3GPP TSG-RAN WG2 Meeting #118-e ***R2-22xxxxx***

Electronic Meeting, May 9 – 20, 2022

**Agenda item:** 6.11.1 / 6.11.2.8

**Source:** Qualcomm Incorporated

**Title:** [Post118-e][603][POS] 37.355 positioning CR

**Document for:**  Discussion

# 1. Introduction

This document summarizes the following email discussion:

* [Post118-e][603][POS] 37.355 positioning CR (Qualcomm)

 Scope: Update and check the CR in R2-2206247.

 Intended outcome: Agreed CR

 Deadline: Short (for RP)

##### References:

[1] R2-2205828, "Summary of LPP Updates and Open Issues".

[2] R2-2205829, "LPP Updates".

[3] R2-2206326, "Rel-17 LPP RIL".

[4] R2-2206327, "Rel-17 LPP ASN1 Review File".

[5] R2-2206328, "LPP Updates and ASN.1 Review".

[6] R2-2206247, "LPP Updates".

[7] R2-2206472, "Updated RAN1 UE features list for Rel-17 NR after RAN1 #109-e Week1", RAN1.

[8] R2-2206396, "37.355 CR for the positioning capabilities", Intel Corporation.

# 2. Discussion

The following updates to R2-2206247 have been made:

9. Update of RAN1 capabilities according to [AT118-e][627][POS] and R2-2206472

 Deleted *ppw-durationOfPRS-Processing-r17*, FG 27-3-3 Component-2, since in [ ] in R2-2206472

 *supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17* is moved under *NR-DL-PRS-ProcessingCapability-r16* (instead of *PRS-ProcessingCapabilityPerBand-r16* (per UE))

 maxCellIDsPerArea-r17 is set to 256

 maxNrOfAreas-r17 is set to 16

 Deleted the Note with the Protection Level definition (moved to Stage 2)

 Added *absoluteFrequencyPointA* and *offsetToPointA* to *NR-SRS-TxTEG-Element*

 FFS, TBD, Editor's Notes deleted

10. The following new RAN1 agreements from RAN1#109-e are implemented:

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| **Agreement**Adopt the following changes to the previous agreement made in RAN1#105e* For both UE-based and UE-assisted DL-AOD, the UE can be requested subject to UE capability to measure and report (for UE-assisted) ~~the~~*N* PRS RSRPP of the first path, where *N* can be {1, 2, 3, …, 24}.
 |

 Corresponding LPP change:

 - Replaced the
 firstPathRSRP-MeasurementReq-r17 ENUMERATED { requested }

 with
 maxDL-PRS-RSRPP-MeasurementsPerTRP-r17 INTEGER (1..24)
in *NR-DL-AoD-RequestLocationInformation*

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| **Agreement*** Support up to 32 measurement instances in a single measurement report.
* Inform RAN2/RAN3 on RAN1s decision
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 Corresponding LPP change:

 - maxMeasInstances-r17 INTEGER ::= 32

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| **Agreement**Include the following in the reply LS to RAN4, RAN2, RAN3: * In RAN1’s understanding, each measurement instance may allow up to 8 reports (or changes) of the TEG-SRS association information for each TEG ID.
* RAN1 kindly requests RAN4 for the confirmation of the understanding.
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 Corresponding LPP change:

 - maxTxTEG-Sets-r17 kept at 64 (8x8)

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| **Agreement**Support the LMF to request the Rx beam sweeping factor.**Agreement**The request from LMF on the Rx beam sweeping factor is a single bit per positioning method, which can take two values.* Value 1: Equal to the UE’s reported Rx beam sweeping factor in the corresponding capability for the band UE supports the feature, and equal to 8 for the FR2 bands that UE does not support the feature.
* Value 2: Equal to 8 (default assumption) for FR2 bands.
* The bit value should be set to the same across DL-TDOA, DL-AoD, and Multi-RTT for hybrid positioning.
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 Corresponding LPP implementation:

