3GPP TSG-RAN WG2 Meeting #131bis R2-25xxxxx

Prague, Czech Republic, October 13-17, 2025

Agenda Item: 8.1.1

Source: Qualcomm Incorporated (Rapporteur)

Title: Remaining LPP open issues for feature "AI/ML for NR air interface"

Document for: Discussion

# 1. Introduction

This document summarizes the remaining open issues related to LPP for the correction phase. It is based on R2-2505702 [2], the agreements reached during RAN2#131 [4], the latest available RAN1 feature list [5], and the most recent RAN1 higher layer parameters list [6].

## References

1. [R2-2504130](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_130/Docs/R2-2504130.zip), "LPP open issues for feature "AI/ML for NR air interface", Qualcomm Incorporated (Rapporteur). RAN2#130.
2. [R2-2505702](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_131/Docs/R2-2505702.zip), "LPP open issues for feature "AI/ML for NR air interface", Qualcomm Incorporated (Rapporteur). RAN2#131.
3. [R2-2506584](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_131/Docs/R2-2506584.zip), CR to 37.355: Introduction of AI/ML Positioning Accuracy Enhancements, Qualcomm Incorporated (Rapporteur). RAN2#131.
4. [Chairnotes](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_131/Inbox/Chair_Notes) RAN2#131, RAN2 Chair (InterDigital).
5. [R1-2506426](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_122/Docs/R1-2506426.zip), "LS on updated Rel-19 RAN1 UE features lists for NR after RAN1#122".
6. [R1-2506626](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_122/Docs/R1-2506626.zip), "LS on Rel-19 higher layers parameters list Post RAN1#122".

# 2. Remaining Open issues for specification 37.355 (LPP)

The following Table is taken from Annex A in R2-2505702 [2], with updates after RAN2#131 shown with change bars.

## Summary of LPP Open Issues and Status

Please see R2-2505702 [2] for further details on each issue.

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| --- | --- | --- | --- | --- | --- | --- |
| Issue | | RAN2#130 Agreement | Status after RAN2#130 | Action after RAN2#130 | RAN2#131 Updates | Action after RAN2#131 |
| LPP#1 | Applicability of *dl-PRS-ResourcePrioritySubset* | The field dl-PRS-ResourcePrioritySubset in IE NR-DL-PRS-Info should be ignored for NR AI/ML positioning. Remove corresponding 'Editor's Note' from the running CR. | Closed | Updated in \_v02 of running CR | - | - |
| LPP#2 | Applicability of IE *NR-DL-PRS-ProcessingCapability* | Regarding the applicability of IE NR-DL-PRS-ProcessingCapability to NR AI/ML positioning Case 1, wait for further RAN1 input and keep the current "Editor's Note" in the running CR for now. | Open | Wait for final RAN1 feature list | The IE *NR-DL-PRS-ProcessingCapability-r16* is currently included in *NR-DL-AIML-ProvideCapabilities-r19*. Per latest RAN1 feature list in R1-2506627 (LS in R1-2506426) most (but not all) fields are applicable to Case 1. | TP is provided in Annex A.  Company input is requested in section 3.1 below. |
| LPP#3 | Applicability of *NR-DL-PRS-QCL-ProcessingCapability* | Regarding the applicability of IE NR-DL-PRS-QCL-ProcessingCapability to NR AI/ML positioning Case 1, wait for further RAN1 input and keep the current "Editor's Note" in the running CR for now. | Open | Wait for final RAN1 feature list | The IE *NR-DL-PRS-QCL-ProcessingCapability-r16* is included in *NR-DL-AIML-ProvideCapabilities-r19*. Per latest RAN1 feature list in R1-2506627 (LS in R1-2506426), the existing fields are all applicable to Case 1: 58-2-5, 58-2-6. | Closed |
| LPP#4 | Applicability *of NR-DL-PRS-ResourcesCapability* | Regarding the applicability of IE NR-DL-PRS-ResourcesCapability to NR AI/ML positioning Case 1, wait for further RAN1 input and keep the current "Editor's Note" in the running CR for now. | Open | Wait for final RAN1 feature list | The IE *NR-DL-PRS-ResourcesCapability-r16* is included in *NR-DL-AIML-ProvideCapabilities-r19*. Per latest RAN1 feature list in R1-2506627 (LS in R1-2506426), the existing fields are all applicable to Case 1: 58-2-3, 58-2-3a, 58-2-3b. | Closed |
| LPP#5 | Applicability of NR-On-Demand-DL-PRS-Configurations-Selected-IndexList | The IE NR-On-Demand-DL-PRS-Configurations-Selected-IndexList is also applicable to NR AI/ML positioning Case 1. The corresponding Editor's Notes in clause 6.4.3, 6.5.10.1, and 6.5.11.1 can be removed. | Closed | Updated in \_v02 of running CR | - | - |
| LPP#6 | Applicability of *NR-PRU-DL-Info* | [LPP-6] The IE NR-PRU-DL-Info is also applicable to NR AI/ML positioning Case 1. The corresponding Editor's Notes in clause 6.4.3 can be removed. FFS if more PRUs are needed to be included for training purposes | Closed.  The FFS is captured as new issue #6a. | Updated in \_v02 of running CR | - | - |
| LPP#6a (new) | Number of PRUs in *NR-PRU-DL-Info* | The IE NR-PRU-DL-Info is also applicable to NR AI/ML positioning Case 1. The corresponding Editor's Notes in clause 6.4.3 can be removed. FFS if more PRUs are needed to be included for training purposes | Open (only the FFS part) | Company contributions (if any) | RAN2#131 Agreement:  Do not introduce a request for additional PRUs (e.g., a number of PRUs) in the Request Assistance Data message. | Closed |
| LPP#7 | Applicability of *NR-SelectedDL-PRS-IndexList* | NR-SelectedDL-PRS-IndexList is applicable to AI/ML positioning Case 1. | Closed | Updated in \_v02 of running CR | - | - |
| LPP#8 | Details of IE NR-AI-ML-PositioningProvideAssistanceData | The IE NR-AI-ML-PositioningProvideAssistanceData contains (at least) all assistance data elements from UE-based DL-TDOA as starting point. This will be revised when additional RAN1 input is available. The current Editor's Note is kept for now.  [RAN1#121] For AI/ML based positioning Case 1, regarding info #7 in the assistance information from legacy UE-based DL-TDOA, it can be provided as in legacy UE-based DL-TDOA or implicitly. | Open | Wait for further RAN1 input (if any) | RAN1 parameter list in R1-2506622:  LMF can provide to UE the assistance information (optional) from legacy UE-based DL-TDOA: Info #1 ~ Info #6, Info #8 ~ Info #15 in Table 8.12.2.1.0-1 in 38.305 v18.3.0.  LMF can provide to UE the assistance information (optional) from legacy UE-based DL-TDOA: Info #7 in Table 8.12.2.1.0-1 in 38.305 v18.3.0.  The associated ID (optional) provides implicit indication of Info #7. For given TRP(s), the same associated ID implies that geographical coordinates of the TRP(s) can be understood as consistent by the UE. The associated ID is not expected to provide the real value of Info #7 (i.e., geographical coordinates of the TRP(s) are not disclosed). An associated ID is configured per-cell (e.g., NCGI-r15).  All the above is supported in current LPP. | Closed |
| LPP#9 | Details of IE *NR-AI-ML-PositioningRequestAssistanceData* | The IE NR-AI-ML-PositioningRequestAssistanceData contains (at least) all assistance data elements from UE-based DL-TDOA as starting point. This will be revised when additional RAN1 input is available. The current Editor's Note is kept for now.  [RAN1#121] For AI/ML based positioning Case 1, regarding info #7 in the assistance information from legacy UE-based DL-TDOA, it can be provided as in legacy UE-based DL-TDOA or implicitly. | Open | Wait for further RAN1 input (if any) | IE *NR-DL-AIML-RequestAssistanceData* matches the IE *NR-DL-AIML-ProvideAssistanceData* | Closed |
| LPP#10 | Details of IE *NR-AI-ML-PositioningProvideLocationInformation* | The IE NR-AI-ML-PositioningProvideLocationInformation contains (at least) the time stamp for the location coordinates (which are reported in CommonIEsProvideLocationInformation). This will be revised when additional RAN1 input is available. The current Editor's Note is kept for now. | Open | Wait for further RAN1 input (if any) | No additional RAN1 input has been received (e.g., in parameter list) | Closed |
| LPP#10a | Applicability of "batch reporting" for AI/ML positioning. |  | Open | Company contributions (if any) | RAN2#131 Agreement:  "Batch reporting", i.e., reporting of up to 32 location results in a single report as supported for the current NR positioning methods, is also applicable to "NR AI/ML Positioning Case 1".  Completed in current LPP. | Closed |
| LPP#11 | Details of IE *NR-AI-ML-PositioningRequestLocationInformation* | The IE NR-AI-ML-PositioningRequestLocationInformation contains (at least) the AssistanceAvailability flag. Additional details/information can be discussed via company contributions. | Open | Company contributions (if any) | RAN2#131 Agreement:  Keep *NR-DL-AIML-RequestLocationInformation*, excluding UE-assisted measurement parameters, and retain only UE-based and common parameters (e.g., *nr-AssistanceAvailability*).  Completed in current LPP | Closed |
| LPP#12 | Details of IE *NR-AI-ML-PositioningProvideCapabilities* | The IE NR-AI-ML-PositioningProvideCapabilities contains (at least) all capabilities from UE-based DL-TDOA as starting point, except the capability related to DL-PRS processing (see #LPP-2/3/4). This will be revised when additional RAN1 input is available. The current Editor's Note is kept for now. | Open | Related to #2/3/4 | DL-PRS (and other RAN1) capabilities have been added  Completed in current LPP. | Closed |
| LPP#13 | Location server error causes | Reuse the existing NR-DL-TDOA-LocationServerErrorCauses structure for AI/ML positioning Case 1, and do not introduce additional error causes in NR-DL-AI-ML-LocationServerErrorCauses. | Closed | No additional LPP impacts. | - | - |
| LPP#14 | Target device error causes | Introduce ‘DL AIML positioning not available’ as new target device error cause for AI/ML positioning case 1, to indicate UE cannot perform positioning method (e.g. model not available and performance monitoring outcome not available). | Closed | Updated in \_v02 of running CR. | RAN2#131 Agreement:  We do not introduce new error cause for the target device error causes. | Closed |
| LPP#15 | Applicability of Positioning Integrity to AI/ML positioning | (LPP-15) positioning Integrity is supported for AI/ML positioning Case 1 | Closed | No additional LPP impacts. | - | - |
| LPP#16 | Signalling of Monitoring Outcome | No new LPP message is introduced for performance monitoring purposes | Closed | No additional LPP impacts. | - | - |
| LPP#17 | Signalling of "ground-truth label" information | (LPP-17): A target UE can obtain the "ground-truth label" information via existing MO-LR procedures. No additional RAN2 specification impacts are foreseen | Closed | No additional LPP impacts. | - | - |
| LPP#18 (new) | Consistency between training and inference | To ensure the consistency between training and inference, the UE should be able to request assistance data associated with a specific group of TRPs. FFS the request associated information in on demand prs request. | Open | Company contributions (if any) | RAN2#131 Agreement:  Introduce list of global cell information (i.e., NCGIs, or PCIs with ARFCN) and TRP ID, as the request associated information to ensure consistency between training and inference.  The UE asks specific TRPs for PRS transmission with on-demand PRS configuration, i.e., within NR-On-Demand-DL-PRS-Request.  Completed in current LPP. | Closed |
| LPP#19 (new) | Applicability of BM related agreements |  | Open | Company contributions (if any) | RAN2#131 Agreement:  Similar to BM, UE decides the applicable functionalities based on NW-side additional conditions (if provided), UE-side additional conditions (internally known by UE) and model availability in device. If nw side additional conditions are not provided then we follow BM conclusion. No stage 3 impacts.  Similar to AI PHY, when applicability changes the UE should report this to the LMF and only what changed. For now capture this at least in stage 2. Check offline if and how this would be implemented in stage 3. | Closed  (captured in Stage 2) |
| LPP#20  (new) | LPP Impacts related to Case 3a/3b |  | Open | Company contributions (if any) | RAN2#131 Agreement:  Case 3a and Case 3b can be supported without new impact to LPP. | Closed |
| LPP#21  (new) | "Associated ID" for TRP Location Coordinates (IE *TRP-ImplicitLocationInfo-r19*) |  | Open | Wait for further RAN1 input and/or company contributions(if any) | RAN2#131 Agreement:  Wait for RAN1 for LPP-21. Take what RAN1 gives us and we implemented. Can compile an LS for next meeting if we have questions. | LS has been sent to RAN1 (R2-2506658).  Wait for RAN1 response. |
| LPP#21a  (new) | "Associated ID" for TRP Location Coordinates (IE *TRP-ImplicitLocationInfo-r19*) |  | Open |  | The RAN1 parameter list in R1-2506622 includes the following:  "The associated ID (optional) provides implicit indication of Info #7. For given TRP(s), the same associated ID implies that geographical coordinates of the TRP(s) can be understood as consistent by the UE. The associated ID is not expected to provide the real value of Info #7 (i.e., geographical coordinates of the TRP(s) are not disclosed). An associated ID is configured per-cell (e.g., NCGI-r15).  Note: Info #7 can be provided explicitly (as in legacy UE-based DL-TDOA) or implicitly by Associated ID.  Note: RAN1 has no consensus whether the IE for assistance data Info#7 and AssociatedID-TRP-LocationInfo can be simultaneously enabled. It is up to RAN2 to decide whether the IE for assistance data Info#7 and AssociatedID-TRP-LocationInfo can be simultaneously enabled."  LPP [3] has currently the following Editor's Note:  It is FFS whether the fields *nr-TRP-LocationInfo* and *nr-TRP-LocationInfo-Implicit* can both be present in IE *NR-PositionCalculationAssistance*. | TP is provided in Annex B.  Company input is requested in section 3.2 below. |

