3GPP TSG RAN WG2 Meeting #118-e Draft R2-220xxxx

**Electronic meeting, 9- 20 May, 2022**

**Agenda item:** 6.11.2.7

**Source:** Intel Corporation

**Title:** Report of [AT118-e][627][POS] Positioning UE capabilities (Intel)

**Document for:**  Discussion and decision

# Introduction

This is the report of following offline discussion:

* [AT118-e][627][POS] Positioning UE capabilities (Intel)

Scope: Discuss proposals on UE capabilities, taking into account the related tdocs: R2-2204933, R2-2205009, R2-2206330.

Intended outcome: Endorsed TPs to some or all of 37.355, 38.331, 38.306, 38.822 (without CBs if possible)

Deadline: Tuesday 2022-05-17 1800 UTC

I would like to split the discussion into two phases:

**Phase 1**: to provide your view on issues;     Deadline:  Friday 2022-05-13 1800 UTC

**Phase 2**: To check TPs; Deadline:  Tuesday 2022-05-17 1800 UTC

Note: we may capture latest RAN1/4 feature list if they can send LS to us in the first week.

# Annex: companies’ point of contact

|  |  |  |
| --- | --- | --- |
| **Company** | **Point of contact** | **Email address** |
| Intel Corporation | Yi Guo | Yi.guo@intel.com |
| Huawei, HiSIlicon | Yinghao Guo | Yinghaoguo@huawei.com |
| Ericsson | Ritesh Shreevastav | [Ritesh.shreevastav@ericsson.com](mailto:Ritesh.shreevastav@ericsson.com) |
| Samsung | Taeseop Lee | Taeseop.lee@samsung.com |

# Discussion

## RAN1/4 feature lists

LPP Rapporteur provided the updated LPP CR based on latest RAN1 and RAN4 situation in

|  |
| --- |
| R2-2205828 Summary of LPP Updates and Open Issues Qualcomm Incorporated  R2-2205829 LPP Updates Qualcomm Incorporated |

Following proposals in R2-2204933 have been covered by LPP Rapporteur’s CR.

|  |
| --- |
| **Proposal 3:For 27-2-1 (LPP change), maxDL-PRS-FirstPathRSRP-MeasPerTRP-r17 is per band capability and should be moved into PRS-ProcessingCapabilityPerBand-r17 (H049).**  Updated in LPP CR as  DL-AoD-MeasCapabilityPerBand-r16 ::= SEQUENCE {  freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,  simul-NR-DL-AoD-DL-TDOA-r16 ENUMERATED { supported } OPTIONAL,  simul-NR-DL-AoD-Multi-RTT-r16 ENUMERATED { supported } OPTIONAL,  ...,  [[  maxDL-PRS-FirstPathRSRP-MeasPerTRP-r17 ENUMERATED { n1, n2, n4, n8, n16, n24 } OPTIONAL,  dl-PRS-MeasRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL  ]]  }  **Proposal 4:For 27-13 (LPP change), 27-13 is missing, and should be added as**  **supportOfDL-PRS-AdditionalPathRSRP-MeasAbove2-r17 ENUMERATED { n4, n6, n8 } OPTIONAL,--27-13**  Updated in LPP CR as  additionalPathsExtSupport-r17.  **Proposal 5:For 27-13a/27-14a (LPP change), supportOfDL-PRS-FirstPathRSRP-Meas-r17 is per band capability, and should be moved into PRS-ProcessingCapabilityPerBand-r17 (H037) (H054)**  Updated in LPP CR as  DL-TDOA-MeasCapabilityPerBand-r17 ::= SEQUENCE {  freqBandIndicatorNR-r17 FreqBandIndicatorNR-r16,  supportOfDL-PRS-FirstPathRSRP-r17 ENUMERATED { supported } OPTIONAL,  dl-PRS-MeasRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL,  ...  }  **Proposal 6:For 27-14 (LPP change), 27-14 is missing, and should be added as**  **supportOfDL-PRS-AdditionalPathRSRP-MeasAbove2-r17 ENUMERATED { n4, n6, n8 } OPTIONAL,--27-14**  **Has been covered in QC’s CR as** additionalPathsExtSupport-r17.  **Proposal 7:For 27-3-2 (LPP change), see I008, v005**  **prs-ProcessingWindowType1A-r17 ENUMERATED { supported } OPTIONAL, -- 27-3-2**  **prs-ProcessingWindowType1B-r17 ENUMERATED { supported } OPTIONAL, -- 27-3-2**  **prs-ProcessingWindowType2-r17 ENUMERATED { supported } OPTIONAL, -- 27-3-2**  **should be updated as**  **-- R1 27-3-2: DL PRS measurement outside MG and in a PRS processing window**  **prs-ProcessingWindowType1A-r17 ENUMERATED { option1, option2, option3} OPTIONAL,**  **prs-ProcessingWindowType1B-r17 ENUMERATED { option1, option2, option3} OPTIONAL,**  **prs-ProcessingWindowType2-r17 ENUMERATED { option1, option2, option3} OPTIONAL**  **has been covered by QC’s CR.**  **Proposal 8:For 27-6 (LPP change), component 2 is added, and to be put under PRS-ProcessingCapabilityPerBand-r17, as**  dl-PRS-SymbolsDurationEveryTms-r17 SEQUENCE {  Tms-r17 ENUMERATED { m8, m16, m20, m30, m40, m80, m160, m320, m640, m1280 },  SymbolsDuration-r17 ENUMERATED { mdot125, mdot25, mdot5, m1, m2, m4, m6, m8, m12, m16, m20, m25, m30, m32, m35, m40, m45, m50}  } OPTIONAL,  **Has been captured in QC’s CR as**  durationOfPRS-Processing-RRC-Inactive-r17 SEQUENCE {  durationOfPRS-ProcessingSymbols-r17 ENUMERATED {nDot125, nDot25, nDot5, n1,  n2, n4, n6, n8, n12, n16, n20, n25,  n30, n32, n35, n40, n45, n50},  durationOfPRS-ProcessingSymbolsInEveryTms-r17  ENUMERATED {n8, n16, n20, n30, n40, n80,  n160,n320, n640, n1280},  ...  } OPTIONAL,  **Proposal 12:For 27-9 (LPP change), remove lowerRxBeamSweepingThan8-FR2-r17 and change numberOfRxBeamSweepingFactor-r17 to**  numberOfRxBeamSweepingFactorFR2-r17 ENUMERATED { n1, n2, n4, n6 } OPTIONAL,  **Covered by QC’s CR as**  lowerRxBeamSweepingThan8-FR2-r17 ENUMERATED { n1, n2, n4, n6 } OPTIONAL,  ...  **Proposal 15:For 27-20 (LPP change), 27-20, Component 1/2 are captured as**  **relationshipTargetPRS-ResourceAndAssociattedSubset-r17 ENUMERATED { sameSet, DiffSet, both } OPTIONAL, -- Component 1 and 2 of 27-20**  **Has been covered by QC’S CR as**  dl-PRS-ResourcePrioritySubset-Sup-r17 ENUMERATED { sameSet, differentSet, sameOrDifferentSet }  OPTIONAL,  **Proposal 17:For 27-18a, 27-18b, 27-18c (LPP change), 27-18a, 27-18b, 27-18c, are missing, should be added under PRS-ProcessingCapabilityPerBand-r17 as**  **nr-DL-PRS-MeasRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL, -- 27-18a, 27-18b, 27-18c,**  has been captured in QC’s CR as  DL-AoD-MeasCapabilityPerBand-r16 ::= SEQUENCE {  freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,  simul-NR-DL-AoD-DL-TDOA-r16 ENUMERATED { supported } OPTIONAL,  simul-NR-DL-AoD-Multi-RTT-r16 ENUMERATED { supported } OPTIONAL,  ...,  [[  maxDL-PRS-FirstPathRSRP-MeasPerTRP-r17 ENUMERATED { n1, n2, n4, n8, n16, n24 } OPTIONAL,  dl-PRS-MeasRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL  ]]  } |

