONAL,

scheduledLocationRequest-r17 SEQUENCE {

utcTime-r17 PositioningModes OPTIONAL,

gnssTime-r17 SEQUENCE {

posModes-r17 PositioningModes,

gnss-TimeIDs-r17 GNSS-ID-Bitmap

} OPTIONAL,

e-utraTime-r17 PositioningModes OPTIONAL,

nrTime-r17 PositioningModes OPTIONAL,

relativeTime-r17 PositioningModes OPTIONAL,

...

} OPTIONAL,

nr-dl-prs-AssistanceDataValidity-r17 SEQUENCE {

area-validity-r17 ENUMERATED {supported} OPTIONAL,

...

}

nr-AdditionalPreconfiguredAD BIT STRING { ZERO (0),

ONE (1),

TWO (2),

FOUR (3),

EIGHT (4),

THIRTYTWO (5)

} (SIZE (1..8))

]]

}

| NR-DL-TDOA-ProvideCapabilities field descriptions |
| --- |
| **nr-AdditionalPreconfiguredAD**  This field specifies the number of preconfigured AD instants which a UE can store, which are outside the current positioning area. |

--ASN1START

ValidityCriteria-r17 ::= SEQUENCE {

positioningAreaIdentifier-r17 INTEGER(0..FFS)

cellList-r17 SEQUENCE (SIZE (1..64)) OF NR-Cell-r17

expirationTime-r17 UTCTime OPTIONAL, -- Need ON

...

}

NR-Cell-r17 := CHOICE {

nr-PhysCellID-r17 NR-PhysCellID-r16 OPTIONAL, -- Need ON

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

...,

}

--ASN1STOP

| ValidityCriteria field descriptions |
| --- |
| ***positioningAreaIdentifier***  This field specifies the area where the AD component is valid. It this area identifier is assigned to a TRP, then it specifies which the positioning Area the TRP belongs to. All TRPs having the same positioning area identifier belong to the same area. All AD having the same positioningAreaIdentifier belong to the same instance of the AD. If the ***positioningAreaIdentifier*** matches one of the stored AD from another LPP session or previous transaction, then the stored AD is replaced by a newly provided AD. |
| ***cellList***  The assistance data provided is valid for the current area if the UE is camped within or connected to one of the cell in the NR-Cell list |
| ***expirationTime***  The time expressed in UTC beyond which the UE cannot assume that the provided AD is valid. |

*– NR-DL-PRS-AssistanceData*

The IE *NR-DL-PRS-AssistanceData* is used by the location server to provide DL-PRS assistance data.

NOTE 1: The location server should include at least one TRP for which the SFN can be obtained by the target device, e.g. the serving TRP.

NOTE 2: The *nr-DL-PRS-ReferenceInfo* defines the "assistance data reference" TRP whose DL-PRS configuration is included in *nr-DL-PRS-AssistanceDataList*. The *nr-DL-PRS-SFN0-Offset's* and *nr-DL-PRS-expectedRSTD's* in *nr-DL-PRS-AssistanceDataList* are provided relative to the "assistance data reference" TRP.

NOTE 3: The network signals a value of zero for the *nr-DL-PRS-SFN0-Offset*, *nr-DL-PRS-expectedRSTD*, and *nr-DL-PRS-expectedRSTD-uncertainty* of the "assistance data reference" TRP in *nr-DL-PRS-AssistanceDataList*.

NOTE 4: For NR DL-TDOA positioning (see clause 6.5.10) the *nr-DL-PRS-ReferenceInfo* defines also the requested "RSTD reference".

For DL-PRS processing, the LPP layer may inform lower layers to start performing DL-PRS measurements and provide to lower layers the information about the location of DL-PRS, e.g. DL-PRS-PointA, DL-PRS Positioning occasion information.

-- ASN1START

NR-DL-PRS-AssistanceData-r16 ::= SEQUENCE {

nr-DL-PRS-ReferenceInfo-r16 DL-PRS-ID-Info-r16,

nr-DL-PRS-AssistanceDataList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-DL-PRS-AssistanceDataPerFreq-r16,

nr-SSB-Config-r16 SEQUENCE (SIZE (1..nrMaxTRPs-r16)) OF

NR-SSB-Config-r16 OPTIONAL, -- Need ON

...,

[[

validityCriteriaList-r17 SEQUNECE (SIZE (1..maxNrAdditionalPreconfAD) OF ValidityCriteria-r17 OPTIONAL, -- Need ON

]]

}

NR-DL-PRS-AssistanceDataPerFreq-r16 ::= SEQUENCE {

nr-DL-PRS-PositioningFrequencyLayer-r16

NR-DL-PRS-PositioningFrequencyLayer-r16,

nr-DL-PRS-AssistanceDataPerFreq-r16 SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

NR-DL-PRS-AssistanceDataPerTRP-r16,

...

}

NR-DL-PRS-AssistanceDataPerTRP-r16 ::= SEQUENCE {

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

nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL, -- Need ON

nr-CellGlobalID-r16 NCGI-r15 OPTIONAL, -- Need ON

nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON

nr-DL-PRS-SFN0-Offset-r16 NR-DL-PRS-SFN0-Offset-r16,

nr-DL-PRS-ExpectedRSTD-r16 INTEGER (-3841..3841),

nr-DL-PRS-ExpectedRSTD-Uncertainty-r16

INTEGER (0..246),

nr-DL-PRS-Info-r16 NR-DL-PRS-Info-r16,

...,

[[

prs-OnlyTP-r16 ENUMERATED { true } OPTIONAL -- Need ON

]],

[[

area-ID-r17 INTEGER(0..FFS) OPTIONAL -- Need ON

]]

}

NR-DL-PRS-PositioningFrequencyLayer-r16 ::= SEQUENCE {

dl-PRS-SubcarrierSpacing-r16 ENUMERATED {kHz15, kHz30, kHz60, kHz120, ...},

dl-PRS-ResourceBandwidth-r16 INTEGER (1..63),

dl-PRS-StartPRB-r16 INTEGER (0..2176),

dl-PRS-PointA-r16 ARFCN-ValueNR-r15,

dl-PRS-CombSizeN-r16 ENUMERATED {n2, n4, n6, n12, ...},

dl-PRS-CyclicPrefix-r16 ENUMERATED {normal, extended, ...},

...

}

NR-DL-PRS-SFN0-Offset-r16 ::= SEQUENCE {

sfn-Offset-r16 INTEGER (0..1023),

integerSubframeOffset-r16 INTEGER (0..9),

...}

~~Area-ID-r17 ::= SEQUENCE {~~

~~-- FFS~~

~~}~~

-- ASN1STOP

##### **Text proposal 4 from [e] (vivo)**

(see [e] for further background and discussion)

-- ASN1START

NR-DL-TDOA-ProvideAssistanceData-r16 ::= SEQUENCE {

nr-DL-PRS-AssistanceData-r16 NR-DL-PRS-AssistanceData-r16 OPTIONAL, -- Need ON

nr-DL-Preconfigured-PRS-AssistanceData-r17 SEQUENCE (SIZE (1..nrMaxPreconfiguration-r17)) OF NR-DL-Preconfigured-PRS-AssistanceDataPerArea-r17 OPTIONAL, -- Need ON

nr-SelectedDL-PRS-IndexList-r16 NR-SelectedDL-PRS-IndexList-r16 OPTIONAL, -- Need ON

nr-PositionCalculationAssistance-r16

NR-PositionCalculationAssistance-r16

OPTIONAL, -- Cond UEB

nr-DL-TDOA-Error-r16 NR-DL-TDOA-Error-r16 OPTIONAL, -- Need ON

...

}

NR-DL-Preconfigured-PRS-AssistanceDataPerArea-r17 ::= SEQUENCE {

validityCellList-r17 SEQUENCE (SIZE (1..nrMaxValidCell)) OF NCGI-r15,

expirationTime-r15 UTCTime,

nr-DL-PRS-AssistanceData-r16 NR-DL-PRS-AssistanceData-r16

}

-- ASN1STOP

##### **Text proposal 5 from [f] (ZTE)**

(see [f] for further background and discussion)

*– NR-Pre-Config-AssistanceData*

The IE NR-Pre-Config-AssistanceData provides a set of possible DL-PRS configurations which can be applied by the target device in different areas.

-- ASN1START

NR-Pre-Config-AssistanceData-r17 ::= SEQUENCE {

Pre-Config-AssistanceData-list-r17 SEQUENCE (SIZE (1..nrMaxNumPre-config-AssistanceData-r17)) OF

NR-Pre-Config-AssistanceData-Element-r17,

...

}

NR-pre-config-AssistanceData-Element-r17 ::= SEQUENCE {

NR-Pre-Config-AssistanceData-id-r17 nr-Pre-Config-AssistanceData-id-r17,

nr*-Pre-Config-AssistanceData-element-r17* NR-DL-PRS-AssistanceData-r16,

Area-ID-r17 INTEGER(0..nrMaxNumAreas-r17)

...

