3GPP TSG-RAN WG2 Meeting #117-e ***R2-2203950***

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 in R2-2203619 and report in R2-2203620

Deadline: Friday 2022-02-25 1000 UTC – extended to Wednesday 2022-03-02 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.

[10] R2-2203620, "Summary of [AT117-e][606][POS] LPP running CR (Qualcomm)".

# 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 column provides the status of the at-meeting discussions.

Issues highlighted in green are supposed to be resolved.

## 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  RAN2 to agree new posSibType6-5 NR-DL-PRS-TRP-TEG-Info for the TRP Tx TEG info and the TP of NR-DL-PRS-TRP-TEG-Info for broadcast n the annex, FFS the description on resource association. |
| 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)). | Postpone to ASN.1 review. |
| 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 | Agreement:  …and to agree the TP …in the annex:  "The dl-PRS-TRP-Tx-TEG-ID in dl-PRS-TEG-InfoSet is associated with the nr-DL-PRS-ResourceID of NR-DL-PRS-Info using the same structure and order." |

## 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.  Explicitly list the involved cell IDs in LPP along with the assistance data. The list can be provided per instance of assistance data. Can be discussed in running CR/ASN.1 whether there are signalling optimisations that improve this approach. |
| 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 | Agreement:  RAN2 understand that multiple instances of PRS assistance data can already be supported by the current LPP spec. One or more NR-DL-PRS-AssistanceData-r16 elements can be provided in one or more LPP Assistance Data messages.  UE capability for the number of PRS-ID+cell ID combinations for which the UE can store AD. |
| 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. |
| 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 |  | Agreements:  A pre-defined on-demand DL-PRS configuration can be described with the Rel-16 IEs NR-DL-PRS-PositioningFrequencyLayer-r16 and NR-DL-PRS-Info-r16 |
| 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 | Agreements:  The value for maxDL-PRS-Configs-r17 is 8. |
| 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 |  | 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  The "index principle" as currently used for the NR-DL-PRS-AssistanceData is also used for the available on-demand DL-PRS configurations.  In the case of available on-demand DL-PRS configurations for multiple NR positioning methods are provided, the nr-On-Demand-DL-PRS-Configurations need to be present in only one of NR-Multi-RTT-ProvideAssistanceData, NR-DL-AoD-ProvideAssistanceData, or NR-DL-TDOA-ProvideAssistanceData. The applicable configuration is then defined as an index in these ProvideAssistanceData messages. |

## 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.  Provide achievable TIR as optional parameter in the Integrity Information Result.  For reporting Mode 1, AL and TTA are not needed. |
| 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 | Agreement:  RAN2 to agree that the value ranges of the RSRPP should be decided by RAN1. |
| 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 | RAN2 to agree that the value ranges of the relative power of DL-PRS resource should be decided by RAN1 |
| 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 | RAN2 to agree that the value ranges of the expected angle assistance (expected angel value and uncertainty) relative power of DL-PRS resource should be decided by RAN1. |
| R1-A5 | Multiplicity and type constraint values | Confirmation/checking of the value ranges. |  | Rapporteur |  | Postpone to ASN.1 review. |