Following proposals are not covered by LPP Rapporteur CR, we would like to check companies’ view.

**Discussion point 1-1: Do you agree to Proposal 1, 2, 9, 10 and 16as below*?***

**Proposal 1:For 27-1 (LPP change), clarify that a single value for nr-UE-RxTEG-ID-MaxSupport-r17 is reported when both multi-RTT and DL-TDOA are supported (H015)**

**Proposal 2: For 27-1 (LPP change), remove value n3 from nr-UE-RxTxTEG-ID-MaxSupport-r17 (H016)**

**Proposal 9:For 27-4, 27-12 (LPP change), wait further inputs from RAN1 (H033, H034).**

**Proposal 10:For 27-7 (LPP change), open issue has been resolved by RAN1, no change is needed for LPP.**

**Proposal 16:For 27-17 (LPP change), 27-17 PRS processing in RRC\_INACTIVE, RAN1 has agreed not include it in LPP, and therefore should be removed from LPP spec. (H036)**

nr-DL-PRS-ProcessingRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL

|  |  |  |
| --- | --- | --- |
| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Huawei, HiSilicon (proporent) | yes |  |
| Qualcomm | yes | P9: I think this should only be H034. H033 is discussed in [631] |
| Samsung | yes |  |

**Discussion point 1-2: Do you agree that 27-8 has been captured as bit 5 of nr-PosCalcAssistanceSupport*?***

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| --- | --- | --- |
| 27. NR\_pos\_enh | 27-8 | Support of PRS TEG association information for UE-based DL-TDOA |

nr-PosCalcAssistanceSupport

bit 5 indicates whether the field nr-DL-PRS-TRP-TEG-Info in IE NR-PositionCalculationAssistance is supported or not.

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| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Huawei, HiSIlicon | Yes |  |
| Qualcomm | Yes |  |
| Samsung | yes |  |

**scussion point 1-3: Do you agree that 27-21 is missing, and should be added as**

|  |  |  |  |
| --- | --- | --- | --- |
| 27. NR\_pos\_enh | 27-21 | PRS boresight direction for UE-assisted DL-AoD | Support of assistance data enhancement to indicate the boresight direction of a PRS resource for UE-assisted DL-AoD. |

**nr-DL-PRS-BoresightInfoSup-r17 ENUMERATED { supported } OPTIONAL, -- 27-21**

|  |  |  |
| --- | --- | --- |
| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Huawei, HiSIlicon | Yes |  |
| Qualcomm | It's not missing… | …it is already in LPP with the LPP IE name (which came from Rel-16):  nr-DL-PRS-BeamInfoSup-r17 ENUMERATED { supported } OPTIONAL, |
|  |  |  |

**Discussion point 1-4: Do you agree that 27-22 has been captured as beamInfoSup of nr-PosCalcAssistanceSupport*?***

|  |  |
| --- | --- |
| 27-22 | PRS beam pattern for UE-based DL-AoD |

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

beamInfoSup (1),

|  |  |  |
| --- | --- | --- |
| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Huawei, HiSilicon | Yes |  |
| Qualcomm | Yes |  |
| Samsung | yes |  |

R2-2206330 On Resolving PPW Capability discrepancy Ericsson

R2-2206330 discussed 27-3-2

|  |  |  |
| --- | --- | --- |
| 27-3-2 | DL PRS measurement outside MG and in a PRS processing window | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing window  2. Support of priority handing options of PRS: Option1, Option2 or Option3   * 1. Option 1: UE may indicates support of two priority states.      1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS      2. State 2: PRS is lower priority than all PDCCH/PDSCH/CSI-RS   2. Option 2: UE may indicate support of three priority states      1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS      2. State 2: PRS is lower priority than PDCCH and URLLC PDSCH and higher priority than other PDSCH/CSI-RS         1. Note: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.      3. State 3: PRS is lower priority than all PDCCH/PDSCH/CSI-RS   3. Option 3: UE may indicate support of single priority state      1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS |

And proposed:

[Proposal 1 UE PPW capabilities are provided to gNB via RRC and captured in TS 38.306.](#_Toc102670848)

[Proposal 2 An enumerated supported on the PPW feature capability is provided via LPP to LMF.](#_Toc102670849)

[Proposal 3 The detailed LPP PPW capability is removed.](#_Toc102670850)

Considering 27-3-2 has been captured in both RRC and LPP as

prs-ProcessingWindowType1A-r17            ENUMERATED { option1, option2, option3}   OPTIONAL,

prs-ProcessingWindowType1B-r17            ENUMERATED { option1, option2, option3}   OPTIONAL,

prs-ProcessingWindowType2-r17             ENUMERATED { option1, option2, option3}   OPTIONAL,

Then seems the only proposal is to remove detailed LPP PPW capability, and only indicate the support of PPW in LPP as

~~prs-ProcessingWindowType1A-r17            ENUMERATED { option1, option2, option3}   OPTIONAL,~~

~~prs-ProcessingWindowType1B-r17            ENUMERATED { option1, option2, option3}   OPTIONAL,~~

~~prs-ProcessingWindowType2-r17             ENUMERATED { option1, option2, option3}   OPTIONAL,~~

prs-ProcessingWindow-r17            ENUMERATED { support}   OPTIONAL

**Discussion point 1-5: Do you agree the proposal 2 and 3 in R2-2206330 *?***

|  |  |  |
| --- | --- | --- |
| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Huawei, HiSIlicon | No | We just need to follow R1 agreement for UE capability for PPW in RRC and LPP |
| Ericsson | Yes | It is strange that UE has to provide granular detailed capabilities to two different NW nodes. It is clear that gNB requires it to configure PPW. However, it is unclear as why would LMF require it. There are no compelling reasons.  Further RAN1 is discussing to merge 27-2-2 and 27-2-3 as gNB would also need 27-2-3. |
| Qualcomm | No | See 27-3-2, 27-3-3  PRS processing capabilities need to be know at LMF (same as it is the case in Rel-16). This is not different w/wo PPW. |
| Samsung | No | From my understanding, there is no clear consensus on how the PPW can be properly configured via the required signalling procedure between UE, LMF, and gNB, which is also being discussed in another offline discussion [635]. Thus, I’m not sure whether the LMF really does not need to know the detailed PPW capability information and want to follow the RAN1 agreement for now. |

## RAN2 related features

R2-2205009 [H022] Summary of R2-agreed capabilities for R17 POSenh Huawei, HiSilicon

R2-2205009 summarized the UE capabilities agreed by R2 for R17 POSenh. The changes looks good. TS38.322 CR should be provided by CR editor when Rel-17 capability is stable, i.e. not this meeting. Therefore in this meeting, we only need to check whether the content of R2-2205009 is correct or not, and the changes will be merged by TS Editor later.

**Discussion point 3.2-1: Do you agree the RAN2 features list shown in R2-2205009? Please add if anything is missing*?***

|  |  |  |
| --- | --- | --- |
| **Company’s name** | **Yes or No?** | **Comments, if any** |
| Huawei, HiSilicon (proporent) | Yes |  |
| Qualcomm | Yes |  |
|  |  |  |