}

-- ASN1STOP

**Question 1:** For the issue of definition of Area ID, which of the above 5 text proposals is preferred (if any)?

|  |  |  |
| --- | --- | --- |
| Company | TP 1,2,3,4,5, other | Comments |
| CATT | 1 | Area ID in TP 1 has the same mechanism as cell list in TP2. But area ID is more straightforward and less on air signalling:  Option A: Cell list for each TRP 256(TRP)\*16 (cells)\*10bit(PhysCellID) = 40Mbits  Option B: Area ID for each TRP 256 TRP \* 8bit(area ID) = 2Mbits  **No need to broadcast area ID of serving cell in SI. Because** UE must have known the cell ID where it stays. Then UE can get the associated area ID of this serving cell directly from the pre-configured assistance data according to the high light info as below. Area ID is always associated with nr-PhysCellID-r16. So no need to broadcast area ID in SI by serving cell again. LPP is good enough!  –                  *NR-DL-PRS-AssistanceData*  NR-DL-PRS-AssistanceDataPerTRP-r16 ::= SEQUENCE {      dl-PRS-ID-r16                   INTEGER (0..255),      nr-PhysCellID-r16               NR-PhysCellID-r16           OPTIONAL,   -- Need ON      nr-CellGlobalID-r16             NCGI-r15                    OPTIONAL,   -- Need ON      nr-ARFCN-r16                    ARFCN-ValueNR-r15           OPTIONAL,   -- Need ON      nr-DL-PRS-SFN0-Offset-r16       NR-DL-PRS-SFN0-Offset-r16,      nr-DL-PRS-ExpectedRSTD-r16      INTEGER (-3841..3841),      nr-DL-PRS-ExpectedRSTD-Uncertainty-r16                                      INTEGER (0..246),      nr-DL-PRS-Info-r16              NR-DL-PRS-Info-r16,      ...,      [[          prs-OnlyTP-r16              ENUMERATED { true }     OPTIONAL    -- Need ON      ]],      [[          area-ID-r17                 Area-ID-r17             OPTIONAL    -- Need ON      ]]  }  Area-ID-r17 ::=                     INTEGER (0..255)    }  -- ASN1STOP  The area ID associated NR-DL-PRS-AssistanceDataPerTRPs shows the DL-PRS valid with the same area-ID of the serving cell where UE stays.  Please find the updated description based on the running CR.  ***area-ID***  This field, if present, specifies the Area ID of the network area to which the TRP for which the *NR-DL-PRS-AssistanceDataPerTRP* is provided belongs to. The associated NR-DL-PRS-AssistanceDataPerTRPs with the same area-ID are available in the concerned area.  NR-DL-PRS-AssistanceData-r16 can be reused to provide pre-configure assistance data. The area ID associated with each TRP and cell-ID can identify the area validity.  Hence, it seems no need to define a new pre-configured PRS data structure. |
| Fraunhofer |  | We have already agreed that **An area ID corresponds to a set of cells on which the UE may use the associated AD.**  Taking the above agreement into account, we can rephrase our above proposal  [[  AreaIDMappingList-r17 SEQUENCE (SIZE (1..maxNrAdditionalPreconfAD) OF AreaIDMapping-r17 AreaIDMapping-r17 OPTIONAL, -- Need ON  ]]  AreaIDMapping-r17 := SEQUENCE {  areaID-r17 INTEGER(0..2048)  cellList-r17 SEQUENCE (SIZE (1..64)) OF NR-Cell-r17  ...,  }  NR-Cell-r17 := CHOICE {  nr-PhysCellID-r17 NR-PhysCellID-r16 OPTIONAL, -- Need ON  nr-CellGlobalID-r17 NCGI-r15 OPTIONAL, -- Need ON  ...,  }  Now, when the areaID is added to any AD, the associated cells for the AD are explicitly clear. The AreaIDMappingList needs to be provided once in LPP and only the areaID needs to be referred back to in the AD.  The proposal from CATT requires a little bit more processing on the UE side. The signalling is not 40 Mb or 2 Mb as indicated above.  The field description of areaID from Apple [c] is a good one and can be reused here.  **For the rest of the signalling, we see the proposals from (4, 5) are a good starting point to provide multiple preconfigured AD for different areas, and we are also willing to start from there instead of using (3).** |
| ZTE | 4 or 5 | 4 and 5 have the same mechanism, they both introduce new IE of multiple instances of pre-configured AD, and each of them associates with validity area. We think this structure is needed to align with the previous agreement well and make spec more clear. |
| Intel | 4 or 5 | We think the area ID can be indicated as part of PRS configuration, possibly per positioning method. Based on the agreement that area ID corresponds to a set of cells on which the UE may use the associated AD, we can consider 4 or 5 as a starting point, i.e. indicating area ID and the list of cells for which the AD is considered valid. |
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## 4.3 Open Issue: On-demand DL-PRS – Issue R2-C1

There was no specific input on issue R2-C1: Pre-defined DL-PRS configurations; the information which defines a pre-defined DL-PRS configuration.

The current running CR [1] defines this as follows:

*– NR-On-Demand-DL-PRS-Configurations*

The IE *NR-On-Demand-DL-PRS-Configurations* provides a set of possible DL-PRS configurations which can be requested by the target device on-demand.

-- ASN1START

NR-On-Demand-DL-PRS-Configurations-r17 ::= SEQUENCE {

on-demand-dl-prs-configuration-list-r17 SEQUENCE (SIZE (1..maxDL-PRS-Configs-r17)) OF

On-Demand-DL-PRS-Configuration-r17,

...

}

On-Demand-DL-PRS-Configuration-r17 ::= SEQUENCE {

dl-prs-configuration-id-r17 DL-PRS-Configuration-ID-r17,

nr-DL-PRS-PositioningFrequencyLayer-r17 NR-DL-PRS-PositioningFrequencyLayer-r16,

nr-DL-PRS-Info-r17 NR-DL-PRS-Info-r16,

...

}

DL-PRS-Configuration-ID-r17 ::= SEQUENCE {

nr-dl-prs-configuration-id-r17 INTEGER (1..maxDL-PRS-Configs-r17),

...

}

-- ASN1STOP

A DL-PRS configuration should be fully defined by the IEs *NR-DL-PRS-PositioningFrequencyLayer-r16* and *NR-DL-PRS-Info-r16* (e.g., TS 38.214).

**Question 2:** Do you agree that a pre-defined DL-PRS configuration can be described with the Rel-16 IEs *NR-DL-PRS-PositioningFrequencyLayer-r16* and *NR-DL-PRS-Info-r16*?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes | It seems NR-DL-PRS-PositioningFrequencyLayer-r16 and NR-DL-PRS-Info-r16 already covers all on-demand parameters from RAN1 although some parameters in NR-DL-PRS-Info-r16 won't be available for on-demand according to RAN1 LS. We are fine to reuse the data structure of Rel-16 for on-demand in Rel-17.  The value of maxDL-PRS-Configs-r17 may be less than nrMaxFreqLayers-r16\* nrMaxTRPs-r16. |
| Fraunhofer | Yes |  |
| ZTE | Yes |  |
| Intel | Yes |  |
|  |  |  |
|  |  |  |
|  |  |  |
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## 4.3 Open Issue: On-demand DL-PRS – Issue R2-C5

There was no further [Pre117-e] discussion on this issue: Pre-defined On-demand DL-PRS configurations for multiple methods; in case of multiple ProvideAssistanceData for different methods, the *NR-On-Demand-DL-PRS-Configurations* need only to be provided once.

However, CATT provided a text proposal in

R2-2202409, "Discussion on the remaining issues of on-demand PRS", CATT.

with the following proposals:

- To reduce the signalling overhead caused by the repeatly provided pre-defined available DL-PRS configurations in case of hybrid positioning scenario, the nr-selected-on-demand-DL-PRS-configurations-IndexList is introduced per RAT-dependent positioning method.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6.5.10.1 NR DL-TDOA Assistance Data – *NR-DL-TDOA-ProvideAssistanceData*  The IE *NR-DL-TDOA-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑assisted and UE-based NR DL-TDOA. It may also be used to provide NR DL-TDOA positioning specific error reason.  -- ASN1START  NR-DL-TDOA-ProvideAssistanceData-r16 ::= SEQUENCE {  nr-DL-PRS-AssistanceData-r16 NR-DL-PRS-AssistanceData-r16 OPTIONAL, -- Need ON  nr-SelectedDL-PRS-IndexList-r16 NR-SelectedDL-PRS-IndexList-r16 OPTIONAL, -- Need ON  nr-PositionCalculationAssistance-r16  NR-PositionCalculationAssistance-r16  OPTIONAL, -- Cond UEB  nr-DL-TDOA-Error-r16 NR-DL-TDOA-Error-r16 OPTIONAL, -- Need ON  ...,  [[ nr-On-Demand-DL-PRS-Configurations-r17  NR-On-Demand-DL-PRS-Configurations-r17  OPTIONAL -- Need ON  nr-selected-on-demand-DL-PRS-configurations-IndexList-r17 NR-selected-on-demand-DL-PRS-configurations-IndexList-r17 OPTIONAL, -- Need ON  ]]  }  -- ASN1STOP   | **Conditional presence** | **Explanation** | | --- | --- | | *UEB* | The field is optionally present, need ON, for UE based NR DL-TDOA; otherwise it is not present. |  | ***NR-DL-TDOA-ProvideAssistanceData* field descriptions** | | --- | | ***nr-DL-PRS-AssistanceData***  This field specifies the assistance data reference and neighbour TRPs and provides the DL-PRS configuration for the TRPs.  Note, if this field is absent but the *nr-SelectedDL-PRS-IndexList* field is present, the *nr-DL-PRS-AssistanceData* may be provided in IE *NR-Multi-RTT-ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData*. | | ***nr-SelectedDL-PRS-IndexList***  This field specifies the DL-PRS Resources which are applicable for this *NR-DL-TDOA-ProvideAssistanceData* message. | | ***nr-PositionCalculationAssistance***  This field provides position calculation assistance data for UE-based mode. | | ***nr-DL-TDOA-Error***  This field provides DL-TDOA error reasons. | | ***nr-On-Demand-DL-PRS-Configurations***  This field provides a set of available DL-PRS configurations which can be requested by the target device on-demand.  Note, if this field is absent but the *nr-selected-on-demand-DL-PRS-configurations-IndexList*  field is present, the *nr-On-Demand-DL-PRS-Configurations* may be provided in IE *NR-Multi-RTT-ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData*. | | ***nr-selected-on-demand-DL-PRS-configurations-IndexList***  This field specifies the available DL-PRS configurations which are applicable for this *NR-DL-TDOA-ProvideAssistanceData* message. | |

|  |
| --- |
| 6.4.3 Common NR Positioning Information Elements – N*R-selected-on-demand-DL-PRS-configurations-IndexList-r17*  The IE *NR-selected-on-demand-DL-PRS-configurations-IndexList* is used by the location server to provide the selected available DL-PRS configurations of *nr-On-Demand-DL-PRS-Configurations* to the target device.  In the case of available DL-PRS configurations for multiple NR positioning methods are provided, the IE *nr-On-Demand-DL-PRS-Configurations* shall be present in only one of *NR-Multi-RTT-ProvideAssistanceData*, *NR-DL-AoD-ProvideAssistanceData*, or *NR-DL-TDOA-ProvideAssistanceData*.  -- ASN1START  NR-selected-on-demand-DL-PRS-configurations-IndexList-r17 ::= SEQUENCE (SIZE (1..maxDL-PRS-Configs-r17)) OF NR-selected-on-demand-DL-PRS-PerConfig-r17,  NR-selected-on-demand-DL-PRS-PerConfig-r17 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF  NR-SelectedDL-PRS-PerFreq-r16  -- ASN1STOP |

**Question 3:** Do you agree with the Text Proposal for IE *NR-selected-on-demand-DL-PRS-configurations-IndexList-r17* above?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes | In case of hybrid positioning, such enhancement is benefit to avoid the repeated provision of the available on-demand PRS configurations. |
| Fraunhofer | No | However, we are fine to go with majority view here.  In our opinion, the requirements for PRS for AoD and DL-TDOA can be different. So, it may be more useful to have method specific On-demand configurations. |
| ZTE | Yes but | NR-SelectedDL-PRS-PerFreq-r16 contains the selection of TRPs in a frequency layer, however in on-demand PRS, UE will not select TRPs, UE will only request for NR-DL-PRS-PositioningFrequencyLayer-r16 and NR-DL-PRS-Info-r16 as Q2 indicates.  So we think NR-SelectedDL-PRS-PerFreq-r16 cannot be directly used here. Instead, DL-PRS-Configuration-ID-r17 should be applied |
| Intel | No | We do not think it is essential to support this enhancement, so we slightly prefer to not support it |
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## 4.4 Open Issue: On-demand DL-PRS – Issues R1-9 , R1-10

There was no further [Pre117-e] discussion on these issues: On-demand PRS information for UE-initiated on-demand DL PRS requests; QCL sources recommended by UE.