 - lowerRxBeamSweepingThan8-FR2-r17 ENUMERATED { requested }

 added to NR-DL-TDOA-RequestLocationInformation, NR-DL-AoD-RequestLocationInformation, and NR-Multi-RTT-RequestLocationInformation

Added RAN1 capabilities (R1-2205608):

 switchingTimeSRS-TX-OtherTX-r17 in PosSRS-RRC-Inactive-OutsideInitialUL-BWP-r17 (27-15b, component 10)

 ppw-durationOfPRS-Processing1-r17, ppw-durationOfPRS-Processing2-r17 in PRS-ProcessingCapabilityOutsideMGinPPWperType-r17 (27-3-3, component 2)

Please provide your comments on "**Draft-R2-2205847\_(CR 37355 LPP Updates)\_v03.docx**" located in the same folder as this discussion document in the Table below.

|  |  |  |
| --- | --- | --- |
| Company | LPP Section / IE | Comments |
| Huawei, HiSilicon | *CommonIEsRequestLocationInformation* | ***scheduledLocatioTime***typo=> location[Rap: Thanks. Fixed in \_v3a.] |
|  | *LOS-NLOS-IndicatorGranularity2* | If we have *LOS-NLOS-IndicatorGranularity2, we may not need to have LOS-NLOS-IndicatorGranularity1? The overhead is not that large*[Rap: I think it is clearer if we keep the *LOS-NLOS-IndicatorGranularity1*. It will be confusing if a location request includes the "both" code-point. I.e., would require additional field description and probably UE internal error handling.However, the question is do we need the granularity/type in *nr-los-nlos-IndicatorRequest-r17* at all?Given that we have added:"NOTE: If the requested type or granularity in *nr-los-nlos-IndicatorRequest* is not possible, the target device may provide a different type and granularity for the estimated *LOS-NLOS-Indicator."*the request could also be a simple BOOLEAN…? Then we don't need the IEs E *LOS-NLOS-IndicatorGranularity1* and *LOS-NLOS-IndicatorType1.*][HW] Agree with the arguments from Rapp above |
|  | NR-DL-PRS-ExpectedAoD-or-AoA | NR-DL-PRS-ExpectedAoD-or-AoA-r17 ::= CHOICE { expectedAoD-r17 SEQUENCE { expectedDL-AzimuthAoD-r17 INTEGER (0..359), expectedDL-AzimuthAoD-Unc-r17 INTEGER (0..60), expectedDL-ZenithAoD-r17 INTEGER (0..180), expectedDL-ZenithAoD-Unc-r17 INTEGER (0..30) }, expectedAoA-r17 SEQUENCE { expectedDL-AzimuthAoA-r17 INTEGER (0..359), expectedDL-AzimuthAoA-Unc-r17 INTEGER (0..60), expectedDL-ZenithAoA-r17 INTEGER (0..180), expectedDL-ZenithAoA-Unc-r17 INTEGER (0..30) }}RAN1 LS indicates that the uncertainty field can be optional as in R1-2205619**Question 2**: Whether the uncertainty field for expected AoD (expected-DL-Azimuth-AoD-Unc and expected-DL-Zenith-AoD-Unc) and expected AoA (expected-DL-Azimuth-AoA-Unc and expected-DL-Zenith-AoA-Unc) can be optional?**RAN1 Answer**: RAN1 assumes that the uncertainty field for the expected AoD (expected-DL-Azimuth-AoD-Unc and expected-DL-Zenith-AoD-Unc) and expected AoA (expected-DL-Azimuth-AoA-Unc and expected-DL-Zenith-AoA-Unc) can be optional under the condition that omitting the field means maximum uncertainty.[Rap:.Is the suggestion to add OPTIONAL to the uncertainty fields? This would require up to 256 x 4 = 1024 bits just to indicate max uncertainty…Why can't the NW not simply set the uncertainty to max value if the uncertainty is not known…? I.e., this RAN1 agreement looks useless/obvious…and seems covered by existing ASN. Instead of "omitting the field means maximum uncertainty" the field can be present with max uncertainty…] [HW] My understanding is that the signalling gain is in the case when you want to indicate max uncertainty. Then, the overhead is just one optionality bit instead of indicating the whole range of (0,..,60)[Rap: I think the question is what is the "nominal case"? I.e., is the uncertainty normally present or absent? My understanding is the former, and the expected AoA/AoD without uncertainty is the exception. If a NW can provide the expected RSTD uncertainty, it should also be able to provide the expected angle uncertainty (both depend on the a-priori UE location).]  |