## 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 | Agreement:  The SRS-TEG association reporting, if any, shall always be reported along with the UE Rx – Tx time difference measurement report for Multi-RTT with no additional periodicities and to agree the TP on report of association for Multi-RTT in the annex. Any additional parameters can be discussed in the running CRs pending RAN1 input.  RAN2 to agree the updated stage-3 design of UE Rx-Tx time difference measurements obtained from different DL PRS resources per UE Rx TEG/ RxTx TEG in the annex, FFS the nr-UE-Tx-TEG-ID-r17 in case2 and case3 (pending RAN1). |
| 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 | Agreements:  Keep the running CR approach for PosCalc AD; can be further discussed in running CR discussion if anything should change. |
| 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 | RAN2 to agree the following option is taken on supporting LMF to provide the TRP beam/antenna information to UE: Option a: New IE to carry the TRP beam/antenna information, e.g., NR-TRP-BeamAntennaInfo in running CR of TS37.355.  RAN2 to agree that both the azimuth and elevation can be optional, but at least one should be provided within the beam/antenna information.  RAN2 to agree the TP of option1 (change the azimuth-r17 and elevation-r17 both to be optional, but add a restriction in the field description that at least azimuth or elevation should be present). |
| 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 | RAN2 to agree that keep RSRP still as mandatory within the measurement results info provided by UE to LMF for DL-AOD in R17, and it may be revised if there is clear agreement from RAN1. |
| 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 | RAN2 to agree that the angle assistance information (expected angel value and uncertainty) should be per TRP.  RAN2 to agree to extend the R16 IE NR-DL-PRS-AssistanceDataPerTRP-r16 to carry the expected angle assistance information (like expected RSTD and expected RSTD uncertainty), FFS with restrictions only applied for DL-AOD positioning method waiting for RAN1 feedback.  RAN2 to agree that the value ranges of the expected angle assistance (expected angel value and uncertainty) relative power of DL-PRS resource should be decided by RAN1. |
| 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 | RAN2 to agree to extend the R16 IE NR-DL-PRS-Resource-r16 to carry the R17 DL-PRS resource subset information, with restrictions that it is only applied for DL-AOD positioning method.  RAN2 to agree that it is up to RAN1 to decide whether further description of UE behaviour needed related to the measurements and/or reporting is needed related to the prioritization of DL-AOD reporting. |
| 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 | Agreements:  10ms Finer granularity is only applied for NR RAT dependent positioning methods. |
| 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 | Agreement:  The LOS/NLOS indicator is associated with UE measurement report and associated TRP and resource id (if there is) in each measurement report, for all RAT-dependent methods except E-CID. |
| 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) |  | Updated as proposed in R2-2202409 (CATT) |
| 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) |  | Updated as proposed in R2-2202409 (CATT) |
| 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) |  | Keep start time/duration |
| 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 | Agreements:  RAN2 to agree new posSibType6-5 NR-DL-PRS-TRP-TEG-Info for the TRP Tx TEG info and the TP of NR-DL-PRS-TRP-TEG-Info for broadcast(8/11) in the annex, FFS the description on resource association. |
| 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 | Agreements:  RAN2 to agree the stage-3 design of RSTD measurements from different DL PRS resources per UE Rx TEG report in the annex.  "When different UE Rx TEGs for RSTD measurements are requested, the maximum number of reported RSTD measurements associated with different DL-PRS Resources per UE Rx TEG per target TRP is 4." |

# 3. Discussion

Companies are invited to review v8 of the running CR and provide any comments related to the LPP implementation of the open issues listed in section 2.