# Summary report and proposals

**For agreement:**

**Online discussion:**

# UE feature list (For reference)

RAN1 NR\_pos\_enh

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 27. NR\_pos\_enh | 27-1-1 | UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning | 1. Support of UE-RxTEGs for UE-assisted DL TDOA and/or Multi-RTT positioning  2. The maximum number of UE-RxTEG, which is supported and reported by UE for UE assisted DL TDOA and/or Multi-RTT positioning  nr-UE-RxTEG-ID-MaxSupport-r17 ENUMERATED {n1, n2, n3, n4, n6, n8} OPTIONAL, -- 27-1-1 for both DL TDOA and multi-RTT | 13-1, one or more of {13-3, 13-4} | No |  | UE-RxTEG reporting is not supported and no assumption can be made on the UE Rx timing errors for the measurements | per band | n/a | n/a | n/a | Component 1 candidate values: {UE-assisted DL TDOA, Multi-RTT positioning, UE-assisted DL TDOA and Multi-RTT positioning}  Component 2 candidate values: {1, 2, 3, 4, 6, 8}  Note: a single value is reported when both multi-RTT and DL-TDOA are supported  Need for location server to know if the feature is supported  If the UE does not include RxTEG-ID associated with a measurement, no assumption can be made on the UE Rx timing errors for this measurement  Note: The “per band” reporting on this capability does not imply, that the RxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTEG ID can span from 0, up to 31 | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-1-2 | Support of UE-TxTEGs for UL TDOA | The maximum number of UE-TxTEG for SRS resource for positioning, which is supported and reported by UE for UL TDOA  nr-UE-TxTEG-ID-MaxSupport-r17 ENUMERATED {n1, n2, n3, n4, n6, n8} OPTIONAL -- 27-1-2 for UL TDOA | 13-8 | Yes |  | UE-TxTEGs for UL TDOA is not supported and no assumption can be made on the UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}  Need for location server to know if the feature is supported  Note: It should support the serving gNB to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB for UL TDOA  Note: If the UE does not include TxTEG-ID associated with a SRS resource for positioning, no assumption can be made on the UE Tx timing error for this SRS resource for positioning. | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-1-2a | Support of UE-TxTEGs for Multi-RTT positioning | The maximum number of UE-TxTEG, which is supported and reported by UE for Multi-RTT positioning  nr-UE-TxTEG-ID-MaxSupport-r17 ENUMERATED {n1, n2, n3, n4, n6, n8} OPTIONAL, -- 27-1-2a for multi-RTT, | 13-4, 13-8 | No |  | UE-TxTEGs for Multi-RTT positioning is not supported and no assumption can be made on the UE Tx timing error for the SRS resource for positioning | per band | n/a | n/a | n/a | The candidate values are {1,2,3,4,6,8}  Need for location server to know if the feature is supported  If the UE does not include TxTEG-ID associated with a measurement, no assumption can be made on the UE Tx timing errors for this SRS resource for positioning  Note: It should support the LMF to request the UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF for Multi-RTT if Multi-RTT is supported by UE | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-1-3 | Support of UE-RxTxTEGs for Multi-RTT | The maximum number of UE-RxTxTEG, which is supported and reported by UE for Multi-RTT positioning  nr-UE-RxTxTEG-ID-MaxSupport-r17 ENUMERATED {n1, n2, n3, n4, n6, n8, n12, n16,  n24, n32, n36, n48, n64} OPTIONAL, -- 27-1-3 for multi-RTT | 13-4 and 13-8 | No |  | UE RxTx for Multi-RTT is not supported and no assumption can be made on the UE RxTx timing error for the measurement | per band | n/a | n/a | n/a | The candidate values are {1, 2, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64}  Need for location server to know if the feature is supported  If the UE does not include RxTxTEG-ID associated with a measurement, no assumption can be made on the UE RxTx timing errors for this measurement  Note: The “per band” reporting on this capability does not imply, that the RxTxTEG IDs in the measurement report are grouped per band; In the measurement report, the RxTxTEG ID can span from 0, up to 255 | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-1-4 | Support of UE Rx TEGs for measuring the same DL PRS resource | The maximum number of different UE-RxTEGs that a UE can support to measure the same DL PRS of a TRP  measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17 ENUMERATED {n2, n3, n4, n6, n8} OPTIONAL, -- 27-1-4 for both DL TDOA | 27-1-1 | No |  | Up to 1 RxTEG is used to measure the same DL PRS resource of a TRP | per band | n/a | n/a | n/a | The candidate values are {2, 3, 4, 6, 8}  Need for location server to know if the feature is supported | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-1-4a | Support of UE Rx TEGs for measuring the same DL PRS resource simultaneously | The maximum number of UE Rx TEGs for measuring the same DL PRS resource simultaneously  measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17 ENUMERATED {n1, n2, n3, n4, n6, n8} OPTIONAL, -- 27-1-4a for both DL TDOA and multi-RTT | 27-1-4 | No |  | No assumption can be made regarding multiple Rx TEGs measuring the same DL PRS resource simultaneously | Per band | n/a | n/a | n/a | The candidate values are {1,2,34,6,8}  Need for location server to know if the feature is supported. | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-2-1 | DL PRS RSRPP measurement report of the first path for UE-assisted DL-AoD | 1.) Support of measuring and reporting the PRS RSRPP of the first path for DL-AoD positioning method  2.) The maximum number of first path PRS RSRPP per TRP  maxDL-PRS-FirstPathRSRP-MeasPerTRP-r17 ENUMERATED { n2, n4, n8, n16, n24 } OPTIONAL, --27-2-1, FFS per UE or Per band | 13-5 | No |  | DL PRS RSRPP measurement report of the first path for UE-assisted DL-AoD is not supported | per band | n/a | n/a | n/a | Component 2 candidate values: 1, 2,4,8,16,24  Need for location server to know if the feature is supported  The maximum number of first path PRS RSRP per TRP should be less than or equal to the maximum number of PRS RSRP (27-2-2)  [Note: Having FG 13-5 as the prerequisite FG does not imply that in a measurement report, reporting PRS-RSRP of a PRS resource should be the prerequisite of reporting PRS-RSRPP for the first path of the PRS resource] | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-2-2 | DL PRS RSRP reporting for more than 8 measurements for UE-assisted DL-AoD positioning | Support reporting K> 8 DL PRS RSRP measurements per TRP.  Note: Multiple RSRPs corresponding to same or different Rx Beam index should be able to be reported for a given PRS resource for different timestamps.  maxDL-PRS-RSRP-MeasurementFR1-r17 ENUMERATED { n16, n24 } OPTIONAL,  maxDL-PRS-RSRP-MeasurementFR2-r17 ENUMERATED { n16, n24 } OPTIONAL, | 13-5 | No |  | UE report of more than 8 DL PRS-RSRP is not supported. | Per UE | n/a | Yes | n/a | The candidate values are {16, 24}  Need for location server to know if the feature is supported  The maximum number of reported DL PRS RSRP in the capability signaling should be no less than the maximum number of reported DL PRS RSRPP of the first path in the capability signaling | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-3-1 | M-sample measurements | The capability to support reporting a measurement based on measuring M=1 samples (instances) of a DL PRS resource set  supportedDL-PRS-ProcessingSamples-r17 ENUMERATED { m1 } OPTIONAL, | 13-1 | No |  | If the UE does not provide the capability, the UE is assumed to support M=4 only | per band | n/a | n/a | n/a | The candidate values are {1 [FFS others]}  Need for location server to know if the feature is supported  Note: The sample number M=1 does not account for the potential AGC sample  Note: this feature is supported for both UE-assisted and UE based positioning | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing window  2. Support of priority handing options of PRS: Option1, Option2 or Option3   * 1. Option 1: UE may indicates support of two priority states.      