# 3. Discussion

## 3.1 DL-PRS Capabilities

It is proposed to replace the IE *NR-DL-PRS-ProcessingCapability* in IE *NR-DL-AIML-ProvideCapabilities* with an AI/ML positioning specific version (*NR-DL-AIML-PRS-ProcessingCapability-r19*) because of the following reasons:

1. Per latest available RAN1 feature list ([R1-2506627](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_122/Docs/R1-2506627.zip)) not all fields in the IE *NR-DL-PRS-ProcessingCapability* are applicable to DL AI/ML positioning.
2. For some features, if the capability indication is not provided for DL AI/ML positioning, the "legacy" capability in IE *NR-DL-PRS-ProcessingCapability* apply*.*
3. One feature (58-2-11) is currently not supported in any LPP capability IE.

A TP based on R1-2506627 is provided in Annex A.

Companies are requested to provide feedback, corrections, or any other comments on the TP1 in Annex A.

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| Company | Comments | Rapporteur Comments |
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## 3.2 "Associated ID" for TRP Location Coordinates

Per Conclusion from RAN1#122 ([R1-2506557](https://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN1/Inbox/R1-2506557.zip)), which is also captured in the parameter list [6] (R1-2506626), no consensus was reached in RAN1 "whether the IE for assistance data Info#7 and AssociatedID-TRP-LocationInfo can be simultaneously enabled.":

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| Conclusion:  RAN1 has no consensus whether the IE for assistance data Info#7 and AssociatedID-TRP-LocationInfo can be simultaneously enabled.  It is up to RAN2 to decide whether the IE for assistance data Info#7 and AssociatedID-TRP-LocationInfo can be simultaneously enabled. |

In current LPP, there is the following Editor's Note in clause 6.4.3:

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| --- |
| Editor's Note: It is FFS whether the fields *nr-TRP-LocationInfo* and *nr-TRP-LocationInfo-Implicit* can both be present in IE *NR-PositionCalculationAssistance*. |

It is proposed to delete the Editor's Note, since this can be left to implementation/deployment (like it is the case for all LPP assistance data and for all LPP positioning methods).

A TP is provided in Annex B.

Companies are requested to provide feedback on the TP2 in Annex B.

If companies believe this network behaviour must be explicitly specified, please provide appropriate justification. For example, would the feature fail or behave unexpectedly if both the UE and the network support explicit and implicit Info#7, and the UE requests both while the network provides both?

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| Company | Comments | Rapporteur Comments |
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## 3.3 Additional Corrections/Comments/Issues

If there are any additional comments, new issues or corrections required to LPP, please provide a description (and possible resolution) in the Table below.

NOTE: When LPP version 19.0.0 is available, the ASN.1 review process will start as endorsed in [R2-2505781](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_131/Docs/R2-2505781.zip) [4]. Therefore, corrections could also be proposed later as part of the ASN.1 review.

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| Company | Any Other Issues and possible resolution | Rapporteur Comments |
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# Annex A: TP1

### 6.4.3 Common NR Positioning Information Elements

[…]

#### *– NR-DL-PRS-ProcessingCapability*

The IE *NR-DL-PRS-ProcessingCapability* defines the common DL-PRS Processing capability. In the case of capabilities for multiple NR positioning methods (except to NR DL AI/ML positioning) are provided, the IE *NR-DL-PRS-ProcessingCapability* applies across the NR positioning methods (except to NR DL AI/ML positioning) and the target device shall indicate the same values for the capabilities in IEs *NR-DL-TDOA-ProvideCapabilities*, *NR-DL-AoD-ProvideCapabilities*, and *NR-Multi-RTT-ProvideCapabilities*.

The *PRS-ProcessingCapabilityPerBand* is defined for a single positioning frequency layer on a certain band (i.e., a target device supporting multiple positioning frequency layers is expected to process one frequency layer at a time).

-- ASN1START

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

prs-ProcessingCapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

PRS-ProcessingCapabilityPerBand-r16,

maxSupportedFreqLayers-r16 INTEGER (1..4),

simulLTE-NR-PRS-r16 ENUMERATED { supported } OPTIONAL,

...,

[[

dummy ENUMERATED { m1, m2, ... } OPTIONAL

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}

PRS-ProcessingCapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

supportedBandwidthPRS-r16 CHOICE {

fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

mhz50, mhz80, mhz100},

fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400},

...

},

dl-PRS-BufferType-r16 ENUMERATED {type1, type2, ...},

durationOfPRS-Processing-r16 SEQUENCE {

durationOfPRS-ProcessingSymbols-r16 ENUMERATED {nDot125, nDot25, nDot5, n1,

n2, n4, n6, n8, n12, n16, n20, n25,

n30, n32, n35, n40, n45, n50},

durationOfPRS-ProcessingSymbolsInEveryTms-r16

ENUMERATED {n8, n16, n20, n30, n40, n80,

n160,n320, n640, n1280},

...