|  | BeamPowerElement | We should mention in the field description that the nr-dl-prs-RelativePower and nr-dl-prs-RelativePowerFine that the UE shall ignore these two fields when received for the first element[Rap: I don't think it should be ignored (strictly speaking). It is set by the NW to (normalized) value 1 (0dB) and all additional values are relative to the first one. Maybe we can clarify:"The first *BeamPowerElement* in this list provides the peak power for this angle and is defined as 0dB power; i.e., the first value is set to '0' by the location server."][HW] but the definition/field description/field name here is “relative power”. “Normalizing it to 0dB” sounds reasonable but not aligned with the description. [Rap: I can't see the confusion. The minimum length of the *beamPowerList* is 2.][HW] I mean the name of the field and the field description both indicate that they are “relative power”. if the first item of the list is defined to be 0dB, it is no longer relative power. BeamPowerElement-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, nr-dl-prs-RelativePower-r17 INTEGER (0..30), nr-dl-prs-RelativePowerFine-r17 INTEGER (0..9) OPTIONAL, -- Need ON ...}***nr-dl-prs-RelativePowerFine***This field provides finer granularity for the *nr-dl-prs-RelativePower*.The total relative power of the DL-PRS Resource is given by *nr-dl-prs-RelativePower* + *nr-dl-prs-RelativePowerFine.*Scale factor 0.1 dB; range 0 to 0.9 dB.[Rap: I see. Modified in \_v05 as follows:***beamPowerList*** This field provides the relative power between DL-PRS Resources for the angle given by *azimuth* and *elevation*.The first *BeamPowerElement* in this list provides the peak power for this angle and is defined as 0dB power; i.e., the first value is set to '0' by the location server. All the remaining *BeamPowerElement*'s in this list provide the relative DL-PRS Resource power relative to this first element in the list.***nr-dl-prs-RelativePower***Except for the first element in *beamPowerList*, this field provides the relative power of the DL-PRS Resource, relative to the first element in the *beamPowerList*.For the first element in *beamPowerList*, this field provides the peak power for this angle normalised to 0 dB.Scale factor 1 dB; range 0..30 dB.***nr-dl-prs-RelativePowerFine***This field provides finer granularity for the *nr-dl-prs-RelativePower*.The total relative power of the DL-PRS Resource is given by *nr-dl-prs-RelativePower* + *nr-dl-prs-RelativePowerFine.*Scale factor 0.1 dB; range 0 to 0.9 dB.Note: For the first element in *beamPowerList*, this field is not needed.] |
| Huawei, HiSilicon2 | *NR-On-Demand-DL-PRS-Configurations* | It seems that the following agreement has not been captured in the spec now. What we need to do is only to mention in the field description the range of the PRS parameters that can be explicitly requested by the UE. Proposal2 (modified): For UE-initiated on-demand PRS request by explicit parameter, no new list is added to the signalling for the network to provide a list of parameters to the UE that the UE should only request within the scope of the list when such configuration is provided. If the network provides predefined OD-PRS configurations, the UE can only request explicit parameters within the scope of those configurations; can discuss in the LPP CR if something needs to be captured for this.[Rap: Added the Note to the field description for *nr-on-demand-DL-PRS-Information* in *NR-On-Demand-DL-PRS-Request*] |
| Huawei, HiSilicon2 | NR-DL-AoD-AdditionalMeasurementElement | R1 has agreed on the following**Agreement**For DL-AoD, the additional RSRPP measurement takes from -30 dB to 30 dB as the reporting range in reference to the first RSRPP measurement* Send an LS to RAN2 and RAN4 informing of the agreement.