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| Company | Open Issue # | Comments |
| Nokia | R2-D1 | To echo Stage-2 (38.305), we think the terminology “integrity requirement” can be incorporated into the description of the field *integrityInformationRequest*. The proposed wording change is as following:  ***integrityInformationRequest***  This field, if present, indicates that the target device is requested to report integrity information for the location estimate and comprises the following integrity requirements ~~subfields~~:  - ***targetIntegrityRisk*** indicates the Target Integrity Risk (TIR) for which the Protection Level (PL) is requested. The TIR is given by *P*=10-0.1*n* [hour-1] where *n* is the value of *targetIntegrityRisk* and the range is 10-1 to 10-9 per hour.  [Rap: Updated accordingly in V9] |
| Nokia | R2-D2 | Based on the agreement:   * *Provide achievable TIR as optional parameter in the Integrity Information Result*   We think it is better to differentiate the naming of TIR parameter in ***integrityInformationRequest*** and ***integrityInfo***, otherwise it is a bit confusing as their values/definitions are not always the same. The proposed wording change is as following:  ***integrityInfo***  This field provides the integrity result for the *locationEstimate.*  - ***horizontalProtectionLevel*** provides the Horizontal Protection Level (HPL) for the *locationEstimate* along the semi-major axis of the error ellipse. Scale factor 0.01 metre; range 0 – 500 metres.  - ***verticalProtectionLevel*** provides the Vertical Protection Level (VPL) for the *locationEstimate*. Scale factor 0.01 metre; range 0 – 500 metres.  - ***achievableT~~t~~argetIntegrityRisk*** indicates the Achievable Target Integrity Risk (TIR) for which the HPL and VPL are provided. The Achievable TIR is given by *P*=10-0.1*n* [hour-1] where *n* is the value of *achievableT~~t~~argetIntegrityRisk* and the range is 10-1 to 10-9 per hour. If this field is absent, the Achievable TIR is the same as *targetIntegrityRisk* in the *IntegrityInformationRequest*.  [Rap: Updated accordingly in V9] |
| Ericsson | R2-B3 | We do not think area ID is applicable to multiRTT. There is also UL component and measurements are bidirectional so having area ID only for DL does not add any value.  [Rap: Take the Deferred MT-LR use case as an example. The UE is pre-configured with assistance data for multiple areas. When an event is triggered, the UE only requests/receives SRS configuration and can use the stored PRS assistance data for Rx-Tx measurements.] |
| Fraunhofer | R2-B3 | The LPP implementation provided by Rapporteur is agreeable for us.  In addition, we think the following clarifying notes to the filed nr-DL-PRS-AssistanceData would be necessary to fully capture the agreements made.  ***nr-DL-PRS-AssistanceData***  This field specifies the assistance data reference and neighbour TRPs and provides the DL-PRS configuration for the TRPs.  NOTE 1: 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.  NOTE 2: One or more NR-DL-PRS-AssistanceData-r16 instants can be provided in one or more LPP Assistance Data messages. 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.  NOTE 3: The number of PRS-ID+cell ID combinations for which the UE can store AD is UE capability.  [Rap: Note 2 should be Need ON behaviour, however, it would be good to capture this in more detail in Stage 2.  The UE capability is curently implemented as follows:  nr-dl-prs-AssistanceDataValidity-r17 SEQUENCE {  area-validity-r17 INTEGER (1..maxAreaIDs-r17) OPTIONAL, ...  },  ***nr-dl-prs-AssistanceDataValidity***  This field, if present, indicates that the target device supports validity conditions for pre-configured assistance data and comprises the following subfields:  - ***area-validity*** indicates that the target device supports pre-configured assistance data with area validity. The integer number indicates the maximum number of area IDs the target device supports*.*  The number of PRS ID+Cell ID compbinations per message does not change (since Rel-16 functionality) but is also implicit in the number of Area IDs a UE can support.] |
| Swift Navigation | R2-D1 | The Protection Level (HPL, VPL) is reported in the Integrity Results but is not yet defined in Stages 2 or 3. The Protection Level definition was determined in the SI (TR 38.857, Section 9.1.1.3) and we suggest to include this as a NOTE under the ***integrityInfo*** field descriptions within the CommonIEsProvideLocationInformation IE, e.g.  …   |  | | --- | | ***integrityInfo***  This field provides the integrity result for the *locationEstimate.*  - ***horizontalProtectionLevel*** provides the Horizontal Protection Level (HPL) for the *locationEstimate* along the semi-major axis of the error ellipse. Scale factor 0.01 metre; range 0 – 500 metres.  - ***verticalProtectionLevel*** provides the Vertical Protection Level (VPL) for the *locationEstimate*. Scale factor 0.01 metre; range 0 – 500 metres.  - ***achievableTargetIntegrityRisk*** indicates the achievable Target Integrity Risk (TIR) for which the HPL and VPL are provided. The achievable TIR is given by *P*=10-0.1*n* [hour-1] where *n* is the value of *achievableTargetIntegrityRisk* and the range is 10-1 to 10-9 per hour. If this field is absent, the achievable TIR is the same as the *targetIntegrityRisk* in *IntegrityInformationRequest*. |   NOTE: **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**  When the PL bounds the positioning error in the horizontal plane or on the vertical axis then it is called Horizontal Protection Level (HPL) or Vertical Protection Level (VPL) respectively.  A specific equation for the PL is not specified as this is implementation-defined. For the PL to be considered valid, it must simply satisfy the inequality above.  [Rap: Added in v10 accordingly.] |