},

maxNumOfDL-PRS-ResProcessedPerSlot-r16 SEQUENCE {

scs15-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

n48, n64} OPTIONAL,

scs30-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

n48, n64} OPTIONAL,

scs60-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

n48, n64} OPTIONAL,

scs120-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

n48, n64} OPTIONAL,

...,

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scs15-v1690 ENUMERATED {n6, n12} OPTIONAL,

scs30-v1690 ENUMERATED {n6, n12} OPTIONAL,

scs60-v1690 ENUMERATED {n6, n12} OPTIONAL,

scs120-v1690 ENUMERATED {n6, n12} OPTIONAL

]]

},

...,

[[

supportedDL-PRS-ProcessingSamples-RRC-CONNECTED-r17 ENUMERATED { supported } OPTIONAL,

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-ProcessingCapabilityOutsideMGinPPW-r17

SEQUENCE (SIZE(1..3)) OF

PRS-ProcessingCapabilityOutsideMGinPPWperType-r17

OPTIONAL,

dl-PRS-BufferType-RRC-Inactive-r17 ENUMERATED { type1, type2, ... } OPTIONAL,

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,

maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17 SEQUENCE {

scs15-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs30-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs60-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs120-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

supportedLowerRxBeamSweepingFactor-FR2-r17 ENUMERATED { n1, n2, n4, n6 } OPTIONAL

]],

[[

supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17 ENUMERATED { supported } OPTIONAL

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[[

prs-MeasurementWithoutMG-r17 ENUMERATED {cp, symbolDot25, symbolDot5,

slotDot5} OPTIONAL

]],

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maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Inactive-r18 SEQUENCE {

scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Connected-r18 SEQUENCE {

scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

ppw-maxNumOfOneSymbolPRS-ResProcessedPerSlot-r18 SEQUENCE {

scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected-r18

PRS-BWA-TwoContiguousIntrabandInMG-r18 OPTIONAL,

prs-BWA-ThreeContiguousIntrabandInMG-RRC-Connected-r18

PRS-BWA-ThreeContiguousIntrabandInMG-r18 OPTIONAL,

prs-BWA-TwoContiguousIntraband-RRC-IdleAndInactive-r18

PRS-BWA-TwoContiguousIntrabandInMG-r18 OPTIONAL,

prs-BWA-ThreeContiguousIntraband-RRC-IdleAndInactive-r18

PRS-BWA-ThreeContiguousIntrabandInMG-r18 OPTIONAL,

reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-Connected-r18 ENUMERATED { supported }

OPTIONAL,

reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive-r18

ENUMERATED { supported } OPTIONAL,

dl-PRS-MeasurementWithRxFH-RRC-Inactive-r18 ENUMERATED { supported } OPTIONAL,

dl-PRS-MeasurementWithRxFH-RRC-Idle-r18 ENUMERATED { supported } OPTIONAL,

reducedNumOfSampleForMeasurementWithFH-RRC-Connected-r18 ENUMERATED { supported }

OPTIONAL,

reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive-r18 ENUMERATED { supported }

OPTIONAL,

supportOfPRS-BWA-WithTwoPFL-Combination-r18 ENUMERATED { supported } OPTIONAL,

dl-PRS-MeasurementWithRxFH-RRC-Connected-r18 DL-PRS-MeasurementWithRxFH-RRC-Connected-r18 OPTIONAL

]]

}

PRS-ProcessingCapabilityOutsideMGinPPWperType-r17 ::= SEQUENCE {

prsProcessingType-r17 ENUMERATED { type1A, type1B, type2 },

ppw-dl-PRS-BufferType-r17 ENUMERATED { type1, type2, ... },

ppw-durationOfPRS-Processing1-r17 SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN-r17

ENUMERATED { msDot125, msDot25, msDot5, ms1, ms2, ms4,

ms6, ms8, ms12, ms16, ms20, ms25, ms30, ms32, ms35,

ms40, ms45, ms50 },

ppw-durationOfPRS-ProcessingSymbolsT-r17

ENUMERATED { ms1, ms2, ms4, ms8, ms16, ms20, ms30, ms40, ms80,

ms160, ms320, ms640, ms1280 }

} OPTIONAL,

ppw-durationOfPRS-Processing2-r17 SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN2-r17

ENUMERATED { msDot125, msDot25, msDot5, ms1, ms2, ms3, ms4, ms5,

ms6, ms8, ms12 },

ppw-durationOfPRS-ProcessingSymbolsT2-r17

ENUMERATED { ms4, ms5, ms6, ms8 }

} OPTIONAL,

ppw-maxNumOfDL-PRS-ResProcessedPerSlot-r17 SEQUENCE {

scs15-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 }

OPTIONAL,

scs30-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 }

OPTIONAL,

scs60-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 }

OPTIONAL,

scs120-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 }

OPTIONAL,

...

},

...,

[[

ppw-maxNumOfDL-Bandwidth-r17 CHOICE {

fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

mhz50, mhz80, mhz100},

fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

} OPTIONAL

]]

}

PRS-BWA-TwoContiguousIntrabandInMG-r18 ::= SEQUENCE {

maximumOfTwoAggregatedDL-PRS-Bandwidth-FR1-r18 ENUMERATED {mhz10, mhz20, mhz40, mhz50,

mhz80, mhz100, mhz160, mhz200}

OPTIONAL,

maximumOfTwoAggregatedDL-PRS-Bandwidth-FR2-r18 ENUMERATED {mhz100, mhz200, mhz400, mhz800}

OPTIONAL,

maximumOfDL-PRS-BandwidthPerPFL-FR1-r18 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

mhz50, mhz80, mhz100} OPTIONAL,

maximumOfDL-PRS-BandwidthPerPFL-FR2-r18 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

OPTIONAL,

dl-PRS-BufferTypeOfBWA-r18 ENUMERATED {type1, type2},

prs-durationOfTwoPRS-BWA-Processing-r18 SEQUENCE {

prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18

ENUMERATED {msDot125, msDot25, msDot5, ms1, ms2, ms4, ms6, ms8, ms12,

ms16, ms20, ms25, ms30, ms32, ms35, ms40, ms45, ms50},

prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18

ENUMERATED {ms8, ms16, ms20, ms30, ms40, ms80, ms160, ms320, ms640, ms1280}

} OPTIONAL,

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18 SEQUENCE {

scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL

},

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18 SEQUENCE {

scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL

}

}

PRS-BWA-ThreeContiguousIntrabandInMG-r18 ::= SEQUENCE {

maximumOfThreeAggregatedDL-PRS-Bandwidth-FR1-r18

ENUMERATED {mhz15, mhz20, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100, mhz120,

mhz140, mhz150, mhz180, mhz200, mhz240, mhz300} OPTIONAL,

maximumOfThreeAggregatedDL-PRS-Bandwidth-FR2-r18

ENUMERATED {mhz150, mhz200, mhz300, mhz400, mhz600, mhz800, mhz1000,

mhz1200} OPTIONAL,

maximumOfDL-PRS-BandwidthPerPFL-FR1-r18

ENUMERATED {mhz5, mhz10, mhz20, mhz40, mhz50, mhz80, mhz100} OPTIONAL,

maximumOfDL-PRS-BandwidthPerPFL-FR2-r18

ENUMERATED {mhz50, mhz100, mhz200, mhz400} OPTIONAL,

dl-PRS-BufferTypeOfBWA-r18 ENUMERATED {type1, type2},

prs-durationOfThreePRS-BWA-Processing-r18 SEQUENCE {

prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18

ENUMERATED {msDot125, msDot25, msDot5, ms1, ms2, ms4, ms6, ms8, ms12,

ms16, ms20, ms25, ms30, ms32, ms35, ms40, ms45, ms50},

prs-durationOfThreePRS-BWA-ProcessingSymbolsT-r18

ENUMERATED {ms8, ms16, ms20, ms30, ms40, ms80, ms160,

ms320, ms640, ms1280}

} OPTIONAL,

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18 SEQUENCE {

scs15-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs30-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL

},

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18 SEQUENCE {

scs60-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs120-r18 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL

}

}

DL-PRS-MeasurementWithRxFH-RRC-Connected-r18 ::=SEQUENCE {

maximumPRS-BandwidthAcrossAllHopsFR1-r18 ENUMERATED {mhz40, mhz50, mhz80, mhz100}