[Rap: There seems nothing what RAN2 can do/decide; e.g., what should be the step size? I think we must wait for the RAN4 mapping Table. Maybe the mapping table can be backwards compatible using the existing value range.][HW] The step size can be 1dB as applied to additional RSRP mapping in Rel-16 for DL-TDOA and Multi-RTT in the following. Hence, the range can be (0..61)NR-DL-TDOA-AdditionalMeasurementElement-r16 ::= SEQUENCE {    nr-DL-PRS-ResourceID-r16        NR-DL-PRS-ResourceID-r16                     OPTIONAL,    nr-DL-PRS-ResourceSetID-r16     NR-DL-PRS-ResourceSetID-r16                   OPTIONAL,    nr-TimeStamp-r16                NR-TimeStamp-r16,    nr-RSTD-ResultDiff-r16          CHOICE {            k0-r16                      INTEGER (0..8191),            k1-r16                      INTEGER (0..4095),            k2-r16                      INTEGER (0..2047),            k3-r16                      INTEGER (0..1023),            k4-r16                      INTEGER (0..511),            k5-r16                      INTEGER (0..255),            ...    },    nr-TimingQuality-r16            NR-TimingQuality-r16,    nr-DL-PRS-RSRP-ResultDiff-r16   INTEGER (0..61)                                 OPTIONAL,    nr-AdditionalPathList-r16       NR-AdditionalPathList-r16                      OPTIONAL,    ...,    [[    nr-UE-Rx-TEG-ID-r17             INTEGER (0..maxNumOfRxTEGs-1-r17)               OPTIONAL,    nr-DL-PRS-FirstPathRSRP-ResultDiff-r17                                   INTEGER (0..61)                                 OPTIONAL,    nr-los-nlos-IndicatorPerResource-r17                                   LOS-NLOS-Indicator-r17                         OPTIONAL,    nr-AdditionalPathListExt-r17    NR-AdditionalPathListExt-r17                   OPTIONAL    ]]}In addition, on first path RSRPP reporting for DL-TDOA and Multi-RTT, RAN1 agreed the following. **Agreement**Support reporting absolute RSRPP for the PRS-RSRPP measurement in DL-TdoA and multi-RTT for at least the additional paths. Hence, for all RSRPP reporting for first measurement/additional measurement/additional path of DL-TDOA and Multi-RTT, the range should be (0..126).Note: as commented earlier, for all RSRPP reporting for the additional (first path) RSRPP of DL-AoD, the range should be (0..61).[Rap: Changed the *nr-DL-PRS-FirstPathRSRP-ResultDiff-r17* in *NR-DL-AoD-AdditionalMeasurementElement-r17* to INTEGER (0..61).For DL-TDOA/mRTT, the additional paths RSRP already have the range (0..126) in *NR-AdditionalPathListExt-r17*.Are you suggesting that the additional RSRPP measurements should also have the range (0..126)? The agreement above mentions only "for at least the additional paths".] |
| Huawei, HiSilicon2 | NR-DL-AoD-RequestLocationInformationNR-DL-TDoA-RequestLocationInformationNR-MultiRTT-RequestLocationInformation | R1 has agreed on the following **Agreement**The request from LMF on the Rx beam sweeping factor is a single bit per positioning method, which can take two values.* Value 1: Equal to the UE’s reported Rx beam sweeping factor in the corresponding capability for the band UE supports the feature, and equal to 8 for the FR2 bands that UE does not support the feature.
* Value 2: Equal to 8 (default assumption) for FR2 bands.
* The bit value should be set to the same across DL-TDOA, DL-AoD, and Multi-RTT for hybrid positioning.