| CATT | R2-B2 | There is a problem in the v9. *Area-ID-CellList* can only indicate one cell list in one instance of DL-PRS AD. For example, there is only one cell list in one instance of NR-DL-TDOA-ProvideAssistanceData according to v9. So when there are multi cell lists for the pre-config AD which always happen in pre-config senario, LMF has to send multi NR-DL-TDOA-ProvideAssistanceData message with different cell list. The logic is that if cell list is indicated per message, no need to indicate the cell list at all. Because all the TRPs in this cell list can be sent in one message naturally by network. So why is the cell list required?  We proposed to compromise the **INTEGER ID** and **cell list** based on v7 as below. It’s up to network to assign an INTEGER ID or cell list to this device in the pre-configured AD. The INTEGER ID can save the memory when pre-configured AD is stored for latency reduction in device. 40Mbits Vs 2Mbits memory cost in one device.  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 ::= CHOICE {  nr-area-ID-r17 INTEGER (0..255),  nr-cell-ID-List-r17 NR-Cell-ID-List-r17  }  NR-Cell-ID-List-r17 ::= SEQUENCE (SIZE(1..maxCellIDsIDsPerArea-r17)) OF NR-Cell-IDs-r17  NR-Cell-IDs-r17 ::= SEQUENCE {  nr-CellGlobalID-r17 NCGI-r15 OPTIONAL, -- Need ON  nr-PhysCellID-r17 NR-PhysCellID-r16 OPTIONAL, -- Need ON  nr-ARFCN-r17 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON  ...  }    }  [Rap: Agree, defining an Area ID as a list of cells is unnecessary, since the assistance data are already provided for a list of cells.  My understaning of this whole concept is rather simple, and similar to what CATT mentioned above, but with the "area ID" being a SEQUENCE of multiple area IDs (i.e., each TRP in the NR-DL-PRS-AssistanceDataPerTRP-r16 belong to one or more area IDs). E.g.,  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 SEQUENCE (SIZE(1..max)) of INTEGER (0..255) OPTIONAL -- Need ON  ]]  }  This allows each TRP being part of one or more Areas. No matter in which message/IE or order a UE receives the assistance data instances, it would always know which TRPs belong to the current Area (which is defined by UE serving/camped cell).  The additional Cell list in the Area ID seems unnecessary.  I suggest adding the definition from CATT (which seems has some support below, together with an FFS.  Updated in V10] |
| Ericsson | R1-3 | RAN1 has been discussed the TRP beam info further, so the TRP beam info needs to be revisited. An associated TRP ID has been agreed, and the discussion about beam info representation continues with a slight majority in favor of Option 1 with a uniform grid. Text proposal that take these into consideration is provided below.  [Rap: I assume we will receive an updated parameter/agreement list in this case. Since this has also been discussed in a dedicated ED "[AT117-e][618][POS] Beam and antenna information for DL-AoD accuracy enhancements (CATT)" and we made some agreements based on this discussion (e.g., item # R1-3 in the issues list), I suggest keeping what we have for now and I add an Editor's Note that this may require a revision based on further RAN1 input (see also below).] |
| Xiaomi | R2-B2 | Regarding the ***Nr-PosCalcAssistanceRequest,*** *it includes* ***Pre-configured-AssiatnceDataRequest*** as following:  *This field indicates that the target device requests pre-configured assistance data with area validity. The integer number indicates the number of different area IDs requested.*  We don’t discuss whether UE can request pre-configured assistance data or not and there is no agreements on UE requesting pre-configured assistance, we suggest to remove it.  [Rap: This should follow normal LPP logic if we include the IE at the top level of a Provide message. But this has now all been removed in V10 and replaced by CATT's proposal above.] |
| ZTE | R2-A3, R2-B2 | 1. We do not think area-ID-CellList-r17 should be embedded in NR-DL-TDOA/AoD/Multi-RTT-ProvideAssistanceData, 2 reasons:    1. On-demand PRS configuration is also embedded in NR-DL-TDOA/AoD/Multi-RTT-ProvideAssistanceData, however area ID is not used for on-demand PRS configuration;    2. We had an agreement that ‘area ID can be broadcasted in the system information ’, but NR-DL-TDOA/AoD/Multi-RTT-ProvideAssistanceData can not be broadcasted.   So we think area-ID-CellList-r17 is better embedded in NR-DL-PRS-AssistanceData  [Rap: Essentially agree, but it should also work as in V9, since all IEs are optional in the Provide message. However, the consequence is (as CATT mentioned above) that each instance can only be valid for one area.  On the broadcast, I'm not sure, but posSI can already have an *areaScope*. A gNB would not broadcast multiple instances since each instance can be obtained from the applicable Area (serving/camped cell) anyhow.]   1. Pre-configured-AssiatnceDataRequest is not needed since for pre-configured AD, we only agreed on UE capability report and LMF indication   [Rap: O.K., but unnecessary restriction in my opinion since we usually always have Request/Provide pairs.]   1. prs-ProcessingWindowTypeRRC-Inactive-r17 in current v9 should be renamed as prs-InactiveBufferingCapability-r17   [Rap: Updated in V10.]   1. NR-TRP-BeamAntennaInfoAzimuth-r17 also contains elevation angle, so it can be renamed as NR-TRP-BeamAntennaInfoAzimuthElevation-r17   [Rap: Updated in V10.] |
| vivo | R2-B5 | The indication of scheduled location time can be based on multiple time bases to support different positioning methods in a single location request.  ScheduledLocationTime-r17 ::= ~~CHOICE~~ SEQUENCE {  [Rap: Updated in V10] |
|  | R2-B2 | Agree with CATT that the current Area-ID-CellList can only indicate one cell list in one instance of DL-PRS AD.  If we cannot reach a consensus to introduce a list of nr-DL-PRS-AssistanceData associate with different validity area, then the version from CATT is a good compromise. In this case, the size of configuration has not changed much. Thus, the following capability shall be ENUMERATED { supported }  nr-dl-prs-AssistanceDataValidity-r17 SEQUENCE { area-validity-r17 INTEGER (1..maxAreaIDs-r17) }  The same for the pre-configured-AssistanceDataRequest.  Besides, we would revise the name of Area-ID to ValidityArea to avoid misunderstanding.  [Rap: Updated in V10.] |