OPTIONAL,

maximumPRS-BandwidthAcrossAllHopsFR2-r18 ENUMERATED {mhz100, mhz200, mhz400} OPTIONAL,

maximumFH-Hops-r18 ENUMERATED {n2, n3, n4, n5, n6} OPTIONAL,

processingDuration-r18 SEQUENCE {

processingPRS-SymbolsDurationN3-r18 ENUMERATED {msDot125, msDot25, msDot5, ms1, ms2,

ms4, ms6, ms8, ms12,ms16, ms20, ms25,

ms30, ms32, ms35, ms40, ms45, ms50},

processingDurationT3-r18 ENUMERATED {ms8, ms16, ms20, ms30, ms40, ms80,

ms160, ms320, ms640, ms1280}

} OPTIONAL,

rf-RxRetuneTimeFR1-r18 ENUMERATED {n70,n140,n210} OPTIONAL,

rf-RxRetuneTimeFR2-r18 ENUMERATED {n35,n70,n140} OPTIONAL,

numOfOverlappingPRB-r18 ENUMERATED {n0,n1,n2,n4} OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-PRS-ProcessingCapability* field descriptions |
| --- |
| ***maxSupportedFreqLayers***  Indicates the maximum number of positioning frequency layers supported by UE. |
| ***simulLTE-NR-PRS***  Indicates whether the UE supports parallel processing of LTE PRS and NR DL-PRS. |
| ***dummy***  This field is not used in the specification. If received it shall be ignored by the receiver. |
| ***supportedBandwidthPRS***  Indicates the maximum number of DL-PRS bandwidth in MHz, which is supported and reported by UE. |
| ***dl-PRS-BufferType***  IndicatesDL-PRS buffering capability. Value *type1* indicates sub-slot/symbol level buffering and value *type2* indicates slot level buffering. |
| ***durationOfPRS-Processing***  Indicates the duration *N* of DL-PRS symbols in units of ms a UE can process every T ms assuming maximum DL-PRS bandwidth provided in *supportedBandwidthPRS* and comprises the following subfields:  - ***durationOfPRS-ProcessingSymbols***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***durationOfPRS-ProcessingSymbolsInEveryTms***: This field specifies the values for *T*. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.  See NOTE 9. |
| ***maxNumOfDL-PRS-ResProcessedPerSlot***  Indicates the maximum number of DL-PRS Resources that UE can process in a slot. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. |
| ***supportedDL-PRS-ProcessingSamples-RRC-CONNECTED***  Indicates the UE capability for support of measurements based on measuring M=1 or M=2 (instances) of a DL-PRS Resource Set. The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE 1: This feature is supported for both UE-assisted and UE based positioning. |
| ***prs-ProcessingWindowType1A***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 1A refers to the determination of prioritization between DL-PRS and other DL signals/channels in all OFDM symbols within the DL-PRS Processing Window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR. Enumerated value indicates supported priority handing options of DL-PRS:  - *option1*: Support of "st1" and "st3" defined in clause 5.1.6.5 of TS 38.214 [45].  - *option2*: Support of "st1", "st2", and "st3" defined in clause 5.1.6.5 of TS 38.214 [45].  - *option3*: Support of "st1" only defined in clause 5.1.6.5 of TS 38.214 [45].  The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE 2: Within a DL-PRS processing window, UE measurement is inside the active DL BWP with DL-PRS having the same numerology as the active DL BWP.  NOTE 2a: When the UE determines higher priority for other DL signals/channels over the DL-PRS measurement/processing, the UE is not expected to measure/process DL-PRS. |
| ***prs-ProcessingWindowType1B***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 1B refers to the determination of prioritization between DL-PRS and other DL signals/channels in all OFDM symbols within the DL-PRS processing window. The DL signals/channels from a certain band are affected. Enumerated value indicates supported priority handing options of DL-PRS (see *prs-ProcessingWindowType1A*).  The UE can include this field only if the UE supports prs-ProcessingCapabilityBandList. Otherwise, the UE does not include this field.  NOTE 3: Within a DL-PRS processing window, UE measurement is inside the active DL BWP with DL-PRS having the same numerology as the active DL BWP.  NOTE 3a: When the UE determines higher priority for other DL signals/channels over the DL-PRS measurement/processing, the UE is not expected to measure/process DL-PRS. |
| ***prs-ProcessingWindowType2***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 2 refers to the determination of prioritization between DL-PRS and other DL signals/channels only in DL-PRS symbols within the DL-PRS processing window. Enumerated value indicates supported priority handing options of DL-PRS (see *prs-ProcessingWindowType1A*).  The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE 4: Within a DL-PRS processing window, UE measurement is inside the active DL BWP with DL-PRS having the same numerology as the active DL BWP.  NOTE 4a: When the UE determines higher priority for other DL signals/channels over the DL-PRS measurement/processing, the UE is not expected to measure/process DL-PRS. |
| ***prs-ProcessingCapabilityOutsideMGinPPW***  Indicates the DL-PRS Processing Capability outside MG of each of the supported PPW Type in the case the UE supports multiple PPW Types in a band and comprises the following subfields:  - ***prsProcessingType***: Indicates the DL-PRS Processing Window Type for which the *prs-ProcessingCapabilityOutsideMGinPPW* are provided.  - ***ppw-dl-PRS-BufferType***: Indicates DL-PRS buffering capability. Value '*type1'* indicates sub-slot/symbol level buffering and value '*type2'* indicates slot level buffering.  - ***ppw-durationOfPRS-Processing1***: Indicates the duration of DL-PRS symbols N in units of ms a UE can process every T ms assuming maximum DL-PRS bandwidth provided in *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:  - ***ppw-durationOfPRS-ProcessingSymbolsN***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***ppw-durationOfPRS-ProcessingSymbolsT***: This field specifies the values for *T*. Enumerated values indicate 1, 2, 4, 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.  - ***ppw-durationOfPRS-Processing2***: Indicates the duration of DL-PRS symbols N2 in units of ms a UE can process inT2 ms assuming maximum DL-PRS bandwidth provided in *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:  - ***ppw-durationOfPRS-ProcessingSymbolsN2***: This field specifies the values for *N2*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12 ms.  - ***ppw-durationOfPRS-ProcessingSymbolsT2***: This field specifies the values for *T2*. Enumerated values indicate 4, 5, 6, 8 ms.  - ***ppw-maxNumOfDL-PRS-ResProcessedPerSlot:*** Indicates the maximum number of DL-PRS resources that UE can process in a slot. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands.  - ***ppw-maxNumOfDL-Bandwidth:*** Indicates the maximum number of DL-PRS bandwidth in MHz, which is supported and reported by UE for DL-PRS measurement outside MG within the PPW.  The UE can include this field only if the UE supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* and *prs-ProcessingWindowType2*. Otherwise, the UE does not include this field.  NOTE 5: A UE that supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* or *prs-ProcessingWindowType2* shall always include the *prs-ProcessingCapabilityOutsideMGinPPW*.  NOTE 6: The (N, T) UE capability in *ppw-durationOfPRS-Processing1* is interpreted as in NOTE 9, and the UE is expected to receive the DL-PRS within the DL-PRS processing window but the processing of the received DL-PRS may be outside a DL-PRS processing window.  NOTE 7: The (N2, T2) UE capability in *ppw-durationOfPRS-Processing2* is interpreted such that the UE is capable of measuring up to N2 ms DL-PRS within a PPW and is capable of completing the DL-PRS processing within the PPW, e.g., if the time duration from the last symbol of the measured DL-PRS Resource(s) inside the PPW to the end of PPW is not smaller than T2 ms.  NOTE 8: A UE which supports *prs-ProcessingCapabilityOutsideMGinPPW* shall support either *ppw-durationOfPRS-Processing1* or *ppw-durationOfPRS-Processing2*, but not both for each supported type in a band. |
| ***dl-PRS-BufferType-RRC-Inactive***  IndicatesDL-PRS buffering capability in RRC\_INACTIVE state. Value '*type1'* indicates sub-slot/symbol level buffering and value '*type2'* indicates slot level buffering. |
| ***durationOfPRS-Processing-RRC-Inactive***  Indicates the duration *N* of DL-PRS symbols in units of ms a UE can process every *T* ms in RRC\_INACTIVE state assuming maximum DL-PRS bandwidth provided in *supportedBandwidthPRS* and comprises the following subfields:  - ***durationOfPRS-ProcessingSymbols***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***durationOfPRS-ProcessingSymbolsInEveryTms***: This field specifies the values for *T*. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.  See NOTE 9. |
| ***maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive***  Indicates the maximum number of DL-PRS Resources a UE can process in a slot in RRC\_INACTIVE state. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. |
| ***supportedLowerRxBeamSweepingFactor-FR2***  Indicates support of the lower Rx beam sweeping factor than 8 for FR2. Enumerated value indicates the number of Rx beam sweeping factors supported. |
| ***supportedDL-PRS-ProcessingSamples-RRC-Inactive***  Indicates the UE capability for support of reduced number of samples for DL-PRS measurement in RRC\_INACTIVE state. The UE can include this field only if the UE supports *prs-ProcessingRRC-Inactive* defined in TS 38.331 [35]. Otherwise, the UE does not include this field. |
| ***maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Inactive***  Indicates the maximum number of single-symbol DL-PRS Resources that UE can process in a slot in RRC\_INACTIVE. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. A UE which supports *maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Inactive* shall support single-symbol DL-PRS with the comb sizes from {2,4,6,12}.  The UE can include this field only if the UE supports one of *dl-PRS-BufferType-RRC-Inactive*, *durationOfPRS-Processing-RRC-Inactive*, and *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive*. Otherwise, the UE does not include this field. |
| ***maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Connected***  Indicates the maximum number of single-symbol DL-PRS Resources that UE can process in a slot inside a measurement gap in RRC\_CONNECTED. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. A UE which supports *maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Connected* shall support single-symbol DL-PRS with the comb sizes from {2,4,6,12}.  The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field. |
| ***ppw-maxNumOfOneSymbolPRS-ResProcessedPerSlot***  Indicates the maximum number of single-symbol DL-PRS Resources that UE can process in a slot outside a measurement gap in RRC\_CONNECTED. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. A UE which supports *ppw-maxNumOfOneSymbolPRS-ResProcessedPerSlot* shall support single-symbol DL-PRS with the comb sizes from {2,4,6,12}.  The UE can include this field only if the UE supports *prs-ProcessingCapabilityOutsideMGinPPW*. Otherwise, the UE does not include this field. |
| ***prs-MeasurementWithoutMG***  Indicates the UE capability for support of Rx timing difference between the serving cell and non-serving cell for DL-PRS measurement within a PPW. Value '*cp*' indicates one CP length, value '*symbolDot25*' indicates 0.25 symbol length, value '*symbolDot5*' indicates 0.5 symbol length and value '*slotDot5*' indicates 0.5 slot length. The UE can include this field only if the UE supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* and *prs-ProcessingWindowType2*. Otherwise, the UE does not include this field. |
| ***prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected***  Indicates the UE capability for support of DL-PRS processing capabilities for aggregated DL-PRS processing of 2 PFLs in intra-band contiguous within a MG for RRC\_CONNECTED state and and comprises the following subfields:  - ***maximumOfTwoAggregatedDL-PRS-Bandwidth-FR1***: Indicates the maximum aggregated DL-PRS bandwidth in MHz for FR1, which is supported and reported by UE.  - ***maximumOfTwoAggregatedDL-PRS-Bandwidth-FR2***: Indicates the maximum aggregated DL-PRS bandwidth in MHz for FR2, which is supported and reported by UE.  - ***maximumOfDL-PRS-BandwidthPerPFL-FR1***: Indicates the maximum DL-PRS bandwidth in MHz for FR1, per PFL.  - ***maximumOfDL-PRS-BandwidthPerPFL-FR2***: Indicates the maximum DL-PRS bandwidth in MHz for FR2, per PFL.  - ***dl-PRS-BufferTypeOfBWA***: Indicates the DL-PRS buffering capability.  - ***prs-durationOfTwoPRS-BWA-Processing***: Indicates the duration of DL-PRS symbols N in units of ms a UE can process every T ms assuming maximum aggregated DL-PRS bandwidth in MHz, which is supported and reported by UE.  - ***prs-durationOfTwoPRS-BWA-ProcessingSymbolsN***: This field specifies the values for N. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***prs-durationOfTwoPRS-BWA-ProcessingSymbolsT***: This field specifies the values for T. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280, 2560 ms.  - ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR1.  - ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR2.  The UE can include this field only if the UE supports *supportedBandwidthPRS, dl-PRS-BufferType, durationOfPRS-Processing* and *maxNumOfDL-PRS-ResProcessedPerSlot*. Otherwise, the UE does not include this field.  NOTE 10: *dl-PRS-BufferTypeOfBWA* follows buffering capability type reported in *dl-PRS-BufferType.*  NOTE 11: The value N should be equal or smaller than the value N reported by *durationOfPRS-ProcessingSymbols*, or this value T should be equal or larger than the value T reported by *durationOfPRS-ProcessingSymbolsInEveryTms.*  NOTE 12: Each two linked DL-PRS Resources are counted as 1 resource.  NOTE 13: *maxNumOfAggregatedDL-PRS-ResourcePerSlot* should be equal or smaller than the value reported by *maxNumOfDL-PRS-ResProcessedPerSlot.*  NOTE 14: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL)/measurement gap repetition period (MGRP) of no more than 30%. |