However, CATT provided a text proposal in

R2-2202409, "Discussion on the remaining issues of on-demand PRS", CATT.

with the following proposals:

- Move *dl-prs-FrequencyRangeReq* out of *NR-On-Demand-DL-PRS-Info-per-FrequLayer*, to *NR-On-Demand-DL-PRS-Information-r17*;

- Change the granularity of recommend list of QCL sources to per resource set per positioning frequency layer per FR granularity;

- Change the granularity of the requests to provide the QCL information to per resource set per positioning frequency layer per FR granularity.

*– NR-On-Demand-DL-PRS-Information*

The IE *NR-On-Demand-DL-PRS-Information* defines the requested on-demand DL-PRS.

-- ASN1START

NR-On-Demand-DL-PRS-Information-r17 ::= SEQUENCE {

dl-prs-FrequencyRangeReq-r17 ENUMERATED { fr1, fr2, ...} OPTIONAL,

nr-on-demand-dl-prs-info-per-FrequLayer-r17

NR-On-Demand-DL-PRS-Info-per-FrequLayer-r17

OPTIONAL,

...

}

NR-On-Demand-DL-PRS-Info-per-FrequLayer-r17 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-On-Demand-DL-PRS-FrequLayerElement-r17

NR-On-Demand-DL-PRS-FrequLayerElement-r17 ::= SEQUENCE {

dl-prs-ResourceSetPeriodicityReq-r17 ENUMERATED { p4, p5, p8, p10, p16, p20, p32, p40,

p64, p80, p160, p320, p640, p1280, p2560,

p5120, p10240, p20480, p40960, p81920, ...}

OPTIONAL,

dl-prs-ResourceBandwidthReq-r17 INTEGER (1..63) OPTIONAL,

dl-prs-ResourceRepetitionFactorReq-r17 ENUMERATED {n2, n4, n6, n8, n16, n32, ...}

OPTIONAL,

dl-prs-NumSymbolsReq-r17 ENUMERATED {n2, n4, n6, n12, ...} OPTIONAL,

dl-prs-CombSizeN-Req-r17 ENUMERATED {n2, n4, n6, n12, ...} OPTIONAL,

dl-prs-QCL-InformationReq-r17 DL-PRS-QCL-InformationReq-r17

...

}

DL-PRS-QCL-InformationReq-r17 ::= SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

DL-PRS-QCL-InformationReqPerTRP-r17

DL-PRS-QCL-InformationReqPerTRP-r17 ::= SEQUENCE {

dl-PRS-ID-r17 INTEGER (0..255),

nr-PhysCellID-r17 NR-PhysCellID-r16 OPTIONAL,

nr-CellGlobalID-r17 NCGI-r15 OPTIONAL,

nr-ARFCN-r17 ARFCN-ValueNR-r15 OPTIONAL,

dl-prs-QCL-InformationReqSet-r17 SEQUENCE (SIZE (1..nrMaxSetsPerTrpPerFreqLayer-r16)) OF

DL-PRS-QCL-InfoReq-r17,

...

}

DL-PRS-QCL-InfoRec-r17 ::= SEQUENCE {

nr-DL-PRS-ResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16,

dl-prs-QCL-InformationReq-r17 CHOICE {

nr-DL-PRS-QCL-Source-r17 DL-PRS-QCL-Info-r16,

dl-prs-QCL-Info-requested-r17 ENUMERATED { true }

}

...

}

-- ASN1STOP

**Question 4:** Do you agree with the Text Proposal for IE *NR-On-Demand-DL-PRS-Information-r17* above?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes | To align with the request parameters and granularity defined by RAN1. |
| ZTE | Yes |  |
| Intel | Yes |  |
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## 4.5 Open Issue: On-demand DL-PRS – Issue R1-11

There was no specific input on issue R1-11: On-demand PRS start/end time; best way for indicating the on-demand DL-PRS start and end time? Should we use a specific start/end time, e.g., UTC? Should we assume RAN1 will define this?

The current running CR [1] defines this in IE *NR-On-Demand-DL-PRS-Request* as follows:

DL-PRS-StartTime-and-Duration-r17 ::= SEQUENCE {

dl-prs-start-time-r17 INTEGER (1..1024) OPTIONAL,

dl-prs-duration-r17 SEQUENCE {

seconds-r17 INTEGER (0..59) OPTIONAL,

minutes-r17 INTEGER (0..59) OPTIONAL,

hours-r17 INTEGER (0..23) OPTIONAL,

...

} OPTIONAL,

...

}

|  |
| --- |
| *NR-On-Demand-DL-PRS-Request* field descriptions |
| ***dl-prs-StartTime-and-Duration***  This field specifies the requested start time and duration for the on-demand DL-PRS and comprises the following subfields:  - ***dl-prs-start-time*** specifies the desired start time for the requested DL-PRS. It indicates the time in seconds from the time the IE *NR-On-Demand-DL-PRS-Request* was received.  - ***dl-prs-duration*** specifies the desired duration of the requested DL-PRS. The desired duration is the sum of the *seconds*, *minutes*, *hours* fields. If this field is included, at least one of the *seconds*, *minutes*, *hours* fields shall be present. |

**Question 5:** Do you agree with the definition of on-demand PRS start/end time in the current version (v5) of the running CR?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT |  | The state time and duration implemented in the running CR currently meets RAN1’s intention, i.e., start time and end time. As for format of the time, either UTC time or the current definition of the running CR is fine to us. |
| ZTE | Yes |  |
| Intel | Yes |  |
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# 5. Phase 2 Discussion

## 5.1 GNSS Integrity

### 5.1.1 Updates in v6 of running LPP CR

The running CR has been updated in v6 according to the following agreements made at RAN2#117-e:

|  |  |
| --- | --- |
| Agreements: |  |
| Proposal 1. For the purpose of GNSS integrity feature added in Release17, use GNSS-RealTimeIntegrity IE to signal to UE bad satellites (and GNSS constellations).  Proposal 2. Update description of GNSS-RealTimeIntegrity IE and Stage 2 to clarly state what condition can be interpreted as DNU = FALSE.  Note: Annex A contain a modified version of the GNSS-RealTimeIntegrity IE which highlights the list of satellites monitored for integrity. This can be used as input for Stage 3 CR and subject to offline review. | Requires further input/discussion.  Section 5.1.1, Question 6. |
| Proposal 6. Agree to include integrity bounds for Clock in the GNSS-SSR-ClockCorrections IE and bounds for Orbit in the existing GNSS-SSR-OrbitCorrections IEs rather than combining them in a new joint IE. | *GNSS-SSR-OrbitCorrections* and *GNSS-SSR-ClockCorrections* are updated accordingly. |
| Proposal 7. If possible, reuse existing IEs the following Integrity Residual Risk parameters: Probability of Onset of Constellation Fault, Mean Constellation Fault Duration, Proability of Onset of Satellite Fault, and Mean Satellite Fault Duration.  Note: candidate IEs in order of preference: GNSS-SSR-OrbitCorrections, GNSS-RealTimeIntegrity IE. This can be dealth offline as part of update to stage 3 CR – input from Rapporteur. | Added in *GNSS-SSR-OrbitCorrections* |
| Proposal 14. Add TIR and AL to the IntegrityInformationRequest-r17 IE. TTA is FFS. Their value ranges shall be based on table 9.2.4 in TR 38.857. | Requires further input/discussion.  Section 5.1.2, Question 7. |
| Proposal 17. Add HPL and VPL to the IntegrityInfo IE. The value range of these two parameters covers 0 – 500m interval. Resolution is 1cm.  Note: HPL representation e.g., 2D ellipse or Alon-Cross track pair is based on input from Stage 3 rapporteur. | Added in *IntegrityInfo* IE |
| Proposal 22. Adopt the following description for the GNSS-Integrity-ServiceAlert in Stage 3. Service DNU is FFS.  GNSS-Integrity-ServiceAlert field descriptions  ionosphereDoNotUse  This field indicates whether the ionospheric corrections in IEs GNSS-SSR-STEC-Correction IE can be used for integrity related applications (FALSE) or not (TRUE).  troposphereDoNotUse  This field indicates whether the tropospheric corrections in IEs GNSS-SSR-GriddedCorrection IE can be used for integrity related applications (FALSE) or not (TRUE). | Updated in *GNSS-Integrity-ServiceAlert* |
| Proposal 3. Release 17 supports only Reporting Mode 1 (PL reporting). Reporting Mode 2 can be revisited in future releases.  Proposal 4. For reporting Mode 1, TTA is not needed. | Requires further input/discussion.  Section 5.1.2, Question 7. |
| Proposal 5 (modified). Provide achievable TIR as optional parameter in the Integrity Information Result | Added in *IntegrityInfo* |

The updates as indicated in the Table above were made as Word User "v6" in the version v6 of the running CR.

Companies are invited to review the updated GNSS Integrity related changes in v6.

Please provide any comments on the GNSS Integrity additions/changes made in v6 of the LPP running CR in the Table below.