[Rap: Added to \_v04][HW] We may need to set the TYPE of the field to be Boolean such that the two values can be indicated. Value 0 indicate beam sweeping factor equal to capability and value 1 indicate beam sweeping factor equal to 8 - lowerRxBeamSweepingThan8-FR2-r17 ENUMERATED { requested }[Rap: I understand that "Value 2" is legacy/existing behaviour. When the *lowerRxBeamSweepingThan8-FR2-r17* is absent, the UE behaves as in Rel-16. When present, the UE is requested to use a reduced beam sweeping factor.Essentially the same as for the measurement samples: We only have a request for the reduced samples m=1, but no explicit request for the Rel-16 behaviour (m=4). Absence of the field means legacy/Rel-16 behaviour.] |
| Huawei, HiSilicon2 | NR-DL-PRS-ProcessingCapability | R1 has agreed on the following. Note that the capability is only for Type1A and Type1B now. **Agreement*** For UE supporting Type-1A or Type-1B PRS processing window, UE may report (N, T) and (N2, N2) in the capability signalling
	+ The reported (N, T) in the capability signalling is similar to the legacy (N, T) in FG 13-1, which assumes to measure the N ms of PRS within a PPW but the processing of the measured PRS may be outside the PRS processing window.
	+ The reported (N2, T2) in the capability signalling assumes to measure and process the N2 ms of PRS only within the PRS processing window length (which covers the T2).
	+ Add the following Note to the corresponding FG in the UE feature spreadsheet
		- Note: The (N2, T2) UE capabilities is interpreted such that the UE is capable of measuring up to N2 ms PRS within a PPW and is capable of completing the PRS processing within the PPW, e.g., if the time duration from the last symbol of the measured PRS resource(s) inside the PPW, to the end of PPW is not smaller than T2 ms
* For UE supporting Type-2 PRS processing window, UE may report (N, T) in the capability signalling similar to the legacy (N, T) in FG 13-1
	+ Assuming the UE to measure the PRS within the PRS processing window and but the processing of the measured PRS may be outside a PRS processing window.
* Note: when the processing time T exceeds the PPW length, other DL data channels/signals that are outside of the PPW but within the periodic T can be received by the UE.
* Discuss in the UE feature session the values {N, T} for all types.

[Rap: I have not seen the corresponding capability values. E.g., what are the values for (N,T) etc. The above is not implementable in LPP][Rap: Now added to\_v05 based on R1-2205608] |
| Huawei, HiSilicon2 |  | Need to check for the other update in the UE capability and LPP parametersR1-2205406 LS on updates of RRC parameters for Rel-17 positioning enhancements RAN1, CATTFinal LS to RAN2 is endorsed in R1-2205406.[Rap: R1-2205406 should be covered by \_v04]UE features for NR positioning enhancements[109-e-R17-UE-features-ePos-01] Email discussion UE on features for NR positioning enhancements – Ralf (AT&T)* 1st check point for LS to RAN2: May 13
* Final check point for any remaining issues: May 20