| ***prs-BWA-ThreeContiguousIntrabandInMG-RRC-Connected***  Indicates the UE capability for support of DL-PRS processing capabilities for aggregated DL-PRS processing of 3 PFLs in intra-band contiguous within a MG for RRC\_CONNECTED state and comprises the following subfields:  **- *maximumOfThreeAggregatedDL-PRS-Bandwidth-FR1***: Indicates the maximum aggregated DL-PRS bandwidth in MHz of for FR1, which is supported and reported by UE.  **- *maximumOfThreeAggregatedDL-PRS-Bandwidth-FR2***: Indicates the maximum aggregated DL-PRS bandwidth in MHz for FR2, which is supported and reported by UE.  **- *maximumOfDL-PRS-BandwidthPerPFL-FR1***: Indicates the maximum DL-PRS bandwidth in MHz for FR1, per PFL  **- *maximumOfDL-PRS-BandwidthPerPFL-FR2***: Indicates the maximum DL-PRS bandwidth in MHz for FR2, per PFL  **- *dl-PRS-BufferTypeOfBWA***: Indicates the DL-PRS buffering capability.  **- *prs-durationOfThreePRS-BWA-Processing***: Indicates the duration of DL-PRS symbols N in units of ms a UE can process every T ms assuming maximum aggregated DL-PRS bandwidth in MHz, which is supported and reported by UE.  **- *prs-durationOfThreePRS-BWA-ProcessingSymbolsN***: This field specifies the values for N. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  **- *prs-durationOfThreePRS-BWA-ProcessingSymbolsT***: This field specifies the values for T. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280, 3840 ms.  **- *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR1.  **- *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR2.  The UE can include this field only if the UE supports *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected****.*** Otherwise, the UE does not include this field.  NOTE15: *dl-PRS-BufferTypeOfBWA* follows buffering capability type reported in *dl-PRS-BufferType.*  NOTE16: The value N should be equal or smaller than the value N reported by *durationOfPRS-ProcessingSymbols*, or this value T should be equal or larger than the value T reported by *durationOfPRS-ProcessingSymbolsInEveryTms.*  NOTE17: Each three linked DL-PRS Resources are counted as 1 resource.  NOTE18: *maxNumOfAggregatedDL-PRS-ResourcePerSlot* should be equal or smaller than the value reported by *maxNumOfDL-PRS-ResProcessedPerSlot*.  NOTE19: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL)/measurement gap repetition period (MGRP) of no more than 30%. |
| ***prs-BWA-TwoContiguousIntraband-RRC-IdleAndInactive***  Indicates the UE capability for support of DL-PRS processing capabilities for aggregated DL-PRS processing of 2 PFLs in intra-band contiguous for RRC\_INACTIVE and RRC\_IDLE state.  The UE can include this field only if the UE supports *dl-PRS-BufferType-RRC-Inactive, durationOfPRS-Processing-RRC-Inactive and maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive*. Otherwise, the UE does not include this field. The capability signalling comprises the following parameters:  - ***maximumOfTwoAggregatedDL-PRS-Bandwidth-FR1***: Indicates the maximum aggregated DL-PRS bandwidth in MHz for FR1, which is supported and reported by UE.  - ***maximumOfTwoAggregatedDL-PRS-Bandwidth-FR2***: Indicates the maximum aggregated DL-PRS bandwidth in MHz for FR2, which is supported and reported by UE.  - ***maximumOfDL-PRS-BandwidthPerPFL-FR1***: Indicates the maximum DL-PRS bandwidth in MHz for FR1, per PFL.  - ***maximumOfDL-PRS-BandwidthPerPFL-FR2***: Indicates the maximum DL-PRS bandwidth in MHz for FR2, per PFL.  - ***dl-PRS-BufferTypeOfBWA***: Indicates the DL-PRS buffering capability.  - ***prs-durationOfTwoPRS-BWA-Processing***: Indicates the duration of DL-PRS symbols N in units of ms a UE can process every T ms assuming maximum aggregated DL-PRS bandwidth in MHz, which is supported and reported by UE.  - ***prs-durationOfTwoPRS-BWA-ProcessingSymbolsN***: This field specifies the values for N. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***prs-durationOfTwoPRS-BWA-ProcessingSymbolsT***: This field specifies the values for T. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280, 2560 ms.  - ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR1.  - ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR2.  NOTE 20: *dl-PRS-BufferTypeOfBWA* follows buffering capability type reported in *dl-PRS-BufferType.*  NOTE 21: The value N should be equal or smaller than the value N reported by *durationOfPRS-ProcessingSymbols*, or this value T should be equal or larger than the value T reported by *durationOfPRS-ProcessingSymbolsInEveryTms.*  NOTE 22: Each two linked DL-PRS resources are counted as 1 resource.  NOTE 23: *maxNumOfAggregatedDL-PRS-ResourcePerSlot* should be equal or smaller than the value reported by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive.* |
| ***prs-BWA-ThreeContiguousIntraband-RRC-IdleAndInactive***  Indicates the UE capability for support of DL-PRS processing capabilities for aggregated DL-PRS processing of 3 PFLs in intra-band contiguous for RRC\_INACTIVE and RRC\_IDLE state. The UE can include this field only if the UE supports *prs-BWA-TwoContiguousIntraband-RRC-IdleAndInactive*. Otherwise, the UE does not include this field. The capability signalling comprises the following parameters:  **- *maximumOfThreeAggregatedDL-PRS-Bandwidth-FR1***: Indicates the maximum aggregated DL-PRS bandwidth in MHz of for FR1, which is supported and reported by UE.  **- *maximumOfThreeAggregatedDL-PRS-Bandwidth-FR2***: Indicates the maximum aggregated DL-PRS bandwidth in MHz for FR2, which is supported and reported by UE.  **- *maximumOfDL-PRS-BandwidthPerPFL-FR1***: Indicates the maximum DL-PRS bandwidth in MHz for FR1, per PFL  **- *maximumOfDL-PRS-BandwidthPerPFL-FR2***: Indicates the maximum DL-PRS bandwidth in MHz for FR2, per PFL  **- *dl-PRS-BufferTypeOfBWA***: Indicates the DL-PRS buffering capability.  **- *prs-durationOfThreePRS-BWA-Processing***: Indicates the duration of DL-PRS symbols N in units of ms a UE can process every T ms assuming maximum aggregated DL-PRS bandwidth in MHz, which is supported and reported by UE.  **- *prs-durationOfThreePRS-BWA-ProcessingSymbolsN***: This field specifies the values for N. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  **- *prs-durationOfThreePRS-BWA-ProcessingSymbolsT***: This field specifies the values for T. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280, 3840 ms.  **- *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR1.  **- *maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR2.  NOTE 24: *dl-PRS-BufferTypeOfBWA* follows buffering capability type reported in *dl-PRS-BufferType.*  NOTE 25: The value N should be equal or smaller than the value N reported by *durationOfPRS-ProcessingSymbols*, or this value T should be equal or larger than the value T reported by *durationOfPRS-ProcessingSymbolsInEveryTms.*  NOTE 26: Each two linked DL-PRS resources are counted as 1 resource.  NOTE 27: *maxNumOfAggregatedDL-PRS-ResourcePerSlot* should be equal or smaller than the value reported by *maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive.* |
| ***reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-Connected***  Indicates whether the UE supports reduced number of samples in positioning measurements with DL-PRS bandwidth aggregation for RRC\_CONNECTED. The UE can include this field only if the UE indicates the capability of maximum aggregated DL-PRS bandwidth for the supported FR1 or FR2 bands by using *maximumOfTwoAggregatedDL-PRS-Bandwidth-FR1* or *maximumOfTwoAggregatedDL-PRS-Bandwidth-FR2* of *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected****.*** Otherwise, the UE does not include this field. |
| ***reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive***  Indicates whether the UE supports reduced number of samples in positioning measurements with DL-PRS bandwidth aggregation for RRC\_IDLE and RRC\_INACTIVE. The UE can include this field only if the UE indicates the capability of maximum aggregated DL-PRS bandwidth for the supported FR1 or FR2 bands by using *maximumOfTwoAggregatedDL-PRS-Bandwidth-FR1* or *maximumOfTwoAggregatedDL-PRS-Bandwidth-FR2* of *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected****.*** Otherwise, the UE does not include this field. |
| ***dl-PRS-MeasurementWithRxFH-RRC-Inactive***  Indicates the UE capability for support of DL-PRS measurement with Rx frequency hopping in RRC\_INACTIVE for RedCap UEs. The UE can include this field only if the UE supports *dl-PRS-MeasurementWithRxFH-RRC-Connected* and *prs-ProcessingRRC-Inactive* defined in TS 38.331 [35]. Otherwise, the UE does not include this field. |
| ***dl-PRS-MeasurementWithRxFH-RRC-Idle***  Indicates the UE capability for support of DL-PRS measurement with Rx frequency hopping in RRC\_IDLE for RedCap UEs. The UE can include this field only if the UE supports *dl-PRS-MeasurementWithRxFH-RRC-Connected*. Otherwise, the UE does not include this field. |
| ***reducedNumOfSampleForMeasurementWithFH-RRC-Connected***  Indicates whether the UE supports reduced number of samples for DL-PRS based positioning measurements with frequency hopping for RRC\_CONNECTED. The UE can include this field only if the UE supports *supportOfRedCap* or *supportOfERedCap* defined in TS 38.331 [35]*,* *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* and *dl-PRS-MeasurementWithRxFH-RRC-Connected*. Otherwise, the UE does not include this field. |
| ***reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive***  Indicates whether the UE supports reduced number of samples for DL-PRS based positioning measurements with frequency hopping for RRC\_IDLE and RRC\_INACTIVE. The UE can include this field only if the UE supports *supportOfRedCap* or *supportOfERedCap* defined in TS 38.331 [35], *supportedDL-PRS-ProcessingSamples-RRC-CONNECTED* and *dl-PRS-MeasurementWithRxFH-RRC-Connected*. Otherwise, the UE does not include this field. |
| ***supportOfPRS-BWA-WithTwoPFL-Combination***  Indicates whether the UE supports DL-PRS bandwidth aggregation with two PFL combinations. The UE can include this field only if the UE supports *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected*. Otherwise, the UE does not include this field. |
| ***dl-PRS-MeasurementWithRxFH-RRC-Connected***  Indicates the UE capability for DL-PRS measurement with Rx frequency hopping within a MG and measurement reporting in RRC\_CONNECTED for RedCap UEs. The UE can include this field only if the UE supports *supportedBandwidthPRS*, *dl-PRS-BufferType*, *durationOfPRS-Processing*, *maxNumOfDL-PRS-ResProcessedPerSlot* and one of *supportOfRedCap* and *supportOfERedCap* defined in TS 38.331 [35]. Otherwise, the UE does not include this field. The capability signalling comprises the following parameters:  - ***maximumPRS-BandwidthAcrossAllHopsFR1:*** Indicates the maximum DL-PRS bandwidth across all hops in MHz for FR1, which is supported and reported by UE.  - ***maximumPRS-BandwidthAcrossAllHopsFR2***: Indicates the maximum DL-PRS bandwidth across all hops in MHz for FR2, which is supported and reported by UE.  - ***maximumFH-Hops***: Indicates the maximum number of hops, which is supported and reported by UE.  - ***processingDuration***: Indicates the duration of DL-PRS symbols N3 in units of ms a UE can process every T3 ms.  - ***processingPRS-SymbolsDurationN3***: This field specifies the values for N3. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***processingDurationT3***: This field specifies the values for T3. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280ms.  - ***rf-RxRetuneTimeFR1***: Indicates the RF Rx retune times between consecutive hops for FR1. Enumerated values indicate 70, 140, 210µs.  - ***rf-RxRetuneTimeFR2***: Indicates the RF Rx retune times between consecutive hops for FR2. Enumerated values indicate 35, 70, 140µs.  - ***numOfOverlappingPRB***: Indicates the overlapping PRB(s) between adjacent hops. Enumerated values indicate 0,1,2,4 PRBs.  NOTE 28: The maximum DL-PRS bandwidth per hop follows *supportedBandwidthPRS*.  NOTE 29: DL-PRS buffering capability follows *dl-PRS-BufferType*. |
| NOTE 9: When the target device provides the *durationOfPRS-Processing* capability (*N*, *T*) for any time window defined in TS 38.214 [45] clause 5.1.6.5, the target device should be capable of processing all DL-PRS Resources within , if  - where K is defined in the TS 38.214 [45] clause 5.1.6.5, and  - the number of DL-PRS Resources in each slot does not exceed the *maxNumOfDL-PRS-ResProcessedPerSlot*, and  - the configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) is as specified in TS 38.133 [46]. |