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| --- | --- |
| Company | Comments |
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### 5.1.2 New Issue: *GNSS Real Time Integrity* IE

The following agreements have been made:

Agreements:

Proposal 1. For the purpose of GNSS integrity feature added in Release17, use GNSS-RealTimeIntegrity IE to signal to UE bad satellites (and GNSS constellations).

Proposal 2. Update description of GNSS-RealTimeIntegrity IE and Stage 2 to clarly state what condition can be interpreted as DNU = FALSE.

Note: Annex A contain a modified version of the GNSS-RealTimeIntegrity IE which highlights the list of satellites monitored for integrity. This can be used as input for Stage 3 CR and subject to offline review.

The *GNSS-RealTimeIntegrity* IE provides the list of "bad satellites" and therefore, a description on what condition can be interpreted as DNU = FALSE could be added. However, the actual text proposal in the reference Annex A adds functionality on monitored satellites, but this can not be made backwards compatible:

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*GNSS-RealTimeIntegrity*

The IE GNSS-RealTimeIntegrity is used by the location server to provide parameters that describe the real-time status of the GNSS constellations. GNSS-RealTimeIntegrity data communicates the health of the GNSS signals to the mobile in real‑time.

The location server shall always transmit the GNSS-RealTimeIntegrity with the current list of unhealthy signals (i.e., not only for signals/SVs currently visible at the reference location), for any GNSS positioning attempt and whenever GNSS assistance data are sent. If the number of bad signals is zero, then the GNSS-RealTimeIntegrity IE ~~shall~~ may be omitted, except where integrity is supported in which case the GNSS-RealTimeIntegrity IE shall be transmitted to indicate the monitored SV-IDs, with gnss-BadSignalList empty. For integrity purposes, a GNSS satellite and signal combination should be considered as being marked “Do Not Use” (DNU) unless the SV-ID and signal is present in the GNSS-IntegrityMonitoredSignalList and the SV-ID and signal are not present in the gnss-BadSignalList.

-- ASN1START

GNSS-RealTimeIntegrity ::= SEQUENCE {

    gnss-BadSignalList                      GNSS-BadSignalList,

    ...,

    [[

    gnss-IntegrityMonitoredSignalList-r17   GNSS-IntegrityMonitoredSignalList,           OPTIONAL

    ]]

}

GNSS-BadSignalList ::= SEQUENCE (SIZE(1..64)) OF BadSignalElement

BadSignalElement ::= SEQUENCE {

    badSVID         SV-ID,

    badSignalID     GNSS-SignalIDs  OPTIONAL,   -- Need OP

    ...

}

GNSS-IntegrityMonitoredSignalList ::= SEQUENCE (SIZE(1..64)) OF MonitoredSignalElement

MonitoredSignalElement ::= SEQUENCE {

    monitoredSVID           SV-ID,

    monitoredSignalID       GNSS-SignalIDs,

    ...

}

-- ASN1STOP

|  |
| --- |
| ***GNSS-RealTimeIntegrity* field descriptions** |
| ***gnss-BadSignalList***  This field specifies a list of satellites with bad signal or signals. |
| ***badSVID***  This field specifies the GNSS *SV‑ID* of the satellite with bad signal or signals. |
| ***badSignalID***  This field identifies the bad signal or signals of a satellite. This is represented by a bit string in *GNSS-SignalIDs*, with a one‑value at a bit position means the particular GNSS signal type of the SV is unhealthy; a zero‑value means healthy. Absence of this field means that all signals on the specific SV are bad. |
| ***gnss-IntegrityMonitoredSignalList***  This field specifies a list of satellites and signals which are monitored to satisfy the DNU requirements in the Integrity Principle of Operation (Clause 8.1.1a of TS 36.305/38/305). |
| ***monitoredSVID***  This field specifies the GNSS *SV‑ID* of the satellite monitored signals. |
| ***monitoredSignalID***  This field identifies the monitored signals of a satellite. This is represented by a bit string in *GNSS-SignalIDs*, where a one‑value at a bit position means the particular GNSS signal type of the SV is monitored; a zero‑value means not monitored. |

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The indication of monitored SV-IDs "with gnss-BadSignalList empty" is not possible, since the *gnss-BadSignalList* is mandatory present.

According to rapporteur's understanding, *GNSS-RealTimeIntegrity* was discussed for supporting the "DNU concept", which could be supported via:

Update description of GNSS-RealTimeIntegrity IE and Stage 2 to clarly state what condition can be interpreted as DNU = FALSE.

However, the functionality of "indicating monitored SV-IDs" would not fit into the IE *GNSS-RealTimeIntegrity* (since it indicates "bad satellites", and therefore DNUs).

The agreement also Notes: "This can be used as input for Stage 3 CR and subject to offline review."

**Question 6a:** Do you agree that a "list of satellites monitored for integrity" need to be provided to the UE?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Swift Navigation | Yes, with comments | There are two issues to solve to make *GNSS-RealTimeIntegrity* work for integrity, relating to making it unambiguous when DNU=FALSE:   1. If no signals are faulty, then currently the *GNSS-RealTimeIntegrity* will not be sent at all, but the UE has no way to distinguish this condition from the case where there is a faulty signal but the *GNSS-RealTimeIntegrity* is not able to be delivered (e.g. loss of connectivity), therefore the UE cannot assume that non-presence of this message constitutes DNU=FALSE.    * To overcome this issue we propose to allow the *GNSS-RealTimeIntegrity* to be sent with an empty *gnss-BadSignalList*    * As Qcom points out this list is currently mandatory and required to have length of at least one. We are unsure of how to handle this in a backwards compatible way but suggest we could allow a zero-length list:   GNSS-BadSignalList ::= SEQUENCE (SIZE(0..64)) OF BadSignalElement   1. If a signal is not present in the *gnss-BadSignalList*, how does the UE distinguish between the case where the signal was omitted because it was not monitored by the network (e.g. a newly launched or unsupported satellite) or if the signal truly is monitored and has no fault.    * To overcome this issue we proposed adding a list of which signals are monitored for integrity (***gnss-IntegrityMonitoredSignalList***)    * As an alternative, if we do not wish to make this addition, we could instead notate in the Stage 2 that the monitored signals are those for which any bound is provided (list is provided implicitly) |
| Intel | Yes | We assume it has been agreed. But we do agree the changes is NBC, and therefore it should not be captured as it is. |
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Question 6b: If your answer to Question 6a was "yes", do you think this can be accomplished with modifications of the IE *GNSS-RealTimeIntegrity*? If yes, please indicate how this could be supported with the IE *GNSS-RealTimeIntegrity*. If no, please indicate what should be the alternative.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Swift Navigation | Unsure | If it is not possible to send an affirmative *GNSS-RealTimeIntegrity* with an empty/zero-length *gnss-BadSignalList* in a backwards compatible way then it may not be possible to modify the *GNSS-RealTimeIntegrity* IE to be reused for integrity. We had proposed an alternative dedicated IE (GNSS-Integrity-ConstellationAlert) in R2-2201214. |
| Intel | No | Separate IE should be more suitable. |
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### 5.1.3 New Issue: *IntegrityInformationRequest*

The following agreements have been made:

Proposal 14. Add TIR and AL to the IntegrityInformationRequest-r17 IE. TTA is FFS. Their value ranges shall be based on table 9.2.4 in TR 38.857.

Agreements:

Proposal 3. Release 17 supports only Reporting Mode 1 (PL reporting). Reporting Mode 2 can be revisited in future releases.

Proposal 4. For reporting Mode 1, TTA is not needed.

The TIR has been added to the *IntegrityInformationRequest-r17* IE in v6 of the running CR. However, AL and TTA have not been added yet, since the above agreements seem conflicting. For reporting mode 1, TTA is not needed (Proposal 4). However, Proposal 14 mentions AL should be added to the *IntegrityInformationRequest-r17* IE. Rapporteur thinks that AL and TTA belong together and that both would not be needed for "Reporting Mode 1" (PL Reporting).

**Question 7:** Do you think the AL and TTA need to be provided in the *IntegrityInformationRequest-r17* IE for "Reporting Mode 1" (PL Reporting)? If yes, what would be the purpose?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Swift Navigation | Yes | We think this is relevant in the case of UE-based MT-LR. The UE must know the AL and TTA KPIs expected by the LCS client to know if it can satisfy them. Although the final step of comparing the PL to the AL can be accomplished by the LMF, the AL and TTA do factor into the algorithm used to implement the PL computation. To understand why we must refer back to the defining inequality for the PL (see SI - TR 38.857 V17.0.0 Section 9.1.1.3):  **Protection Level:** The 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 AL and the PL being less than or equal to the AL, for longer than the TTA, is less than the required TIR, i.e., the PL satisfies the following inequality:  **Prob per unit of time [((PE> AL) & (PL<=AL)) for longer than TTA] < required TIR**  NOTE: 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.  NOTE: A specific equation for the PL is not specified as this is implementation-defined. For the PL to be considered valid, it must simply satisfy the inequality above.  Note that the inequality includes the AL and the TTA as parameters. In general, the implementation may not be able to satisfy this inequality for all possible values of AL and TTA, and therefore the UE must know if it can meet these KPIs.  For example, a given UE may know that it may have 5 seconds of lag to respond to a fault and adjust the PL accordingly, but if the LMF is expecting a TTA of 1 second then the inequality may be violated for 4 seconds until the UE is able to adjust its PL output.  Another example is if the UE algorithm cannot detect faults below 1m to the level required by the TIR. Under the inequality it is still permitted to output a PL in this case, so long as the LMF is expecting an AL > 1m. If the AL < 1m then the UE must know not to issue a PL in this case – this is the distinction between Misleading Information (MI) and Hazardous Misleading Information (HMI), see SI Figures 9.1.1.4-A and 9.1.1.4-B.  For UE-based MO-LR the KPIs are known internally to the UE so this topic is not an issue.  Regardless, Stage 2 currently does not cover the details of the Integrity Information Request, Integrity Info or Protection Level but should include this definition of the PL above from the SI. Specifically, the PL description is needed in Stage 2 to accompany the PL field descriptions which have been added in Stage 3 under *integrityInfo* (within the *CommonIEsProvideLocationInformation* IE). |
| ZTE | Yes | Agree with Swift that AL may be used in calculating PL, however that is based on implementation |
| Intel | No | Agree with Rapporteur |
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## 5.2 On-demand DL-PRS

### 5.2.1 New Issue: Location Server Error Causes

The following agreement has been made:

Agreement:

Proposal 9-1 (modified): To respond to an unfulfilled UE-initiated on-demand PRS request, an error cause may be provided to the UE. To be discussed under running CR if the cause values are new or if we reuse existing values.