Companies are invited to provide any other comments on the LPP running CR in the Table below.

|  |  |
| --- | --- |
| Company | Comments |
| Ericsson | Text proposal with an updated NR-TRP-BeamAntennaInfo-r17 IE reflecting the RAN1 discussions. This is also a much more efficient representation than what is in the current running CR – something that becomes important for scalability and for adaption to posSIBs.  -- ASN1START  NR-TRP-BeamAntennaInfo-r17 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF  NR-TRP-BeamAntennaInfoPerFreqLayer-r17  NR-TRP-BeamAntennaInfoPerFreqLayer-r17 ::= SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF  NR-TRP-BeamAntennaInfoPerTRP-r17  NR-TRP-BeamAntennaInfoPerTRP-r17 ::= SEQUENCE {  dl-PRS-ID-r17 INTEGER (0..255),  nr-PhysCellID-r17 NR-PhysCellID-r16 OPTIONAL, -- Need ON  nr-CellGlobalID-r17 NCGI-r15 OPTIONAL, -- Need ON  nr-ARFCN-r17 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON  associated-DL-PRS-ID-r16 INTEGER (0..255) OPTIONAL,  lcs-GCS-TranslationParameter-r17 LCS-GCS-TranslationParameter-r16 OPTIONAL, -- Need OP  dl-PRS-RelativeBeamPowers-r17 DL-PRS-RelativeBeamPowers-r17,    ...  }  DL-PRS-RelativeBeamPowers-r17 ::= SEQUENCE {  dl-PRS-RefAzimuth-r17 INTEGER (0..359), OPTIONAL, -- Need OP  dl-PRS-RefAzimuth-fine-r17 INTEGER (0..9) OPTIONAL, -- Need OP  dl-PRS-RefElevation-r17 INTEGER (0..180) OPTIONAL, -- Need OP  dl-PRS-RefElevation-fine-r17 INTEGER (0..9) OPTIONAL, -- Need OP  numberOfStepsAzimuth-r17 INTEGER (0..1800), OPTIONAL. -- Need OP  numberOfStepsElevation-r17 INTEGER (0..900), OPTIONAL. -- Need OP  stepOfAzimuth-r16 ENUMERATED {d01, d1, ...},  OPTIONAL, -- Need OP  stepOfElevation-r16 ENUMERATED {d01, d1, ...},  OPTIONAL, -- Need OP  dl-PRS-RelativeBeamPowerList-r17 CHOICE {  rbp-10deg-r17 SEQUENCE (SIZE (1..maxNoOfRelativeBeamPowers-r17)) OF DL-PRS-RelativeBeamPowerPerPower10deg-r17,  rbp-01deg-r17 SEQUENCE (SIZE (1..maxNoOfRelativeBeamPowers-r17)) OF DL-PRS-RelativeBeamPowerPerAngle01deg-r17,  }  }  DL-PRS-RelativeBeamPowerPerAngle10deg-r17 ::= SEQUENCE {  dl-PRS-ReferenceResourceID-r17 NR-DL-PRS-ResourceID-r16 OPTIONAL, -- Need OP  dl-PRS-ReferenceResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16 OPTIONAL, -- Need OP  beamPowerDiffList-r17 SEQUENCE (SIZE (2..maxNumResourcesPerAngle-r17)) OF  BeamPowerDiffElement10deg-r17,  ...  }  DL-PRS-RelativeBeamPowerPerAngle01deg-r17 ::= SEQUENCE {  dl-PRS-ReferenceResourceID-r17 NR-DL-PRS-ResourceID-r16 OPTIONAL, -- Need OP  dl-PRS-ReferenceResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16 OPTIONAL, -- Need OP  beamPowerDiffList-r17 SEQUENCE (SIZE (2..maxNumResourcesPerAngle-r17)) OF  BeamPowerDiffElement01deg-r17,  ...  }  BeamPowerDiffElement10deg-r17 ::= SEQUENCE {  nr-dl-prs-ResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16 OPTIONAL, -- Need OP  nr-dl-prs-ResourceID-r17 NR-DL-PRS-ResourceID-r16 OPTIONAL, -- Need OP,  nr-dl-prs-RelativePower-r17 INTEGER (0..30),  ...  }  BeamPowerDiffElement01deg-r17 ::= SEQUENCE {  nr-dl-prs-ResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16 OPTIONAL, -- Need OP  nr-dl-prs-ResourceID-r17 NR-DL-PRS-ResourceID-r16 OPTIONAL, -- Need OP  nr-dl-prs-RelativePower-r17 INTEGER (0..300),  ...  }  -- ASN1STOP  [Rap: Thanks for the TP. As mentioned above, let's wait for the RAN1 updates. In the meantime, it would be appreciated if Ericsson could also devlop the corresponding field description, since I don't fully understand the proposal (in particular the part with the number of steps, since they should be implict dependent on how many items are provided?)] |
| Xiaomi | The following definitions should be updated to align with TS38.305 running CR.  **TRP Tx Timing Error Group (TRP Tx TEG):** A TRP Tx TEG is associated with the transmissions of one or more DL-PRS Resources, which have the Tx timing error difference within a certain margin.  **UE Rx Timing Error Group (UE Rx TEG)**: A UE Rx TEG is associated with one or more DL timing measurements, which have the Rx timing error difference within a certain margin.  **UE Tx Timing Error Group (UE Tx TEG)**: A UE Tx TEG is associated with the transmissions of one or more UL SRS Resources for Positioning, which have the Tx timing error difference within a certain margin.  **UE RxTx Timing Error Group (UE RxTx TEG):** A UE RxTx TEG is associated with one or more UE Rx-Tx time difference measurements, which have the 'Rx timing errors+Tx timing errors' difference within a certain margin.  [Rap: We asked RAN1 in our LS for an updated definition and I assume we will receive a response from RAN1 (probably together with other changes). I suggest waiting for the next RAN1 update before making these changes.] |