#### *– NR-DL-PRS-QCL-ProcessingCapability*

The IE *NR-DL-PRS-QCL-ProcessingCapability* defines the common DL-PRS QCL Processing capability. The target device can include this IE only if the target device supports *NR-DL-PRS-ProcessingCapability* or *NR-DL-AIML-PRS-ProcessingCapability*. Otherwise, the target device does not include this IE.

In the case of capabilities for multiple NR positioning methods (except for NR DL AI/ML positioning) are provided, the IE *NR-DL-PRS-QCL-ProcessingCapability* applies across the NR positioning methods (except to NR DL AI/ML positioning) and the target device shall indicate the same values for the capabilities in IEs *NR-DL-TDOA-ProvideCapabilities*, *NR-DL-AoD-ProvideCapabilities*, and *NR-Multi-RTT-ProvideCapabilities*.

-- ASN1START

NR-DL-PRS-QCL-ProcessingCapability-r16 ::= SEQUENCE {

dl-PRS-QCL-ProcessingCapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

DL-PRS-QCL-ProcessingCapabilityPerBand-r16,

...

}

DL-PRS-QCL-ProcessingCapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

ssb-FromNeighCellAsQCL-r16 ENUMERATED { supported} OPTIONAL,

prs-FromServNeighCellAsQCL-r16 ENUMERATED { supported} OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-PRS-QCL-ProcessingCapability* field descriptions |
| --- |
| ***ssb-FromNeighCellAsQCL***  Indicates the support of SSB from neighbour cell as QCL source of a DL-PRS. UE supporting this feature also support reusing SSB measurement from RRM for receiving DL-PRS.  Note: It refers to Type-C for FR1 and Type-C & Type-D support for FR2. |
| ***prs-FromServNeighCellAsQCL***  Indicates the support of DL-PRS from serving/neighbour cell as QCL source of a DL-PRS.  Note 1: It refers to Type-D support for FR2.  Note 2: A DL-PRS from a PRS-only TP is treated as DL-PRS from a non-serving cell. |

[…]

#### *– NR-DL-PRS-ResourcesCapability*

The IE *NR-DL-PRS-ResourcesCapability* defines the DL-PRS Resources capability for each NR positioning method. The target device can include this IE only if the target device supports *NR-DL-PRS-ProcessingCapability* or NR*-DL-AIML-PRS-ProcessingCapability*. Otherwise, the target device does not include this IE.

-- ASN1START

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

maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer-r16

INTEGER (1..2),

maxNrOfTRP-AcrossFreqs-r16 ENUMERATED { n4, n6, n12, n16, n32,

n64, n128, n256, ..., n24-v1690},

maxNrOfPosLayer-r16 INTEGER (1..4),

dl-PRS-ResourcesCapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

DL-PRS-ResourcesCapabilityPerBand-r16,

dl-PRS-ResourcesBandCombinationList-r16 DL-PRS-ResourcesBandCombinationList-r16,

...

}

DL-PRS-ResourcesCapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

maxNrOfDL-PRS-ResourcesPerResourceSet-r16 ENUMERATED { n1, n2, n4, n8, n16, n32, n64, ...},

maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer-r16

ENUMERATED { n6, n24, n32, n64, n96, n128,

n256, n512, n1024, ...},

...

}

DL-PRS-ResourcesBandCombinationList-r16 ::= SEQUENCE (SIZE (1..maxBandComb-r16)) OF

DL-PRS-ResourcesBandCombination-r16

DL-PRS-ResourcesBandCombination-r16 ::= SEQUENCE {

bandList-r16 SEQUENCE (SIZE (1..maxSimultaneousBands-r16)) OF

FreqBandIndicatorNR-r16,

maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet-r16

CHOICE {

fr1-Only-r16 ENUMERATED {n6, n24, n64, n128, n192,

n256, n512, n1024, n2048},

fr2-Only-r16 ENUMERATED {n24, n64, n96, n128, n192,

n256, n512, n1024, n2048},

fr1-FR2Mix-r16 SEQUENCE {

fr1-r16 ENUMERATED {n6, n24, n64, n96, n128,

n192, n256, n512, n1024, n2048},

fr2-r16 ENUMERATED {n24, n64, n96, n128, n192,

n256, n512, n1024, n2048},

...