In the LPP running CR, the following additional error causes were introduced in '*method'*-*LocationServerErrorCauses.* For example:

*– NR-DL-TDOA-LocationServerErrorCauses*

The IE *NR-DL-TDOA-LocationServerErrorCauses* is used by the location server to provide NR DL-TDOA error reasons to the target device.

-- ASN1START

NR-DL-TDOA-LocationServerErrorCauses-r16 ::= SEQUENCE {

cause-r16 ENUMERATED { undefined,

assistanceDataNotSupportedByServer,

assistanceDataSupportedButCurrentlyNotAvailableByServer,

notProvidedAssistanceDataNotSupportedByServer,

...,

on-demand-dl-prs-NotSupportedByServer-r17,

on-demand-dl-prs-SupportedButCurrentlyNotAvailableByServer-r17

},

...

}

-- ASN1STOP

**Question 8:** Do you agree that the additional cause values above should be introduced in the '*method'*-*LocationServerErrorCauses* for DL-TDOA, DL-AoD, and Multi-RTT?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| ZTE | Yes | After the decision made in [631], some restrictions regarding to the new cause may needed |
| Intel | No | The existing cause values seem sufficient to cover this case. It is not clear what additional error cause can be useful for the UE |
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### 5.2.2 New Issue: maxDL-PRS-Configs

The following agreement has been made:

Agreement:

P11/P15-2/P15-3 to be discussed in the running CR discussion.

Proposal 11 The maximum number of on-demand PRS configurations, i.e., maxDL-PRS-Configs-r17 signalled to the UE is to be specified. RAN2 to further discuss the value of maxDL-PRS-Configs-r17.

Proposal 15-2: The maxDL-PRS-Configs-r17 defines the number of pre-defined on-demand PRS configurations that may be stored based on the UE’s capability.

Proposal 15-3: If the network provides a set of on-demand PRS configurations that exceed the maxDL-PRS-Configs-r17, a UE error is sent to the LMF and it is up to UE implementation on how to handle it.

**Question 9a:** What should be the value for *maxDL-PRS-Configs-r17* in the LPP running CR?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| ZTE |  | An integer like (2,4,6,8,12) should be fine |
| Intel |  | 4 or 8 |
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**Question 9b:** Do you agree that the *maxDL-PRS-Configs-r17* defines the number of pre-defined on-demand PRS configurations that may be stored based on the UE’s capability?

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| --- | --- | --- |
| Company | Yes/No | Comments |
| ZTE | Yes | It depends on UE’s storage capability. An integer like (2,4,6,8,12) should be reported from UE to LMF as a UE capability, to tell LMF the maximum number of on-demand PRS configuration it can store |
| Intel | Yes |  |
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Proposal 15-3 seems not possible. I.e., per ASN.1, a network can not provide a set of on-demand PRS configurations that exceed the *maxDL-PRS-Configs-r17*.

**Question 9c:** Any comments on Proposal 15-3?

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| --- | --- | --- |
| Company | Yes/No | Comments |
| ZTE | Yes | Agree with rapporteur that excess is not permitted |
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# Annex A: RAN2 Agreements

## A.1 Latency Reduction

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| --- |
| Agreement:  Send response LS R2-2104420 to SA2 on Scheduling Location in Advance to reduce Latency;  With regard to latency reduction related to the measurement gaps postpone the RAN2 discussion until more input/agreements from RAN1/RAN4 are available. |

Agreements:

Support pre-configuration of assistance data to the UE at least in an LPP session. Details of how to enable this are FFS (e.g. what additional functionality beyond deferred location procedure might be needed).

The LPP Request Location Information message can serve as an indication to the UE to utilize the pre-configured AD. FFS additional conditions/validity criteria for using the pre-configured AD.

Agreement:

Proposal 3: Regarding the validity conditions/criteria associated with pre-configured assistance data, consider at least the following options:

 Option A: Based on a validity area (e.g. a list of cells)

 Option B: Based on a (configured) validity timer or a numerical limit on number of times it is utilized

 Option C: Based on explicit modification or release from the LMF/NG-RAN

 Option D: Based on the UE’s current location and/or the time

Agreement:

Proposal 6 (modified): In response to the question asked by SA2 regarding UE positioning capability, ~~it is proposed to~~ capture that the positioning related UE capabilities can be variable.

NOTE: P6 was edited after agreement for clarity (deletion marked with strikeout). Checked in email discussion [AT115-e][600].

Agreements:

Proposal 1: Assistance data can be (pre-)configured independently of any given LPP positioning session and thus can be reused across multiple positioning sessions.

Proposal 2: It is suggested to agree that in order to reduce positioning latency associated with signaling of assistance data (via both broadcast or dedicated signaling), pre-configured assistance data can be considered valid for usage across multiple LPP positioning sessions.

FFS spec impact from these proposals.

Agreement:

Pre-configured assistance data (distinct from “pre-defined configuration” as discussed for on-demand PRS) refers to the DL-PRS assistance data (with associated validity criteria) that can be provided to the UE (before or during an ongoing LPP positioning session), to be then utilized for potential positioning measurements at a future time (e.g. for deferred MT-LR). FFS whether to capture this in a spec.

Agreement:

Proposal 8 (modified): Down-prioritize dynamic triggering of a preconfigured SRS at UE in connected mode by gNB for transmitting SRS based on measurement report provided by UE in Rel-17.

Agreements:

Proposal 1a (modified): Include a "Scheduled Location Time" with measurement time information in LPP CommonIEsRequestLocationInformation, defining the desired time when the location measurements or location estimate is to be obtained/valid. FFS if the information is an absolute time or a window.

Proposal 1d: Include the capability to support scheduled location in each method-ProvideCapabilities message, where 'method' can be any of the LPP positioning methods. The capability should indicate the time base(s) supported for scheduling location measurements.

Agreements:

Proposal 3a (modified): Pre-configured DL-PRS assistance data can be associated with a "validity area" at least in LPP. FFS on details and whether it would be included in RRC broadcast.

Agreements:

Proposal 5a: A new UL MAC CE for positioning measurement gap activation and deactivation request is introduced.

Proposal 5b: The new UL MAC CE for positioning measurement gap activation and deactivation request includes at least the ID of the pre-configured positioning measurement gap configuration for which the activation/deactivation is requested. Other parameter are FFS.

Proposal 5c (modified): A new DL MAC CE for positioning measurement gap activation and deactivation command is introduced for positioning latency reduction. LS to RAN1/4 indicating our conclusion, and confirming that DL MAC CE can also be used for positioning measurement gap deactivation as well as activation (to be drafted by email).

Proposal 5d: The new DL MAC CE for positioning measurement gap activation and deactivation command includes at least the ID of the pre-configured positioning measurement gap configuration which has been configured/activated by the gNB. Other parameter are FFS.

Proposal 5e: The Scheduling Request should be triggered when there is no PUSCH and UL MAC CE for positioning measurement gap activation/deactivation request is triggered.

Agreements:

Proposal 3.2.1.2-1: [Easy agreements] [8/9] For storing LPP capability in the AMF, do not introduce “variability indicator ” in LPP capability.

Proposal 3.2.1.3-1 (modified): [Easy agreements] [10/10] Include the capability to support validity area in each method ProvideCapabilities message, where “method” can be any of the LPP positioning methods that rely on DL-PRS. FFS on other validity criteria.

Agreements:

Proposal 4: The pre-configured Measurement Gap Configurations for Positioning are provided via RRCReconfiguration message. The pre-configured Measurement Gap Configurations for Positioning are included in IE MeasGapConfig.

Proposal 5: The content of the pre-configured Measurement Gap Configurations for Positioning includes at least the existing measurement gap parameters together with an ID identifying each Measurement Gap Configuration for Positioning.

Proposal 6: The existing RRC LocationMeasurementIndication procedure to request the positioning measurement gaps can still be used by a UE, even when pre-configured measurement gaps are provided to the UE.

Agreements:

Proposal 7: The PRS processing window configuration is provided via RRCReconfiguration message. Whether PRS processing window configuration is provided per BWP or not is up to RAN1 to decide.

Proposal 8: A new DL MAC CE for PRS Processing Window activation and deactivation command is introduced.

Proposal 9: The new DL MAC CE for PRS Processing Window activation and deactivation command includes at least the ID of the pre-configured PRS Processing Window configuration, at least in the case when multiple PRS Processing Windows can be configured.

Proposal 10: The UE behaviour related to the PRS Processing Window feature is captured in the MAC specification.

Agreement:

Proposal 3: Pre-configured DL-PRS assistance data can consist of multiple instances, where each instance is applicable to a different area within the network. FFS on additional specification impacts and whether this can already be supported with the agreement made that pre-configured DL-PRS assistance data can be associated with a "validity area". Single instance of AD is not excluded; FFS if there would be signalling for multiple area IDs in the same instance. Signalling details can be discussed in the LPP running CR discussion.

Agreements:

- On the concurrent measurement gap, RAN2 wait for further input from RAN1/RAN4.

- On the Network-Controlled Small Gap, RAN2 wait for further input from RAN1/RAN4.

- An LMF needs to provide "assistance information" to a gNB to support measurement gap (pre-)configuration.

- The information that needs to be transferred between LMF and gNB to support the positioning measurement gap (pre-)configuration can be decided by RAN3.

- Whether UL MAC CE can also be used for PRS processing window activation/deactivation should be decided by RAN1.

- The information that needs to be transferred between LMF and gNB to support the PRS Processing Windows configuration can be decided by RAN3.

Agreements:

Proposal1: Scheduled location time is an absolute time in LPP spec. (14/15)

Proposal3: The indication of scheduled location time can be based on different time bases. (8/12)

Proposal5: No need to report area ID along with PRS measurement to the LMF if the PRS AD is associated with area ID. (9/10)

Proposal6 (modified): areaID can be broadcasted in the system information. This has no spec impact if the area ID is defined to be something already broadcasted in the system information. Detailed signalling can be further discussed in the LPP running CR discussion and in the context of defining the area ID.