R1-2205510 Session Notes for Agenda Item 8.16.5 Ad-Hoc Chair (AT&T)All agreements under this agenda item are captured in R1-2205510[Rap: R1-2205510 seems implemented in \_v03 (i.e., LS has been received in R2-2206472. However, what is missing is the new Capability Sheet, including the PRS processing window capabilities above.][Rap: Now added.] |
| ZTE | *NR-DL-TDOA-ProvideCapabilities**NR-DL-AoD-ProvideCapabilities**NR-Multi-RTT-ProvideCapabilities* | For v04 version:Current *nr-dl-prs-AssistanceDataValidity-r17* is to tell LMF how many areas UE can support. However this area number is useless since LMF only provides UE with a list of cells, not several lists of cells corresponding several areas. In addition, we also delete the area ID.So we suggest to change the IE to boolean value to indicate whether UE support pre-AD with area validity or not; or change the IE to indicate the maximum number of cells in a cell list.[Rap: Although, the area-id has been removed, the *maxNrOfAreas-r17* is still needed. Each *method-ProvideAssistanceData-r16* provides one instance of the assistance data, valid for the *Area-ID-CellList-r17*. The number of instances/areas a UE can store needs to be a UE capability (i.e., a UE can not store/handle an arbitrary large number of areas/instances.] |
| CATT | *–NR-DL-TDOA-LocationInformation*locationSource-r17 LocationSource-r13 OPTIONAL -- cond batch2 | Typo: -- cond batch2 should be -- Cond batch2[Rap: Thanks. Fixed in \_v05] |
| CATT | – *NR-Multi-RTT-SignalMeasurementInformation*NR-SRS-TxTEG-Element-r17 ::= SEQUENCE { nr-TimeStamp-r17 NR-TimeStamp-r16 OPTIONAL, -- Need OP nr-UE-Tx-TEG-ID-r17 INTEGER (0..maxNumOfTxTEGs-1-r17), carrierFreq-r17 SEQUENCE { offsetToPointA-r17 INTEGER (0..2199) }, | The carrierFreq may be OPTIONAL to save the signalling.[Rap: Changed in \_v05] |
| Ericsson | *NR-TRP-BeamAntennaInfo* | The field descriptions are incorrect. Should be***associated-DL-PRS-ID***This field specifies the dl-PRS-ID of the associated TRP,  from which certain field data is obtained, see the field descriptions of nr-*TRP-BeamAntennaAngles* and *lcs-GCS-TranslationParameter* fields ***nr-TRP-BeamAntennaAngles*** This field provides the relative power between DL-PRS Resources per angle per TRP. If this field is absent and the field *associated-DL-PRS-ID* is present, the *nr-TRP-BeamAntennaAngles* for this TRP are obtained from the *nr-TRP-BeamAntennaAngles of the associated TRP.*   ***lcs-GCS-TranslationParameter***This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [44]. If this field and the *associated-DL-PRS-ID* field both are absent, the *azimuth* and *elevation* are provided in a GCS. If this field is absent and the *associated-DL-PRS-ID field* is present, then the *lcs-GCS-TranslationParameter* for this TRP is obtained from the *lcs-GCS-TranslationParameter* of the associated TRP.[Rap: Changed in \_v06.] |
| Ericsson | *NR-DL-PRS-BeamInfo* | This is more tricky – also these are incorrect. Any suggestion how to correct them with backward compatibility. Basically, a legacy UEdo not expect *lcs-GCS-TranslationParameter* to be provided with the *associated-DL-PRS-ID*Should be like below.: An ugly solution would be to add yet another beam info set that can be present with the associated-DL-PRS-ID to ensure backward compatibility.***associated-DL-PRS-ID***This field specifies the dl-PRS-ID of the associated TRP,  from which certain field data is obtained, see the field descriptions of *dl-PRS-BeamInfoSet* and *lcs-GCS-TranslationParameter* fields ***dl-PRS-BeamInfoSet*** This field provides the relative power between DL-PRS Resources per angle per TRP. If this field is absent and the field *associated-DL-PRS-ID* is present, the *dl-PRS-BeamInfoSet* for this TRP are obtained from the *dl-PRS-BeamInfoSet of the associated TRP.*   ***lcs-GCS-TranslationParameter***This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [44]. If this field and the *associated-DL-PRS-ID* field both are absent, the *azimuth* and *elevation* are provided in a GCS. If this field is absent and the *associated-DL-PRS-ID field* is present, then the *lcs-GCS-TranslationParameter* for this TRP is obtained from the *lcs-GCS-TranslationParameter* of the associated TRP.[Rap: Rel-16 change. This requires a separate discussion.] |