1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS      2. State 2: PRS is lower priority than all PDCCH/PDSCH/CSI-RS   2. Option 2: UE may indicate support of three priority states      1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS      2. State 2: PRS is lower priority than PDCCH and URLLC PDSCH and higher priority than other PDSCH/CSI-RS         1. Note: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.      3. State 3: PRS is lower priority than all PDCCH/PDSCH/CSI-RS   3. Option 3: UE may indicate support of single priority state      1. State 1: PRS is higher priority than all PDCCH/PDSCH/CSI-RS   prs-ProcessingWindowType1A-r17 ENUMERATED { supported } OPTIONAL, -- 27-3-2  prs-ProcessingWindowType1B-r17 ENUMERATED { supported } OPTIONAL, -- 27-3-2  prs-ProcessingWindowType2-r17 ENUMERATED { supported } OPTIONAL, -- 27-3-2  supportedPrioHandlingOptOfPPW-r17 ENUMERATED { option1,option2,option3 } OPTIONAL, | 13-1 | Yes |  | DL PRS measurement outside MG and in a PRS processing window is not supported | per band | n/a | n/a | n/a | Component 1 candidate values: One or more of {Type 1A, Type 1B, Type 2}  Component 2 candidate values: {option1, option2, option3}  Need for location server to know if the feature is supported  Note: Component 2 can be reported per supported band for each type supported by the UE, details left to RAN2  Note:   * Type 1A refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR * Type 1B refers to the determination of prioritization between DL PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected * Type 2 refers to the determination of prioritization between DL PRS and other DL signals/channels only in DL PRS symbols within the PRS processing window   Note: When the UE determines higher priority for other DL signals/channels over the PRS measurement/processing, the UE is not expected to measure/process DL PRS which is applicable to all of the above capability options  Note: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-3-3 | DL PRS Processing Capability outside MG - buffering capability | 1. DL PRS buffering capability  a) Type 1 – sub-slot/symbol level buffering  b) Type 2 – slot level buffering  [2. Maximum duration of DL PRS symbols N in units of ms a UE can process in the first part of a PRS processing window assuming maximum DL PRS bandwidth in MHz, such that the UE is capable of reporting the measurements T-N ms after the last PRS symbol]  3. Max number of DL PRS resources that UE can process in a slot under it  prs-BufferingCapability-r17 ENUMERATED { type1, type2 } OPTIONAL,  maxDL-PRS-ResourcesProcessInSlot-r17 ENUMERATED { n1, n2, n4, n6, n8, n12,  n16, n24, n32, n48, n64 } OPTIONAL, | 27-3-2 | No |  | DL PRS measurement outside MG and in a PRS processing window is not supported | Per band | n/a | n/a | n/a | Component 1 candidate values: {Type 1, Type 2}  [Candidate 2 component values:  a) N: {0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12} ms  b) T: {N+4, N+5, N+6, N+8} ms]  Component 3 candidate values:  FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz  FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz  Need for location server to know if the feature is supported  Note: A UE may declare PRS processing capabilities of each of the supported Type-1A, Type-1B, Type-2” capabilities in case it supports multiple types in a band | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-4-1 | LOS/NLOS Indicator for UE-assisted positioning | 1. Support reporting LoS/NLoS indicator type to LMF  2. LOS/NLOS indicator granularity  nr-los-nlos-AssistanceDataSupport-r17 SEQUENCE {  type-r17 ENUMERATED { hardvalue, softvalue, both },  granularity-r17 ENUMERATED { trpspecific, resourcespecific, both},  ...  } OPTIONAL, -- Cond losNlosInfoSup | one of 13-5,13-6, or 13-11 | No |  | LOS/NLOS Indicator for UE-assisted positioning is not supported | Per UE | n/a | n/a | n/a | [Component 1 candidate values: {hard value, soft value[, both]}]  Component 2 candidate values: {trpSpecific, resourceSpecific[, both]}  [Note: a single value is reported when both multi-RTT and DL-TDOA are supported]  FFS: signalling per method  Need for location server to know if the feature is supported | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-6 | DL PRS processing capabilities in RRC inactive state | 1. DL PRS buffering capability  a) Type 1 – sub-slot/symbol level buffering  b) Type 2 – slot level buffering  2. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE  3. Max number of DL PRS resources that UE can process in a slot  prs-InactiveBufferingCapability-r17 ENUMERATED { type1, type2 } OPTIONAL,  maxDL-PRS-ResourcesProcessInSlotRRC-Inactive-r17  ENUMERATED { n1, n2, n4, n6, n8, n12,  n16, n24, n32, n48, n64 } OPTIONAL, |  | No |  | DL PRS processing in RRC inactive state is not supported | Per band | n/a | n/a | n/a | Component 1 candidate values: {Type 1, Type 2}  Component 2 candidate values:  T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms  N: {0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50} ms  Component 3 candidate values:  FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz  FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz  Need for location server to know if the feature is supported  Note: Having the PRS processing capabilities in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-7 | Multiple measurement instances which can be included in a single measurement report | Support of mutiple measurement instances which can be included in a single measurement report  multiMeasInSameMeasReport-r17 ENUMERATED { supported } OPTIONAL, -- 27-7, FFS on component 2 |  | No |  | Multiple measurement instances which can be included in a single measurement report are not supported | Per UE | No | No | No |  | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-8 | Support of PRS TEG association information for UE-based DL-TDOA | Support of reception of association between PRS and TRP Tx TEG for UE-based positioning  prs-TEG-AssociationUE-BasedSupport-r17 ENUMERATED { supported }  nr-PosCalcAssistanceSupport?  