Proposal10: eLCID is adopted for UL MAC CE for MG activation/deactivation request and DL MAC CE for MG activation/deactivation command. (13/13)

Proposal14: eLCID is adopted for DL MAC CE for PPW activation/deactivation command. (13/13)

Proposal15: Adopt the 10 milliseconds granularity in the responseTime. (13/13)

Agreement:

If the UE receives assistance data for a PRS-ID+cell ID combination for which it has already stored assistance data, it overwrites the stored assistance data. If the UE receives assistance data for a PRS-ID+cell ID for which it has not stored assistance data, it maintains its stored assistance data for other PRS-ID+cell ID combinations.

UE capability for the number of PRS-ID+cell ID combinations for which the UE can store AD.

Agreement:

Proposal2 (modified): Differentiate the UE capability of time bases for different positioning modes. (7/12)

Agreements:

An area ID corresponds to a set of cells on which the UE may use the associated AD. Downselect from the following options:

1. Explicitly list the involved cell IDs in LPP along with the assistance data
2. Broadcast in each cell one or more area IDs that are then referred to in LPP.

Resolve this signalling question in the LPP running CR (coordinating with RRC if necessary).

## A.2 Positioning in RRC\_INACTIVE State

Agreements:

WA: Any uplink LCS or LPP message can be transported in RRC\_INACTIVE from RAN2 perspective, subject to the data volume supported by AS layers. I.e. RAN2 do not specify a restriction on message type.

FFS if LPP needs to select transport, i.e. if the message is just submitted to lower layers which decide how to deliver it (SDT, change state, etc.).

FFS if RRC state is exposed to LPP.

Agreements:

Any uplink LCS or LPP message can be transported in RRC\_INACTIVE from RAN2 perspective.

Follow Rel-17 SDT framework for INACTIVE UL and DL positioning:

 If the UE initiated data transmission using UL SDT, the network can send DL LCS, LPP message and RRC message (e.g. to configure SRS (TBD on what message is used), if UL positioning supported) to the UE.

 Otherwise, if UE did not initiate UL SDT, rely on legacy operation, i.e. the network shall transition the UE to RRC\_CONNECTED, e.g. based on RAN paging.

Agreements:

Exposure of the RRC state of the UE to the LPP layer of the UE for RRC\_INACTIVE UL and DL positioning will not be specified. This does not exclude cross-layer behaviour in implementations.

The RRC state of the UE is not exposed to the LMF for INACTIVE UL and DL positioning.

Agreements:

LPP PDU and LCS message transfer:

Proposal 1: The LPP PDU Transfer Procedure in Annex A is used as baseline for further work.

NOTE 1: Some details may depend on further progress of the SDT work item.

NOTE 2: Whether such a procedure needs to be captured in Stage 2 specification or not can be decided later when the procedure has been fully developed/agreed. That is, the procedure can be considered as "running baseline".

Proposal 2: The LCS Message Transfer Procedure in Annex B is used as baseline for further work.

NOTE 1: Some details may depend on further progress of the SDT work item.

NOTE 2: Whether such a procedure needs to be captured in Stage 2 specification or not can be decided later when the procedure has been fully developed/agreed. That is, the procedure can be considered as "running baseline".

Proposal 3: UL LPP message segmentation can also be used by the UE in RRC\_INACTIVE state; i.e., a LPP message body can be sent in several shorter LPP messages instead of one long LPP message by using the SDT "Subsequent Data Transmission" phase. FFS spec impact.

DL and RAT-independent positioning:

Proposal 4: The Deferred 5GC-MT-LR Procedure with SDT for DL-only and RAT-independent positioning in Annex C is used as baseline for further work.

NOTE 1: Some details may depend on further progress of SDT work item.

NOTE 2: Whether such a procedure needs to be captured in Stage 2 specification or not can be decided later when the procedure has been fully developed/agreed. That is, the procedure can be considered as "running baseline".

NOTE 3: Once the procedure is stable from RAN2 perspective, send an LS to SA2 including the baseline procedure.

Agreement:

(High priority)Proposal 1: Support all the RAT independent positioning methods in RRC\_INACTIVE state.

Agreement:

gNB can configure the UE with periodic SRS (assuming periodic SRS is supported in RRC\_INACTIVE) by RRCRelease with suspendConfig at least when periodic event is configured for deferred MT-LR. Other cases can be further discussed.

Agreement:

Proposal 1 (modified): The PRS configuration from LMF to UE is independent of the RRC state. That is, no impact on PRS configuration for RRC\_INACTIVE (13/15) from RAN2 perspective.

Agreement:

Proposal 4 (modified): For positioning in RRC\_INACTIVE state, the positioning assistance data can be delivered to UE through the following ways:

- positioning system information, i.e. posSIB;(12/13)

- pre-configure assistance data when UE in RRC\_CONNECTED state;(11/13)

- send to UE in RRC\_INACTIVE during ongoing SDT procedure. (9/13)

Agreement:

Proposal 6: SRS for positioning in RRC\_INACTIVE state can be configured through the following ways:

- RRCRelease with SuspendConfig (13/13)

- SDT DL RRC message, i.e. Msg B / Msg 4 of RA-SDT (9/13)

- WA: pre-configure positioning SRS in RRC\_CONNECTED (9/13)

FFS detailed signalling for these approaches.

Proposal 8: Support SP SRSp for positioning in RRC\_INACTIVE state. (12/13)

Proposal 9: SP Positioning SRS Activation/Deactivation MAC CE is reused for triggering SRSp transmission in RRC\_INACTIVE. (12/12)

Proposal 10: AP SRSp is not supported for positioning in RRC\_INACTIVE state. (11/13)

Agreements:

Proposal 1 (modified) To support UL positioning in RRC\_INACTIVE, reuse SDT TA timer mechanism (with a separate timer with similar function) for TA validation.

Proposal 2 To support UL positioning in RRC\_INACTIVE, reuse RSRP change based solution for TA validation

Proposal 3 The SRSp configuration is considered as invalid if TA is not valid.

Proposal 4 When cell reselection is performed and UE initiates RRC resume procedure to the cell which is different from the cell in which the SRSp is configured, the TA timer configuration for SRS should be released.

Proposal 5 (modified) The SRSp configuration is released when the UE sends RRCResumeRequest to a cell other than the cell where it is released to RRC\_INACTIVE state.

Proposal 6 BWP info together with the SRS-PosResourceSet IE is included in RRCRelease message for SRS configuration in RRC\_INACTIVE.

Proposal 7 RAN2 confirms RAN1 agreement that UE may be configured to transmit UL SRS for Positioning where the following parameters are additionally configured for the transmission of the SRS for Positioning during the RRC\_INACTIVE state: frequency location and bandwidth, SCS, CP length.

Proposal 8 Add the restriction on AP SRS in the field description of resourceType “The aperiodic is not applicable for the UE in RRC\_INACTIVE.”.

FFS if the TA timer configuration is invalidated upon any cell reselection.

Agreement:

RAN2 will not make additional effort to make the gNB aware of when to transit the UE to RRC\_INACTIVE (left to gNB implementation and RAN3 solution).

Agreements:

Proposal 3 The agreement with WA: pre-configure positioning SRS in RRC\_CONNECTED is removed.

Proposal 12 (modified) No indication is added in Rel-17 from NW to UE for the continuity of UL SRS Tx when transiting from one mode to other.

Agreements:

Proposal 6: TA timer configuration of SRS for positioning (SRSp) is invalidated upon any cell reselection (i.e. even if the UE does not initiate the RRC resume procedure) (11/12)

Proposal 7: Follow CG-SDT solution for (a) RSRP derivation for positioning SRS TA validation, and (b) definition of stored downlink pathloss reference RSRP value at the very first positioning SRS transmission (12/12)

Agreements:

Proposal 2: Agree on Low Power Periodic and Triggered 5GC-MT-LR Procedure with SDT (in R2-2203443) for UL-only and UL+DL positioning in RRC\_INACTIVE as baseline for Stage 2 discussion

Proposal 1: Add clarification note (as below) in Stage 2 specification:

Note: Positioning may be performed when a UE is in RRC\_INACTIVE state. Any uplink LCS or LPP message can be transported in RRC\_INACTIVE. If the UE initiated data transmission using UL SDT, the network can send DL LCS, LPP message and RRC message (e.g. to configure SRS for positioning, if UL positioning is supported) to the UE.

Agreement:

Send LS to SA2 to let SA2 decide the spec impacts on Low Power Periodic and Triggered 5GC-MT-LR Procedures with SDT for DL-only and RAT-Independent positioning (based on agreed baseline from RAN2#115-e), for UL-only positioning, and for UL+DL positioning (baseline based on R2-2203443)

Agreements:

Proposal 4 (modified): Support the following options for activation of SP-SRSp transmission in RRC INACTIVE:

- Option a: If there is ongoing SDT, the network can send SRS activation command to the UE in INACTIVE.

- Option b: Send the Activation MAC CE along with the SRSp configuration when gNB releases the UE to RRC\_INACTIVE

Proposal 5 (modified): Support the following for deactivation of SP-SRSp transmission in RRC INACTIVE:

- If gNB chooses to send the SP-SRSp deactivation command to the UE in INACTIVE, gNB can send SP-SRSp deactivation command to the UE if there is ongoing SDT.

- If gNB chooses not to send the SP-SRSp deactivation command to the UE in RRC\_INACTIVE, no additional mechanism is specified (i.e. the gNB can only wait for the TA timer to expire)

## A.3 On-demand DL-PRS

Agreements:

UE-initiated on-demand PRS request is enabled by enhancing LPP RequestAssistanceData. FFS how much control the network has over the UE request.

The UE-initiated mechanism is enabled by the UE request triggering a request from the LMF, and the actual PRS changes are requested by the LMF irrespective of whether the procedure is UE- or LMF-initiated.

Put the stage 2 description for UE-initiated and LMF-initiated PRS request under the same framework.

Agreements:

The network can signal predefined PRS configurations to the UE and the UE can select one to request. FFS if the UE can request a configuration with different parameters and exactly which parameters are flexible.

Agreements:

Proposal 2: Define a new LPP assistance data IE which can contain a set of possible on-demand DL-PRS configurations, where each on-demand DL-PRS configuration has an associated identifier.