},

...

},

...

}

-- ASN1STOP

| *NR-DL-PRS-ResourcesCapability* field descriptions |
| --- |
| ***maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer***  Indicates the maximum number of DL-PRS Resource Sets per TRP per positioning frequency layer supported by UE. |
| ***maxNrOfTRP-AcrossFreqs***  Indicates the maximum number of TRPs across all positioning frequency layers. |
| ***maxNrOfPosLayer***  Indicates the maximum number of supported positioning frequency layers. |
| ***dl-PRS-ResourcesBandCombinationList***  Provides the capabilities of DL-PRS Resources for the indicated band combination in *bandList*. This field is provided for all band combinations for which the target device supports DL-PRS. |
| ***maxNrOfDL-PRS-ResourcesPerResourceSet***  Indicates the maximum number of DL-PRS Resources per DL-PRS Resource Set. Value 16, 32, 64 are only applicable to FR2 bands. Value 1 is not applicable for DL-AoD. |
| ***maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer***  Indicates the maximum number of DL-PRS Resources per positioning frequency layer. Value 6 is only applicable to FR1 bands. |
| ***maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet***  Indicates the maximum number of DL-PRS Resources supported by UE across all frequency layers, TRPs and DL-PRS Resource Sets.  fr1-Only: This is applicable for FR1 only band combinations;  fr2-Only: This is applicable for FR2 only band combinations;  fr1-FR2Mix: This is applicable for band combinations containing FR1 and FR2 bands. fr1 means for FR1 in FR1/FR2 mixed operation, and fr2 means for FR2 in FR1/FR2 mixed operation. |

[…]

#### 6.5.13.6 NR DL AI/ML Positioning Capability Information

#### – *NR-DL-AIML-ProvideCapabilities*

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

-- ASN1START

NR-DL-AIML-ProvideCapabilities-r19 ::= SEQUENCE {

locationCoordinateTypes-r19 LocationCoordinateTypes OPTIONAL,

periodicalReporting-r19 ENUMERATED { supported } OPTIONAL,

periodicReportingIntervalMsSupport-r19 PeriodicReportingIntervalMsSupport-r18 OPTIONAL,

ten-ms-unit-ResponseTime-r19 ENUMERATED { supported } OPTIONAL,

scheduledLocationRequestSupported-r19 ScheduledLocationTimeSupport-r17 OPTIONAL,

nr-PosCalcAssistanceSupport-r19 BIT STRING {

trpLocSup (0),

beamInfoSup (1),

rtdInfoSup (2),

trpTEG-InfoSup (3),

nr-IntegritySup (4),

pruInfoSup (5),

trpLoc-ImplicitSup (6)

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

nr-los-nlos-AssistanceDataSupport-r19 SEQUENCE {

type LOS-NLOS-IndicatorType2-r17,

granularity LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

nr-DL-PRS-ExpectedAoD-or-AoA-Sup-r19 BIT STRING {

eAoD (0),

eAoA (1)

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

nr-DL-AIML-On-Demand-DL-PRS-Support-r19 NR-On-Demand-DL-PRS-Support-r17 OPTIONAL,

nr-DL-AIML-On-Demand-DL-PRS-ForBWA-Support-r19

ENUMERATED { supported } OPTIONAL,

nr-dl-prs-AssistanceDataValidity-r19 SEQUENCE {

area-validity INTEGER (1..maxNrOfAreas-r17) OPTIONAL,

...

} OPTIONAL,

multiLocationEstimateInSameMeasReport-r19 ENUMERATED { supported } OPTIONAL,

nr-IntegrityAssistanceSupport-r19 BIT STRING {

serviceParametersSup (0),

serviceAlertSup (1),

riskParametersSup (2),

integrityParaTRP-LocSup (3),

integrityParaBeamInfoSup (4),

integrityParaRTD-InfoSup (5)

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

nr-DL-AIML-CapabilityPerBandList-r19 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

NR-DL-AIML-CapabilityPerBand-r19 OPTIONAL, nr-DL-AIML-PRS-Capability-r19 NR-DL-PRS-ResourcesCapability-r16,

nr-DL-AIML-QCL-ProcessingCapability-r19 NR-DL-PRS-QCL-ProcessingCapability-r16,

nr-DL-AIML-PRS-ProcessingCapability-r19 NR-DL-AIML-PRS-ProcessingCapability-r19,

...

}

NR-DL-AIML-CapabilityPerBand-r19 ::= SEQUENCE {

freqBandIndicatorNR-r19 FreqBandIndicatorNR-r16,

simul-DL-AIML-and-DL-TDOA-r19 ENUMERATED { supported} OPTIONAL,

simul-DL-AIML-and-DL-AoD-r19 ENUMERATED { supported} OPTIONAL,

supportOfDL-PRS-BWA-RRC-Connected-r19 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-AIML-ProvideCapabilities* field descriptions |
| ***locationCoordinateTypes***  This field indicates the geographical location coordinate types that a target device supports for DL AI/ML positioning. TRUE indicates that a location coordinate type is supported and FALSE that it is not. |
| ***periodicalReporting***  This field, if present, indicates that the target device supports *periodicalReporting.* If this field is absent, the target device does not support *periodicalReporting* in *CommonIEsRequestLocationInformation* from the location server. |
| ***periodicReportingIntervalMsSupport***  This field, if present, indicates that the target device supports the *reportingIntervalMs* in IE *PeriodicalReportingCriteriaExt* in IE *CommonIEsRequestLocationInformation* from the location server and specifies the minimum millisecond periodic reporting interval supported. |
| ***ten-ms-unit-ResponseTime***  This field, if present, indicates that the target device supports the enumerated value '*ten-milli-seconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. |
| ***scheduledLocationRequestSupported***  This field, if present, indicates that the target device supports scheduled location requests – i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* – and the time base(s) supported for the scheduled location time. |
| ***nr-PosCalcAssistanceSupport***  This field indicates the Position Calculation Assistance Data supported by the target device. This is represented by a bit string, with a one‑value at the bit position means the particular assistance data is supported; a zero‑value means not supported.  - bit 0 indicates whether the field *nr-TRP-LocationInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 1 indicates whether the field *nr-DL-PRS-BeamInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 2 indicates whether the field *nr-RTD-Info* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 3 indicates whether the field *nr-DL-PRS-TRP-TEG-Info* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 4 together with bit 0 indicates whether the fields *nr-IntegrityTRP-LocationBounds*, *nr-IntegrityDL-PRS-ResourceSetARP-LocationBounds*, *nr-IntegrityDL-PRS-ResourceARP-LocationBounds* in IE *NR-TRP-LocationInfo* are supported or not; bit 4 together with bit 1 indicates whether the field *nr-IntegrityBeamInfoBounds* in IE *NR-DL-PRS-BeamInfo* is supported or not; bit 4 together with the bit 2 indicates whether the field *nr-IntegrityRTD-InfoBounds* in IE *NR-RTD-Info* is supported or not;  - bit 5 indicates whether the field *nr-PRU-DL-Info* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 6 indicates whether the field *nr-TRP-LocationInfo-Implicit* in IE *NR-PositionCalculationAssistance* is supported or not. |
| ***nr-los-nlos-AssistanceDataSupport***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* in IE *NR-PositionCalculationAssistance*:  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in *LOS-NLOS-Indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistance*.  - *granularity* indicates whether the target device supports the granularity for *nr-los-nlos-indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* of '*per-trp*', '*per-resource*', or both. |
| ***nr-DL-PRS-ExpectedAoD-or-AoA-Sup***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedAoD-or-AoA* in *NR-DL-PRS-AssistanceData.* |
| ***nr-DL-AIML-On-Demand-DL-PRS-Support***  This field, if present, indicates that the target device supports on-demand DL-PRS requests. |
| ***nr-DL-AIML-On-Demand-DL-PRS-ForBWA-Support***  This field, if present, indicates that the target device supports on-demand DL-PRS request for bandwidth aggregation. |
| ***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 areas the target device supports*.* |
| ***multiLocationEstimateInSameMeasReport***  This field, if present, indicates that the target device supports multiple location estimate instances in a single measurement report. |
| ***nr-IntegrityAssistanceSupport***  This field indicates the Integrity Assistance Data supported. This is represented by a bit string, with a one‑value at the bit position means the particular assistance data is supported; a zero‑value means not supported.  - bit 0 indicates whether the field *nr-IntegrityServiceParameters* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 1 indicates whether the field *nr-IntegrityServiceAlert* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 2 indicates whether the field *nr-IntegrityRiskParameters* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 3 indicates whether the field *nr-IntegrityParametersTRP-LocationInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 4 indicates whether the field *nr-IntegrityParametersDL-PRS-BeamInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 5 indicates whether the field *nr-IntegrityParametersRTD-Info* in IE *NR-PositionCalculationAssistance* is supported or not. |
| ***simul-DL-AIML-and-DL-TDOA***  This field, if present, indicates that the target device supports simultaneous operation of NR DL AI/ML and NR DL-TDOA positioning. The target device can include this field only if the target device supports UE-based NR DL-TDOA. Otherwise, the target device does not include this field. |
| ***simul-DL-AIML-and-DL-AoD***  This field, if present, indicates that the target device supports simultaneous operation of NR DL AI/ML and NR DL-AoD positioning. The target device can include this field only if the target device supports UE-based NR DL-AoD. Otherwise, the target device does not include this field. |
| ***supportOfDL-PRS-BWA-RRC-Connected***  Indicates whether the target device supports DL-PRS bandwidth aggregation in RRC\_CONNECTED for NR DL AI/ML positioning.  The target device can include this field only if the target device supports *maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer, maxNrOfTRP-AcrossFreqs, maxNrOfPosLayer* and *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected*. Otherwise, the target device does not include this field. |
| ***nr-DL-AIML-PRS-Capability***  This field indicates the DL-PRS Resources capability supported by the target device. |
| ***nr-DL-AIML-QCL-ProcessingCapability***  This field indicates DL-PRS QCL Processing capability supported by the target device. |
| ***nr-DL-AIML-PRS-ProcessingCapability***  This field indicates the DL-PRS Processing capability supported by the target device. |

#### 6.5.13.6a NR DL AI/ML Positioning Capability Information Elements

#### *– NR-DL-AIML-PRS-ProcessingCapability*

The IE *NR-DL-AIML-PRS-ProcessingCapability* defines the DL-PRS Processing capability for NR DL AI/ML Positioning.