# Annex A: RAN2 Agreements

## A.1 Latency Reduction

|  |
| --- |
| 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).

Agreements:

Proposal 1 (modified): Explicitly list the involved cell IDs in LPP along with the assistance data. The list can be provided per instance of assistance data. Can be discussed in running CR/ASN.1 whether there are signalling optimisations that improve this approach.

Proposal 2: validity timer for AD is not introduced in Rel-17.

Agreements:

For triggering condition for the UL MAC CE, reuse current RRC condition for Rel-16 PRS gap request, taking into account preconfigured MG. If the preconfigured MG is there and can satisfy the UE’s requirement, the UE uses MAC CE, otherwise RRC message as in Rel-16. The selection is specified in RRC. Reuse the “not configured or not sufficient” language from Rel-16.

Proposal 4.1: UL MAC CE for MG activation and deactivation is triggered by upper layers.

Proposal 4.3: LPP signalling for LMF to indicate to UE whether to send/not send the UL MAC CE for positioning MG activation request is not defined.

Proposal 4.5: the following options to cancel a triggered UL MAC CE for MG activation and deactivation should be captured in the spec; other options can be discussed in the running CR discussion.

• When the MAC CE is transmitted

• When a request from upper layers to transmit a new request to gNB for a new/modified gap configuration is received

• When an indication from upper layers that the gaps are not needed any more or a gap with a new id needs to be activated is received

• On MAC reset

Agreement:

RAN2 understand that multiple instances of PRS assistance data can already be supported by the current LPP spec. One or more NR-DL-PRS-AssistanceData-r16 elements can be provided in one or more LPP Assistance Data messages.

## 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)

Agreements:

Proposal 1: Follow SDT solution that the TA Timer for SRS for positioning (SRSp) is restarted upon reception of TA command in RRC\_INACTIVE (10/10)

Proposal 2: Follow SDT solution that SRS for positioning (SRSp) in RRC\_INACTIVE state can only be configured through RRC Release message (i.e. RRCReconfiguration and RRCReconfigurationComplete are not used for configuring SRSp) (10/10)

Proposal 3: No specification impacts are identified by RAN2 in Rel-17 for handling the relationship between DRX cycle and positioning measurement delay requirements in RRC\_INACTIVE (8/10)

## 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.

Agreements:

Proposal 1-1:

• If the NW has provided the pre-defined on-demand PRS configurations to the UE, explicit parameter requests from the UE are allowed provided that the request is within the scope of the received pre-defined on-demand PRS configurations.

• If the NW has not provided the pre-defined on-demand PRS configurations to the UE, the UE may blindly request on-demand PRS parameters via an explicit request within the scope of the RAN1 agreed parameter list.

Proposal 1-2: Add a Stage 2 note clarifying the difference between index-based and explicit-based on-demand PRS requests.

Proposal 2: On-demand PRS configuration is defined with a Need ON tag, i.e., no new additional behaviours are required.