Proposal 3 (modified): The new LPP assistance data IE from Proposal 2 can be included in an LPP Provide Assistance Data message and/or a new posSIB.

Agreement:

Proposal 4 (modified): The procedure(s) for on-demand DL-PRS should support at least the following functionality (up to RAN3 what is in NRPPa vs. OAM, etc.):

- Providing the requested on-demand DL-PRS configuration information from an LMF to the gNB (e.g., explicit parameter or identifier of a predefined DL-PRS configuration), and confirmation of the request by the gNB

- Provision of (possible/allowed) on-demand DL-PRS configurations that the gNB can support from a gNB to an LMF

- TRP capability transfer (e.g., whether the RAN node supports the reconfiguration of DL-PRS, etc.)

Agreements:

Before providing available DL-PRS configuration to the UE, the LMF may obtain configuration information on what DL-PRS can be supported from one or more TRPs via NRPPa.

Capture the steps provided above as a baseline, along with a note indicating it remains FFS if the UE can send the MO-LR to request on-demand PRS.

FFS if we indicate to SA2 that MO-LR can be used to trigger on-demand PRS procedure.

It is up to Network (LMF) implementation on the steps to follow (accept/reject/ignore) on receiving request from UE for changing the DL-PRS configurations.

Agreements:

Proposal 1: RAN2 to agree to support the UE originated request of on-demand PRS via MO-LR for autonomous self location. (11/14)

Proposal 3: RAN2 to agree that UE can send an MO-LR Request message included in an UL NAS TRANSPORT message to the serving AMF including an LPP Request Assistance Data message which is used for on-demand DL-PRS transmission, and the MOLR-Type of this MO-LR Request message is “assistanceData”. (12/14)

Proposal 4: RAN2 to agree the following general stage 2 procedure as baseline for UE initiated on-demand PRS via MO-LR. (13/14) [Figure 2 of R2-2109483, with the associated list of steps as given in section 5 of R2-2109483.] To be discussed in development of the running stage 2 CR (post-meeting) how much of this detail we need to capture in 38.305.

Agreements:

Proposal 1.1: The UE may initiate an on-demand PRS request per positioning method including DL-TDoA, DL-AoD and Multi-RTT, via the existing LPP RequestAssistanceData message.

Proposal 1.2: There is no need for introducing a new LPP message to carry the on-demand PRS request.

Agreements:

If the LMF indicates predefined configurations, the UE can request them via LPP RequestAssistanceData.

Agreement:

LPP signalling supports index-based and explicit request of DL-PRS parameters from the UE. The UE is not required to implement requesting explicit parameters and the LMF is not required to grant them if the UE does request.

Agreements:

Proposal 3.2.3-1: [Easy agreements] [10/10] For On-Demand PRS, introduce LPP capability on UE-initiated On-Demand PRS Request;

Agreements:

Proposal 4: UE may explicitly request on-demand PRS parameters based on the Rel-16 value ranges. [14/14]

Proposal 6: A UE reason/cause for an on-demand PRS request is not supported. [12/14]

Proposal 7: The posSI message cannot be the response for a UE’s On-Demand PRS request. [13/14]

Proposal 12: The DL-PRS-Configuration ID is only defined by an identifier (ID). [13/14]

Proposal 13: On-demand PRS configuration is at least provided per positioning method. [12/14]

Agreement:

Proposal 5: The UE may indicate its preferred on-demand PRS pre-defined configuration via a list in decreasing order of preference (i.e., sorted from the UE’s most preferred to least preferred on-demand PRS configuration). [10/14]

Agreement:

Proposal 14 (modified): UE-initiated on-demand PRS capability information is independently requested/indicated per positioning method.

Agreement:

Proposal 9-1 (modified): To respond to an unfulfilled UE-initiated on-demand PRS request, an error cause may be provided to the UE. To be discussed under running CR if the cause values are new or if we reuse existing values.

Agreement:

P11/P15-2/P15-3 to be discussed in the running CR discussion.

## A.4 GNSS Positioning Integrity

Agreement:

Proposal 1 (modified): RAN2 confirms that LPP messages RequestCapabilities and ProvideCapabilities are used to transfer capability information of GNSS positioning integrity support. FFS the contents of capability information for GNSS positioning integrity support.

Agreements:

Proposal 1: Agree that the GNSS feared events will be addressed in the WI.

Proposal 2 (modified): Agree that all for A-GNSS positioning methods, positioning integrity determination is supported in LPP.

Proposal 3: Agree that additional IEs are needed in LPP to support A-GNSS positioning integrity determination.

Proposal 4: The specific algorithms used for positioning integrity shall be up to implementation.

Proposal 5: For interoperability, the use of “hard-coded” parameters should be minimized and instead the needed parameters should be sent explicitly in the assistance data.

Proposal 6: RAN2 agrees that the PL will be reported in the Integrity Results. 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.

Proposal 8: Agree that the UE feared events will be handled in the implementation for UE-based (network-assisted) methods of positioning integrity determination.

Proposal 10: Agree that the LMF feared events can be handled via implementation for the UE-based (network-assisted) and UE-assisted (LMF-based) methods of positioning integrity determination.

Proposal 11: RAN2 agrees to use Common Positioning IEs to transfer the KPIs and Integrity Results.

Proposal 12: RAN2 agrees that the LPP procedures can be used to transfer the KPIs and Integrity Results. For UE-assisted, the LCS procedures remain FFS in the case of MO-LR.

Agreements:

In Rel-17, we do not address the data transmission feared event (i.e. we rely on the system’s existing methods for assuring data integrity).

Agreements:

Proposal 1: The support of GNSS integrity is enabled by using existing NG-RAN positioning architecture.

Proposal 2: Any additional functional elements, positioning/integrity modes, etc. should be introduced only when needed.

Agreements:

Proposal 3 (modified): Separate procedures for "A-GNSS Positioning Integrity" as proposed in R2-2107503 will not be defined; the existing A-GNSS (and general location) Procedures are applicable/sufficient.

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.

Proposal 5 (modified): RAN2 confirms that LPP messages RequestAssistanceData and ProvideAssistanceData are used to transfer integrity assistance data for GNSS positioning at least for UE-based mode.

Agreements:

Proposal 1. Request feedback from RTCM SC134 on the specific technical attributes:

- overbounding of GNSS errors: zero-mean assumption (provision of standard deviation only) or non-zero mean assumption (provision of mean in addition to standard deviation); paired overbounding vs single overbounding.

- additional items are FFS for now and depend on progress during RAN2 #116.

Proposal 2. RAN2 to proceed with the Rel-17 work scope. What is achieved is FFS and depends on contributions and proposals under discussions in R2-2110181.

Proposal 3. RAN2 agrees to leverage in the future on standards for GNSS integrity message produced by RTCM SC134 when this become available.

Proposal 4. Include in the draft LS all our agreements/conclusions dealing with GNSS integrity.

Agreements:

Proposal1-1 (modified): WA: The paired overbounding technique is supported for bounding the error probability distribution for GNSS integrity as a baseline.

Proposal1-2 (modified): Error representation by SSR is supported for GNSS integrity. FFS alignment with the assistance data for OSR in RTCM (also FFS alignment with SSR, if RTCM produce something in that direction in the Rel-17 time frame).

Agreements:

Proposal2-9: Assistance data for GNSS integrity can be sent periodically.

Proposal2-11: The assistance data in GNSS-RealTimeIntegrity can be reused for GNSS integrity in R17

Agreement:

Pursue LMF-based integrity on a best-effort basis in Rel-17.

Agreements:

Proposal 1: RAN2 agrees to add the Integrity Principle of Operation (Clause 8.1.1a) text from Appendix A (R2-2201761) into TS 36.305 and TS 38.305.

Proposal 2: Agree to add the descriptions from Appendix A (R2-2201761) for the SSR Code Bias (8.1.2.1.23), SSR Phase Bias (8.1.2.1.24), SSR STEC Corrections (8.1.2.1.25) and SSR Gridded Corrections (8.1.2.1.26) as baseline. Final wording is subject to the outcomes of Stage 3 and depends on which integrity IEs and associated fields are included in LPP.

Proposal 3: Agree to add the Integrity Service Parameters (8.1.2.1.29) and Integrity Alerts (8.1.2.1.30) descriptions from Appendix A (R2-2201761) into TS 36.305 and TS 38.305.

Proposal 4: RAN2 agrees to include the description for the Orbit Clock Error Bounds, as per Appendix A (R2-2201761), but the final description is FFS subject to the Stage 3 discussions on whether option (b), (c) or (d) is preferred (or another alternative):

(b) Duplicate within the SSR Orbit and Clock IEs (NW determines which to include).

(c) Add orbit and clock integrity bounds (mean, sigma) to the existing Orbit and Clock IEs (but without the full covariance).

(d) Define a separate message as a new IE (i.e. a combined message for the Orbit Clock Error Bounds).

Proposal 5: RAN2 agrees to include the Integrity Residual Risk Parameters into their existing corresponding GNSS IEs (as per Appendix A (R2-2201761). This discussion is also subject to the Stage 3 outcomes regarding which IEs and associated fields to define for integrity.

Proposal 6: Agree to add Section 8.1.2.1b-1 and Table 8.1.2.1b-1 (as per Appendix A (R2-2201761)) into TS 36.305 and TS 38.305. The field names in Table 8.1.2.1b-1 are subject to the outcomes of Stage 3 regarding which integrity IEs and associated fields to include in LPP.

Agreements:

Proposal 1: Agree to add a new IE for the Integrity Service Parameters which contains the irMinimum and irMaximum fields. The IE will be included under GNSS-CommonAssistData.

Proposal 2: Agree to add a new IE for Integrity Service Alerts under GNSS-CommonAssistData which contains the Ionosphere DNU and Troposphere DNU.

FFS on whether to also include the Service DNU.

Proposal 4: Agree to add the Mean and Standard Deviation parameters for the Integrity Bounds within the existing SSR-Code-Bias, SSR-Phase-Bias, SSR-STEC-Correction and SSR-GriddedCorrection IEs in LPP, as per Table 3.2-1 in R2-2201765.