bit 5 indicates whether the field *nr-DL-PRS-TRP-TEG-Info* in IE *NR-PositionCalculationAssistance* is supported or not. | 13-1 | No |  | Positioning calculation assistance data containing association between PRS and TRP Tx TEG is not supported by UE | Per UE | n/a | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-9 | Support of lower Rx beam sweeping factor | 1. Support of the lower Rx beam sweeping factor than 8 for FR2  2. Number of Rx beam sweeping factors  lowerRxBeamSweepingThan8-FR2-r17 ENUMERATED { supported } OPTIONAL,  numberOfRxBeamSweepingFactor-r17 ENUMERATED { FFS } OPTIONAL, |  | No |  | UE only supports 8 as the Rx beam sweeping factor defined by RAN4. | Per band | n/a | n/a  FR2 only | n/a | Component 2 candidate values: {1,2,4,6}  Need for location server to know if the feature is supported | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-10 | Support of UL MAC CE based MG activation request for PRS measurements | 1. Support of using UL MAC CE to request measurement gap for PRS measurements: The information in the UL MAC CE for MG activation request by the UE can be one ID associated with the preconfiguration of the MG  2. Support of preconfiguration of MGs in RRC signaling for PRS measurements: Each MG in the preconfiguration is associated with an ID  mg-ActivationRequestPRS-Meas-r17 ENUMERATED {supported} OPTIONAL, --27-10 | 27-11 | Yes |  | Using UL MAC CE to indicate measurement gap for PRS measurements to the gNB is not supported. | Per UE | No | No | No |  | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-10a | Low latency MG activation request for PRS measurements | support of low latency MG activation request for PRS measurements  mg-ActivationRequest-r17 ENUMERATED { supported } OPTIONAL -- 27-10a | [27-10] | No |  | Low latency MG activation request for PRS measurements is not supported | Per UE | No | No | No | Need for location server to know if the feature is supported | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-11 | Support of DL MAC CE based MG activation request for PRS measurements | 1. Support of preconfiguration of MGs in RRC signaling for PRS measurements: Each MG in the preconfiguration is associated with an ID  2. Support of using DL MAC CE to activate the MG for PRS measurements: The DL MAC CE for MG activation indicates the ID associated with the preconfigured MG  mg-ActivationCommPRS-Meas-r17 ENUMERATED {supported} OPTIONAL, --27-11 |  | Yes |  | Using DL MAC CE to activate the preconfigured MG for PRS measurements is not supported | Per UE | No | No | No |  | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-12 | LOS/NLOS indicator for UE-based positioning assistance data | Support reception of the assistance data containing the LOS/NLOS indicator.  1. LOS/NLOS indicator type  2. LOS/NLOS indicator granularity  nr-los-nlos-IndicatorSupport-r17 SEQUENCE {  type-r17 ENUMERATED { hardvalue, softvalue, both },  granularity-r17 ENUMERATED { trpspecific, resourcespecific, both},  ...  } OPTIONAL, |  | No |  | LOS/NLOS indicator for UE-based positioning assistance data is not supported | Per UE | No | No | No | [Component 1 candidate values: {softValue, hardValue, both}]  Component 2 candidate values: {resourceSpecific, trpSpecific[, both]}  Need for location server to know if the feature is supported. | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-13 | Additional path reporting for UE-assisted DL-TDOA | 1. Support of additional detected path timing reporting for K>2 additional paths for UE-assisted DL-TDOA  2. Support of RSRPP reporting for additional paths if UE supports FG 27-13a  supportOfDL-PRS-AdditionalPathRSRP-MeasAbove2-r17 ENUMERATED { n4, n6, n8 } OPTIONAL,--27-13 |  | No |  | Additional path reporting for UE-assisted DL-TDOA is not supported | Per UE | No | No | No | Component 1 candidate values: {4, 6, 8}  Need for location server to know if the feature is supported. | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-13a | First path RSRPP reporting for UE-assisted DL-TDOA | 1. Support of RSRPP reporting for first path  supportOfDL-PRS-FirstPathRSRP-Meas-r17 ENUMERATED { supported }  supportOfDL-PRS-FirstPathRSRP-MeasFR1-r17 ENUMERATED { supported} OPTIONAL,  supportOfDL-PRS-FirstPathRSRP-MeasFR2-r17 ENUMERATED { supported} OPTIONAL, | 13-1 | No |  | First path RSRPP reporting for UE-assisted DL-TDOA is not supported | per band | n/a | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-14 | Additional path reporting for Multi-RTT | 1. Support of additional detected path timing reporting for K>2 additional paths for Multi-RTT  2. Support of RSRPP reporting for additional paths if UE supports FG 27-14a  supportOfDL-PRS-AdditionalPathRSRP-MeasAbove2-r17 ENUMERATED { n4, n6, n8 } OPTIONAL,--27-14 |  | No |  | Additional path reporting for Multi-RTT is not supported | Per UE | No | No | No | Component 1 candidate values: {4, 6, 8}  Need for location server to know if the feature is supported. | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-14a | First path RSRPP reporting for Multi-RTT | 1. Support of RSRPP reporting for first path  supportOfDL-PRS-FirstPathRSRP-Meas-r17 ENUMERATED { supported } OPTIONAL--27-14a, FFS per UE or Per band  [[  supportOfDL-PRS-FirstPathRSRP-MeasFR1-r17 ENUMERATED { supported} OPTIONAL,  supportOfDL-PRS-FirstPathRSRP-MeasFR2-r17 ENUMERATED { supported} OPTIONAL, | 13-1 | No |  | First path RSRPP reporting for Multi-RTT is not supported | per band | n/a | n/a | n/a | Need for location server to know if the feature is supported. | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-15 | Positioning SRS transmission in RRC\_INACTIVE state for initial UL BWP | 1. Max number of SRS Resource Sets for positioning supported by UE  2. Max number of P/SPSRS Resources for positioning  3. Max number of P/SPSRS Resources for positioning per slot  4. Max number of periodic SRS Resources for positioning  5. Max number of periodic SRS Resources for positioning per slot  -- R1 27-15: Positioning SRS transmission in RRC\_INACTIVE state for initial UL BWP  srs-AllPosResourcesRRC-Inactive-r17 SRS-AllPosResourcesRRC-Inactive-r17 OPTIONAL, |  | Yes |  | Positioning SRS transmission in RRC\_INACTIVE state for initial UL BWP is not supported | Per band | n/a | n/a | n/a | Component 1 candidate values: {1, 2, 4, 8, 12, 16}  Component 2 candidate values: {1,2,4,8,16,32,64}  Component 3 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}  Component 4 candidate values: {1,2,4,8,16,32,64}  Component 5 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}  Note: OLPC for SRS for positioning based on SSB from the last serving cell (the cell that releases UE from connection) is part of this FG. No dedicated capability signaling is intended for this component  Need for location server to know if the feature is supported | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-15b | Positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP | 1. Maximum SRS bandwidth supported for each SCS that UE supports within a single CC 2. Max number of SRS Resource Sets for positioning supported by UE 3. Max number of periodic SRS Resources for positioning 4. Max number of periodic SRS Resources for positioning per slot 5. [Different numerology between the SRS and the initial UL BWP is supported] 6. [SRS operation without restriction on the BW: BW of the SRS may not include BW of the CORESET#0 and SSB] 7. Max number of P/SP SRS Resources for positioning 8. Max number of P/SP SRS Resources for positioning per slot 9. FFS: center frequenecy | 27-15 | Yes |  | Positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP is not supported | Per band | n/a | n/a | n/a | Component 1 candidate values: FFS  Component 2 candidate values: {1, 2, 4, 8, 12, 16}  Component 3 candidate values: {1,2,4,8,16,32,64}  Component 4 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}  Component 5 candidate values: FFS  Component 6 candidate values: FFS  Component 7 candidate values: FFS  Note 1: The SRS should have a locationAndBandwidth, SCS, CP, defined the same way as a legacy BWP.  [Note 2: Based on other signalled UE capabilities, the UE supports at least one connected mode configuration where a hypothetical BWP defined by this SRS is the active BWP and switching between this active BWP and the initial BWP is supported.]  [Note 3: If component 5 is not signaled, the UE only supports same numerology between the SRS and the initial UL BWP]  [Note 4: If component 6 is not signaled, the UE supports only SRS BW that include the BW of the CORESET #0 and SSB.]  [Need for location server to know if the feature is supported] | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-15a | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP with semi-persistent SRS | 1. Max number of semi-persistent SRS Resources for positioning  2. Max number of semi-persistent SRS Resources for positioning per slot | 27-15 | Yes |  | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP with semi-persistent SRS is not supported | Per band | n/a | n/a | n/a | Component 1 candidate values: {1,2,4,8,16,32,64}  Component 2 candidate values: {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}  [Need for location server to know if the feature is supported]  FFS: outside initial BWP | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-16 | OLPC for positioning SRS in RRC\_INACTIVE state - gNB | Same asRRC  OLPC-SRS-Pos-r16  -- R1 27-16: OLPC for positioning SRS in RRC\_INACTIVE state - gNB  olpc-SRS-PosRRC-Inactive-r17 OLPC-SRS-Pos-r16 OPTIONAL, |  | Yes |  | OLPC for positioning SRS in RRC\_INACTIVE state is not supported (gNB) | Per band | n/a | n/a | n/a |  | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-16a | OLPC for positioning SRS in RRC\_INACTIVE state – location server | Same as LPP  OLPC-SRS-Pos-r16  olpc-SRS-PosRRC-Inactive-r17 OLPC-SRS-Pos-r16 OPTIONAL, |  | No |  | OLPC for positioning SRS in RRC\_INACTIVE state is not supported (location server) | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.  Support of OLPC in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling |
| 27. NR\_pos\_enh | 27-17 | PRS processing in RRC\_INACTIVE | Support of PRS processing in RRC\_INACTIVE  RRC  -- R1 27-17: PRS processing in RRC\_INACTIVE  prs-ProcessingRRC-Inactive-r17 ENUMERATED {supported} OPTIONAL,  LPP  nr-DL-PRS-ProcessingRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL | [13-1, 13-2, 13-3, 13-4] | Yes |  | PRS processing in RRC\_INACTIVE is not supported | per band | n/a | n/a | n/a | Note: UE supporting this feature may support at least one from DL RSTD, DL PRS-RSRP, or UE Rx – Tx time difference measurement | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-18a | Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA | Support of PRS measurement in RRC\_INACTIVE state for DL-TDOA  nr-DL-PRS-MeasRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL, -- 27-18a, 27-18b, 27-18c, |  | No |  | PRS measurement in RRC\_INACTIVE state for DL-TDOA is not supported | per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.  Note: Applicable for both UE-assisted and UE-based DL-TDOA  Note: PRS capabilities for DL-TDOA measurement and reporting described in FGs in 13-3, 13-3a, 13-3b, 13-6, 13-13 are the same for RRC Inactive.  Support of PRS processing measurement in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-18b | Support of PRS measurement in RRC\_INACTIVE state for DL-AoD | Support of PRS measurement in RRC\_INACTIVE state for DL-AoD  nr-DL-PRS-MeasRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL, -- 27-18a, 27-18b, 27-18c, |  | No |  | PRS measurement in RRC\_INACTIVE state for DL-AoD is not supported | per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.  Note: Applicable for both UE-assisted and UE-based DL-AoD  Note: PRS capabilities for DL-AOD measurement and reporting described in FGs 13-2, 13-2a, 13-2b, 13-5, 13-13 are the same for RRC Inactive.  Support of PRS processing measurement in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-18c | Support of PRS measurement in RRC\_INACTIVE state for Multi-RTT | 1. Support of PRS measurement in RRC\_INACTIVE state for Multi-RTT  nr-DL-PRS-MeasRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL, -- 27-18a, 27-18b, 27-18c, |  | No |  | PRS measurement in RRC\_INACTIVE state for for Multi-RTT is not supported | per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.  Note: PRS capabilities for Multi-RTT measurement and reporting described in FGs in 13-4, 13-4a, 13-4b, 13-11, 13-11a, 13-14 are the same for RRC Inactive  Support of PRS processing measurement in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-19 | Spatial relation for positioning SRS in RRC\_INACTIVE state - gNB | Same as*RRC*  *SpatialRelationsSRS-Pos-r16*  -- R1 27-19: Spatial relation for positioning SRS in RRC\_INACTIVE state - gNB  spatialRelationsSRS-PosRRC-Inactive-r17 SpatialRelationsSRS-Pos-r16 OPTIONAL, |  | Yes |  | Spatial relation for positioning SRS in RRC\_INACTIVE state is not supported (gNB) | Per band | n/a | n/a | n/a |  | Optional with capability signalling |
| 27. NR\_pos\_enh | 27-19a | Spatial relation for positioning SRS in RRC\_INACTIVE state – location server | Same as *LPP*  *SpatialRelationsSRS-Pos-r16*  spatialRelationsSRS-Pos-r17 SpatialRelationsSRS-Pos-r16 OPTIONAL --27-19 |  | No |  | Spatial relation for positioning SRS in RRC\_INACTIVE state is not supported (location server) | Per band | n/a | n/a | n/a | Need for location server to know if the feature is supported.  Support of spatial relation in RRC\_INACTIVE state does not imply that LMF is aware of or controlling UE RRC state | Optional with capability signalling |
| 27. NR\_pos\_enh | 27-20 | PRS subset association for UE assisted DL-AoD | 1. Support of assistance data enhancement to indicate a subset of PRS resources for each PRS resource for the purpose of prioritization of DL-AoD reporting.  2. Supported resource set relationship for the target PRS resource and the associated subset  [3. Support associated subset measurement reporting]  nr-DL-PRS-ResourcePriorityListSup-r17 ENUMERATED { supported } OPTIONAL, --27-20 FFS on component 2 and 3 |  | No |  | PRS subset association for DL-AoD is not supported by the UE. | Per UE | n/a | n/a | n/a | Component 2 candidate values: {sameSet, DifferentSet, sameOrDifferentSet}  [Component 3 candidate values: {associated subset only, the target PRS resource and the associated subset}]  Need for location server to know | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-21 | PRS boresight direction for UE-assisted DL-AoD | Support of assistance data enhancement to indicate the boresight direction of a PRS resource for UE-assisted DL-AoD.  nr-DL-PRS-BoresightInfoSup-r17 ENUMERATED { supported } OPTIONAL, -- 27-21 |  | No |  | UE-assisted DL-AoD with boresight direction of each DL-PRS is not supported. | Per UE | n/a | n/a | n/a | Need for location server to know | Optional with capability signaling. |
| 27. NR\_pos\_enh | 27-22 | PRS beam pattern for UE-based DL-AoD | Support of PRS beam pattern for DL-AoD  nr-DL-PRS-BeamInfoSup-r17 ENUMERATED { supported } OPTIONAL, -- 27-22  or nr-PosCalcAssistanceSupport-r17 BIT STRING { trpLocSup (0),  beamInfoSup (1),  ? |  | No |  | UE-based DL-AoD with PRS beam pattern is not supported. | Per UE | n/a | n/a | n/a | Need for location server to know | Optional with capability signaling. |