Agreements:

Proposal 3 (modified): A pre-defined on-demand DL-PRS configuration can be described with the Rel-16 IEs NR-DL-PRS-PositioningFrequencyLayer-r16 and NR-DL-PRS-Info-r16

Proposal 4: The "index principle" as currently used for the NR-DL-PRS-AssistanceData is also used for the available on-demand DL-PRS configurations.

In the case of available on-demand DL-PRS configurations for multiple NR positioning methods are provided, the nr-On-Demand-DL-PRS-Configurations need to be present in only one of NR-Multi-RTT-ProvideAssistanceData, NR-DL-AoD-ProvideAssistanceData, or NR-DL-TDOA-ProvideAssistanceData. The applicable configuration is then defined as an index in these ProvideAssistanceData messages.

Proposal 7 (modified): The previous agreement is modified as follows [see R2-2203620 for revmarked version]:

To respond to an unfulfilled UE-initiated on-demand PRS request, new location server error cause values are introduced indicating that on-demand DL-PRS assistance data are not available or not supported.

Proposal 8: The value for maxDL-PRS-Configs-r17 is 8.

## 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

Agreements:

Proposal 5: Add the following Notes to the IE GNSS-RealTimeIntegrity:

NOTE 1: If GNSS integrity assistance data are provided (i.e., any of GNSS-Integrity-ServiceParameters, GNSS-Integrity-ServiceAlert, ORBIT-IntegrityParameters, SSR-IntegrityOrbitBounds, CLOCK-IntegrityParameters, SSR-IntegrityClockBounds, SSR-IntegrityCodeBiasBounds, SSR-IntegrityPhaseBiasBounds, STEC-IntegrityParameters, STEC-IntegrityErrorBounds, SSR-GriddedCorrectionIntegrityParameters, TropoDelayIntegrityErrorBounds) the following interpretation of the IE GNSS-RealTimeIntegrity applies:

- Absence of the IE GNSS-RealTimeIntegrity indicates DNU=FALSE according to the Integrity Principle of Operation specified in subclause 8.1.1a of TS 38.305 [40] for all GNSS satellites for which integrity assistance data are provided.

- Presence of the IE GNSS-RealTimeIntegrity for a GNSS satellite and signal combination indicates DNU=TRUE for this GNSS satellite and signal combination according to the Integrity Principle of Operation specified in subclause 8.1.1a of TS 38.305 [40].

NOTE 2: The UE assumes that only those satellites for which the GNSS integrity assistance data are provided are monitored by the network and can be used for integrity related applications.

Proposal 6: The previous agreement is modified as follows [see R2-2203620 for revmarked version]:

Add TIR to the IntegrityInformationRequest-r17 IE. The value range shall be based on table 9.2.4 in TR 38.857.

Proposal 4. For reporting Mode 1, AL and TTA are not needed.

## 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.

Agreements:

Proposal 1 (modified): The SRS-TEG association reporting, if any, shall always be reported along with the UE Rx – Tx time difference measurement report for Multi-RTT with no additional periodicities (8/11) and to agree the TP on report of association for Multi-RTT in the annex (11/12). Any additional parameters can be discussed in the running CRs pending RAN1 input.

Proposal 2 (modified): For UL-TDOA, configure UE TxTEG Report Config in SRS-Config IE and a new RRC message to report the changes of UE TxTEG (9/11).

Proposal 5 (modified): Each of association information of UL SRS resources with timestamp indicating the change of the Tx TEG association (8/12) and agree the TP of UE-TxTEG-Report-v17xy-IEs via RRC in the annex.

Agreements:

Proposal 6: RAN2 to agree new posSibType6-5 NR-DL-PRS-TRP-TEG-Info for the TRP Tx TEG info (10/11) and the TP of NR-DL-PRS-TRP-TEG-Info for broadcast(8/11) in the annex, FFS the description on resource association.

Proposal 8: RAN2 to agree the stage-3 design of RSTD measurements from different DL PRS resources per UE Rx TEG report in the annex (10/12).

Proposal 9 (modified): RAN2 to agree the updated stage-3 design of UE Rx-Tx time difference measurements obtained from different DL PRS resources per UE Rx TEG/ RxTx TEG in the annex (9/9), FFS the nr-UE-Tx-TEG-ID-r17 in case2 and case3 (pending RAN1).

Agreements:

Proposal 14: RAN2 to agree the following option is taken on supporting LMF to provide the TRP beam/antenna information to UE: Option a: New IE to carry the TRP beam/antenna information, e.g., NR-TRP-BeamAntennaInfo in running CR of TS37.355. (8/12)

Proposal 16: As for the TRP beam/antenna information provided by the LMF to the UE for UE-based DL-AoD, RAN2 to agree that the peak power value that is used as the reference for other resource powers on a specific angle is not provided (12/12).