Proposal 6: RAN2 agrees to update Stage 2 with a description of the Mean Fault Duration parameters. The following changes are proposed in addition to the Stage 2 text updates that were agreed in R2-2201765, for inclusion into the running Stage 2 CR:

[Chair’s note: See R2-2201765 for the properly formatted and change-marked version of this agreement]

8.1.2.1.31 Integrity Residual Risk Parameters

Integrity Residual Risk Parameters are used to provide the residual risk parameters related to the satellite, constellation, ionosphere and troposphere residual risk probabilities. These parameters include a Probability of Onset which is defined per unit of time and represents the probability that the feared event begins. The Mean Duration represents the expected mean duration of the corresponding feared event and is used to convert the Probability of Onset to a probability that the feared event is present at any given time, i.e.

P(Feared Event is Present)= Mean Duration\*Probability of Onset of Feared Event

Proposal 8: Agree to include the Integrity Correlation Times parameters from Table 3.2-3 (R2-2201765) within the SSR-STEC-Correction and SSR-GriddedCorrection IEs in LPP, with updated field names as follows:

tCorrelationIonosphere changed to ionoRangeErrorCorrelationTime

tCorrelationIonosphereRate changed to ionoRangeRateErrorCorrelationTime

tCorrelationTroposphere changed to tropoRangeRateErrorCorrelationTime

tCorrelationTroposphereRate changed to tropoRangeRateErrorCorrelationTime

Agreements:

Introduce a new posSIB for the new assistance data added for integrity.

Agreements:

Proposal 1. For the purpose of GNSS integrity feature added in Release17, use GNSS-RealTimeIntegrity IE to signal to UE bad satellites (and GNSS constellations).

Proposal 2. Update description of GNSS-RealTimeIntegrity IE and Stage 2 to clarly state what condition can be interpreted as DNU = FALSE.

Note: Annex A contain a modified version of the GNSS-RealTimeIntegrity IE which highlights the list of satellites monitored for integrity. This can be used as input for Stage 3 CR and subject to offline review.

Proposal 3. For the purpose of GNSS integrity feature added in Release17, an additional DNU flag per constellation is not needed.

Open Issue #2:

Proposal 4. For Release 17, the bounding of GNSS errors is based on paired overbounding principle characterized by mean and standard deviation. In future releases provision of full covariance matrix for the orbital covariance can be revisited.

Proposal 6. Agree to include integrity bounds for Clock in the GNSS-SSR-ClockCorrections IE and bounds for Orbit in the existing GNSS-SSR-OrbitCorrections IEs rather than combining them in a new joint IE.

Open Issue #3:

Proposal 7. If possible, reuse existing IEs the following Integrity Residual Risk parameters: Probability of Onset of Constellation Fault, Mean Constellation Fault Duration, Proability of Onset of Satellite Fault, and Mean Satellite Fault Duration.

Note: candidate IEs in order of preference: GNSS-SSR-OrbitCorrections, GNSS-RealTimeIntegrity IE. This can be dealth offline as part of update to stage 3 CR – input from Rapporteur.

Proposal 8. Probability of Onset of Ionosphere Fault and Mean Ionosphere Fault Duration parameters are included in the GNSS-SSR-STEC-Correction. Probability of Onset of Troposphere Fault and Mean Troposphere Fault Duration parameters are included in the GNSS-SSR-GriddedCorrection.

Open Issue #5:

Proposal 10. Agree to enable periodic transmission of assistance data for GNSS integrity.

Proposal 11. Add gnss-Integrity-PeriodicServiceAlert-r17 to the list of periodic GNSS assistance data. FFS if other IEs need to be added (input from Stage 3 rapporteur).

Open Issue #6:

Proposal 13: Adopt the mapping of GNSS Integrity IEs to posSIB as propoed in the table from below:

GNSS Common Assistance Data (clause 6.5.2.2)

posSibType assistanceDataElement

posSibType1-9 GNSS-Integrity-ServiceParameters

posSibType1-10 GNSS-Integrity-ServiceAlert

Open Issue #7, #8 (R2-D1):

Proposal 14. Add TIR and AL to the IntegrityInformationRequest-r17 IE. TTA is FFS. Their value ranges shall be based on table 9.2.4 in TR 38.857.

Open Issue #9 (R2-D2):

Proposal 17. Add HPL and VPL to the IntegrityInfo IE. The value range of these two parameters covers 0 – 500m interval. Resolution is 1cm.

Note: HPL representation e.g., 2D ellipse or Alon-Cross track pair is based on input from Stage 3 rapporteur.

Open Issue #10 (R2-D4):

Proposal 21. Adopt the proposed encoding for GNSS-Integrity-ServiceParameter in Stage 3.

Proposal 22. Adopt the following description for the GNSS-Integrity-ServiceAlert in Stage 3. Service DNU is FFS.

GNSS-Integrity-ServiceAlert field descriptions

ionosphereDoNotUse

This field indicates whether the ionospheric corrections in IEs GNSS-SSR-STEC-Correction IE can be used for integrity related applications (FALSE) or not (TRUE).

troposphereDoNotUse

This field indicates whether the tropospheric corrections in IEs GNSS-SSR-GriddedCorrection IE can be used for integrity related applications (FALSE) or not (TRUE).

Open Issue #11 (R2-D5):

Proposal 23. Adopt the proposed encoding of the SSR-IntegrityCodeBiasBounds.

Open Issue #12 (R2-D6):

Proposal 24. Adopt the proposed encoding of the SSR-IntegrityPhaseBiasBounds.

Open Issue #13 (R2-D7):

Proposal 25. Adopt the proposed encoding for the STEC-IntegrityParameters-r17 and STEC-IntegrityErrorBounds-r17.

Open Issue #14 (R2-D8):

Proposal 26. Adopt the proposed encoding for the SSR-GriddedCorrectionIntegrityParameters-r17 and TropoDelayIntegrityErrorBounds-r17.

Agreement:

Proposal 1. Covariance parameters for Orbital errors are not included in Rel17. These terms, together with the full cross-covariance matrix, can be revisted in future releases and possibly coordinated with RTCM.

Agreement:

Proposal 2. The validity time of the integrity bounds is set as equal to the validity time of the SSR data. No additional validity time parameter is defined in Rel17.

Agreements:

Proposal 3. Release 17 supports only Reporting Mode 1 (PL reporting). Reporting Mode 2 can be revisited in future releases.

Proposal 4. For reporting Mode 1, TTA is not needed.

Proposal 5 (modified). Provide achievable TIR as optional parameter in the Integrity Information Result

## A.5 Other

## A.5.1 PRUs

Agreements:

Proposal 1 (modified): For purposes of RAN2 discussion, the PRU functionality as described in the RAN1 LS can be considered as UE with known location (to some degree of accuracy) at least (16/17).

PRU modelled as a gNB can be discussed in RAN3 (no RAN2 action).

Agreement:

RAN2 confirm that the PRU considered as a UE supports the normal LPP procedures for assistance data transfer and location information transfer.

Agreement:

Proposal 5: Regarding the handling of the PRU topic, agree the following way forward:

(1) Send an LS to SA2 asking SA2 whether the MT-LR or MO-LR location procedures as currently specified in TS 23.273 can be used to enable an LMF obtaining location measurements from PRUs (via LPP) and to trigger SRS transmission of PRUs (via NRPPa), or whether an LMF needs to be enabled to instigate location procedures for a PRU (e.g., LPP, NRPPa procedures) without receiving a location request for the PRU from an AMF (i.e., in the absence of an MT-LR or MO-LR for the PRU), and if so, whether support can be provided as part of Release 17.

(2) Send an LS to RAN1 asking RAN1 whether the LMF determined "correction information" obtained from PRU measurements need to be provided to target UEs for UE-based mode of operation, and if so, ask RAN1 to provide further details on the specific "correction information" which need to be provided to target UEs. In addition, ask RAN1 to provide further details on the "PRU antenna orientation information" which should be provided to an LMF.

LS to be progressed by email (extension of [AT116-e][615], to approve by email by EOM).

Agreements:

Proposal 3: RAN2 confirm that the PRU considered as a UE supports the normal LPP procedures for PRU capability transfer.

Proposal 1 (modified): RAN2 confirms that a PRU can support at least the following functionality (as described in the RAN1 LS), dependent on PRU capability:

- Provide the positioning measurements (e.g., RSTD, RSRP, Rx-Tx time differences) to an LMF.

- Transmit the UL SRS signals for positioning.

- FFS known location information and antenna orientation information

Agreement:

RAN2 will not discuss PRUs further without further guidance from RAN1 (LS or feature list).

## A.5.2 Positioning accuracy enhancements

Agreements:

Proposal 2.1-1: enhance LPP assistance data signalling to allow UE to request and LMF to provide TRP beam/antenna information.

Proposal 2.1-2: enhance LPP assistance data signalling to allow LMF to provide the association information of DL PRS resources with TRP Tx TEG ID.

Proposal 2.1-6: enhance LPP assistance data signalling to allow UE to request and LMF to provide the expected angle value and uncertainty.

Proposal 2.2-1: introduce in LPP RequestLocationInformation: request for UE Rx TEG ID, maximum number of Rx TEGs for the same PRS resource, request for UE Tx TEG ID, maximum number of RxTx TEGs for the same PRS resource, request for UE RxTx TEGD ID.

Proposal 2.2-2: introduce in LPP ProvideLocationInformation: UE Rx TEG IDs, UE Tx TEG IDs, and UE RxTx TEG IDs.

Proposal 2.2-3: introduce in LPP ProvideLocationInformation: multiple UE Rx-Tx time difference measurements (for N different UE Rx TEGs), and multiple UE Rx-Tx time difference measurements (for N different UE RxTx TEGs with the same UE Tx TEG).

Proposal 2.2-5: introduce support for an LMF to request and UE to report first path PRS RSRP for DL-AoD.

Proposal 2.2-6: introduce support for extended additional paths beyond 2.

Proposal 2.2-7: introduce support a LoS/NLoS indication per RSTD, RSRP and UE RxTx measurements.

Agreements:

Proposal 2.1-3: to include the association information of DL PRS resources with TRP Tx TEG ID in posSIB.

Proposal 2.1-4: include in the LPP assistance data the information about subset of PRS resources for the purpose of prioritization of DL-AOD reporting.

Proposal 2.1-5: include in the LPP assistance data the the boresight direction information.

For UL-TDOA, RRC signalling is used to convey the information about signalling for association of UL SRS resources with UE Tx TEGs ID to the gNB. For multi-RTT, LPP is used. FFS which RRC message(s) are used.