RAN4 NR\_pos\_enh

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 14. NR\_pos\_enh | 14-1 | per-FR MG for PRS measurement | Capability of supporting per-FR MG for PRS measurement  -- RAN4 14-1: per-FR MG for PRS measurement  independentGapConfigPRS-r17 ENUMERATED {supported} OPTIONAL | Rel-15 per-FR gap (independentGapConfig) | yes | no |  | Per UE | No | No | N/A |  | Optional with capability signalling |
| 14  NR\_pos\_enh | 14-2 | PRS measurement for reduced sample in RRC\_inactive state | Capability of supporting reduced number of samples (M=1, 2) for PRS measurement in RRC\_inactive state | [27-17] | no |  | The reduced number of samples (M=1,2) for PRS measurement in RRC\_inactive state cannot be supported. The UE is assumed to support M=4 only. | Per UE | No | No | N/A |  | Optional with capability signaling |
| 14. NR\_pos\_enh | 14-3 | PRS measurement without MG | Capability for the threshold used to be compared against with the Rx timing difference to determine whether the PRS from the non-serving cell satisfy the condition of PRS measurement outside MG. | [27-3-2] | yes |  |  | Per UE | No | No | N/A | The candidate threshold values: [CP length, half of slot] | Optional with capability signaling |
| 14. NR\_pos\_enh | 14-4 | Parallel PRS measurements in RRC\_INACTIVE state | Capability for the support of performing RRM measurement and PRS measurement in parallel  -- R4 14-4: Parallel PRS measurements in RRC\_INACTIVE state, FR1/FR2 diff  parrallelPRS-MeasRRC-Inactive-r17 ENUMERATED {supported} OPTIONAL, |  | yes | no | RRM measurement and PRS measurement cannot be performed in parallel | Per UE | No | Yes | N/A | Measurement period for UE suporting this capability scales with Kcarrier\_PRS=1 | Optional with capability signalling |

# Reference

1. R2-2205828 Summary of LPP Updates and Open Issues Qualcomm Incorporated
2. R2-2205829 LPP Updates Qualcomm Incorporated
3. R2-2204933 Positioning UE capabilities Intel Corporation
4. R2-2205009 [H022] Summary of R2-agreed capabilities for R17 POSenh Huawei, HiSilicon
5. R2-2206330 On Resolving PPW Capability discrepancy Ericsson