Proposal 17: RAN2 to agree that the value ranges of the relative power of DL-PRS resource should be decided by RAN1 (11/12).

Proposal 18: RAN2 to agree that keep RSRP still as mandatory within the measurement results info provided by UE to LMF for DL-AOD in R17 (10/12) ), and it may be revised if there is clear agreement from RAN1.

Proposal 19: RAN2 to agree that the value ranges of the RSRPP should be decided by RAN1 (11/12).

Proposal 20: RAN2 to agree that the angle assistance information (expected angel value and uncertainty) should be per TRP (12/12).

Proposal 21: RAN2 to agree to extend the R16 IE NR-DL-PRS-AssistanceDataPerTRP-r16 to carry the expected angle assistance information (like expected RSTD and expected RSTD uncertainty)(7/12), FFS with restrictions only applied for DL-AOD positioning method waiting for RAN1 feedback.

Proposal 22: RAN2 to agree that the value ranges of the expected angle assistance (expected angel value and uncertainty) relative power of DL-PRS resource should be decided by RAN1 (8/11).

Proposal 23 (modified): RAN2 to agree to extend the R16 IE NR-DL-PRS-Resource-r16 to carry the R17 DL-PRS resource subset information, with restrictions that it is only applied for DL-AOD positioning method (8/12).

Proposal 24: RAN2 to agree that it is up to RAN1 to decide whether further description of UE behaviour needed related to the measurements and/or reporting is needed related to the prioritization of DL-AOD reporting.

Agreement:

The LOS/NLOS indicator is associated with UE measurement report and associated TRP and resource id (if there is) in each measurement report, for all RAT-dependent methods except E-CID.

Agreements:

Proposal 3 (modified): The configurable intervals on report of association of TxTEG via RRC are ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240. Relation to SRS intervals can be further checked in running CR discussion.

reportingAmount can be 1 or infinity.

Agreements:

Proposal 1: RAN2 to agree that the beam/antenna information request only applies to the UE-based DL-AOD positioning method (11/11).

Proposal 2 (modified): The following assistance data may be requested by UE for UE-based DL-AoD:

‑ losNlosInfo (10/11);

‑ beam/antenna information (11/11);

Proposal 3 (modified): The following assistance data may be requested by UE for UE-based DL-TDOA:

‑ losNlosInfo (9/11);

‑ trpTEG-Info (10/11);

Proposal 5: RAN2 to agree that both the azimuth and elevation can be optional, but at least one should be provided within the beam/antenna information (10/11).

Agreements:

Keep the running CR approach for PosCalc AD; can be further discussed in running CR discussion if anything should change.

Proposal 6: RAN2 to agree the TP of option1 (change the azimuth-r17 and elevation-r17 both to be optional, but add a restriction in the field description that at least azimuth or elevation should be present) (7/11).

## A.5.3 UE capabilities

Agreements:

Granularity of response time:

Proposal point 3.2.1-1: [for agreements] [6/9] 10ms Finer granularity is only applied for NR RAT dependent positioning methods;

Capabilities for integrity:

Proposal point 3.2.2-1: [for agreements] [10/10] For GNSS integrity capability, adapt capabilities captured in the running LPP CR R2-2201723 as baseline;

TPs for individual capability items:

Proposal point 3.3.1-1: [for agreements] [8/8] 27-1 TEG is captured as

[TPs in R2-2202494]

Proposal point 3.3.2-1: [for agreements] 27-2, 27-13, 27-13a, 27-14, 27-14a are captured as

[TPs in R2-2202494]

Proposal point 3.3.3-1: [for agreements] 27-3/27-6 are captured as

[TPs in R2-2202494]

Proposal point 3.3.4-1: [for agreements] 27-4, 27-12 are captured as

[TPs in R2-2202494]

Proposal point 3.3.5-1: [for agreements] 27-7 are captured as

[TPs in R2-2202494]

Proposal point 3.3.7-1: [for agreements] 27-9 are captured as

[TP in R2-2202494]

Proposal point 3.3.8-1: [for agreements] 27-10, 27-10a, 27-11 are captured as

[TPs in R2-2202494]

Proposal point 3.3.9-1: [for agreements] 27-20, 27-21, 27-22are captured as

[TP in R2-2202494]

Proposal point 3.3.10-1: [for agreements] 27-15---27-19 are captured as

[TPs in R2-2202494]

Proposal point 3.4-1: [for agreements] 14-1 are captured as

[TPs in R2-2202494]