-- ASN1START

NR-DL-AIML-PRS-ProcessingCapability-r19 ::= SEQUENCE {

nr-dl-aiml-prs-ProcessingCapabilityBandList-r19 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

NR-DL-AIML-PRS-ProcessingCapabilityPerBand-r19,

supportedActivatedPRS-ProcessingWindow-r19 ENUMERATED {n2, n3, n4} OPTIONAL,

...

}

NR-DL-AIML-PRS-ProcessingCapabilityPerBand-r19 ::= SEQUENCE {

freqBandIndicatorNR-r19 FreqBandIndicatorNR-r16,

nr-dl-aiml-prs-ProcessingCapability-r19 NR-DL-AIML-PRS-ProcessingCapabilityElement-r19

OPTIONAL,

prs-ProcessingWindowType1A-r19 ENUMERATED { option1, option2, option3} OPTIONAL,

prs-ProcessingWindowType1B-r19 ENUMERATED { option1, option2, option3} OPTIONAL,

prs-ProcessingWindowType2-r19 ENUMERATED { option1, option2, option3} OPTIONAL,

prs-ProcessingCapabilityOutsideMGinPPW-r19

SEQUENCE (SIZE(1..3)) OF

PRS-ProcessingCapabilityOutsideMGinPPWperType-r19

OPTIONAL,

prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected-r19

PRS-BWA-TwoContiguousIntrabandInMG-r19 OPTIONAL,

prs-BWA-ThreeContiguousIntrabandInMG-RRC-Connected-r19

PRS-BWA-ThreeContiguousIntrabandInMG-r19 OPTIONAL,

supportOfPRS-BWA-WithTwoPFL-Combination-r19

ENUMERATED { supported } OPTIONAL,

...

}

NR-DL-AIML-PRS-ProcessingCapabilityElement-r19 ::= SEQUENCE {

supportedBandwidthPRS-r19 CHOICE {

fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

mhz50, mhz80, mhz100},

fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400},

...

},

dl-PRS-BufferType-r19 ENUMERATED {type1, type2, ...},

durationOfPRS-Processing-r19 SEQUENCE {

durationOfPRS-ProcessingSymbols-r19 ENUMERATED {nDot125, nDot25, nDot5, n1,

n2, n4, n6, n8, n12, n16, n20, n25,

n30, n32, n35, n40, n45, n50},

durationOfPRS-ProcessingSymbolsInEveryTms-r19

ENUMERATED {n8, n16, n20, n30, n40, n80,

n160, n320, n640, n1280},

...

},

maxNumOfDL-PRS-ResProcessedPerSlot-r19

SEQUENCE {

scs15-r19 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs30-r19 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs60-r19 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs120-r19 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

...

},

...

}

PRS-ProcessingCapabilityOutsideMGinPPWperType-r19 ::= SEQUENCE {

prsProcessingType-r19 ENUMERATED { type1A, type1B, type2 },

ppw-dl-PRS-BufferType-r19 ENUMERATED { type1, type2, ... },

ppw-durationOfPRS-Processing1-r19

SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN-r19

ENUMERATED { msDot125, msDot25, msDot5, ms1, ms2, ms4,

ms6, ms8, ms12, ms16, ms20, ms25, ms30, ms32,

ms35, ms40, ms45, ms50 },

ppw-durationOfPRS-ProcessingSymbolsT-r19

ENUMERATED { ms1, ms2, ms4, ms8, ms16, ms20, ms30, ms40,

ms80, ms160, ms320, ms640, ms1280 },

...

} OPTIONAL,

ppw-durationOfPRS-Processing2-r19

SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN2-r19

ENUMERATED { msDot125, msDot25, msDot5, ms1, ms2, ms3, ms4,

ms5, ms6, ms8, ms12 },

ppw-durationOfPRS-ProcessingSymbolsT2-r19

ENUMERATED { ms4, ms5, ms6, ms8 },

...

} OPTIONAL,

ppw-maxNumOfDL-PRS-ResProcessedPerSlot-r19

SEQUENCE {

scs15-r19 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64 } OPTIONAL,

scs30-r19 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64 } OPTIONAL,

scs60-r19 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64 } OPTIONAL,

scs120-r19 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64 } OPTIONAL,

...

},

ppw-maxNumOfDL-Bandwidth-r19 CHOICE {

fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40, mhz50, mhz80,mhz100},

fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400},

...

} OPTIONAL,

...

}

PRS-BWA-TwoContiguousIntrabandInMG-r19 ::= SEQUENCE {

maximumOfTwoAggregatedDL-PRS-Bandwidth-FR1-r19 ENUMERATED {mhz10, mhz20, mhz40, mhz50,

mhz80, mhz100, mhz160, mhz200}

OPTIONAL,

maximumOfTwoAggregatedDL-PRS-Bandwidth-FR2-r19 ENUMERATED {mhz100, mhz200, mhz400, mhz800}

OPTIONAL,

maximumOfDL-PRS-BandwidthPerPFL-FR1-r19 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

mhz50, mhz80, mhz100} OPTIONAL,

maximumOfDL-PRS-BandwidthPerPFL-FR2-r19 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

OPTIONAL,

dl-PRS-BufferTypeOfBWA-r19 ENUMERATED {type1, type2},

prs-durationOfTwoPRS-BWA-Processing-r19 SEQUENCE {

prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r19

ENUMERATED {msDot125, msDot25, msDot5, ms1, ms2, ms4, ms6, ms8, ms12,

ms16, ms20, ms25, ms30, ms32, ms35, ms40, ms45, ms50},

prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r19

ENUMERATED {ms8, ms16, ms20, ms30, ms40, ms80, ms160, ms320, ms640, ms1280},

...

} OPTIONAL,

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r19 SEQUENCE {

scs15-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs30-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs60-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

...

},

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r19 SEQUENCE {

scs60-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs120-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

...

},

...

}

PRS-BWA-ThreeContiguousIntrabandInMG-r19 ::= SEQUENCE {

maximumOfThreeAggregatedDL-PRS-Bandwidth-FR1-r19

ENUMERATED {mhz15, mhz20, mhz30, mhz40, mhz50, mhz60, mhz80, mhz100, mhz120,

mhz140, mhz150, mhz180, mhz200, mhz240, mhz300} OPTIONAL,

maximumOfThreeAggregatedDL-PRS-Bandwidth-FR2-r19

ENUMERATED {mhz150, mhz200, mhz300, mhz400, mhz600, mhz800, mhz1000,

mhz1200} OPTIONAL,

maximumOfDL-PRS-BandwidthPerPFL-FR1-r19

ENUMERATED {mhz5, mhz10, mhz20, mhz40, mhz50, mhz80, mhz100} OPTIONAL,

maximumOfDL-PRS-BandwidthPerPFL-FR2-r19

ENUMERATED {mhz50, mhz100, mhz200, mhz400} OPTIONAL,

dl-PRS-BufferTypeOfBWA-r19

ENUMERATED {type1, type2},

prs-durationOfThreePRS-BWA-Processing-r19 SEQUENCE {

prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r19

ENUMERATED {msDot125, msDot25, msDot5, ms1, ms2, ms4, ms6, ms8, ms12,

ms16, ms20, ms25, ms30, ms32, ms35, ms40, ms45, ms50},

prs-durationOfThreePRS-BWA-ProcessingSymbolsT-r19

ENUMERATED {ms8, ms16, ms20, ms30, ms40, ms80, ms160,

ms320, ms640, ms1280},

...

} OPTIONAL,

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r19 SEQUENCE {

scs15-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs30-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs60-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

...

},

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r19 SEQUENCE {

scs60-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

scs120-r19 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 } OPTIONAL,

...

},

...

}

-- ASN1STOP

| *NR-DL-AIML-PRS-ProcessingCapability* field descriptions |
| --- |
| ***supportedActivatedPRS-ProcessingWindow***  Indicates the number of supported PRS Processing windows. |
| ***nr-dl-aiml-prs-ProcessingCapability***  Indicates the DL-PRS processing capability for NR DL AI/ML positioning and comprises the following subfields:  - ***supportedBandwidthPRS***: Indicates the maximum number of DL-PRS bandwidth in MHz, which is supported and reported by UE.  - ***dl-PRS-BufferType***: Indicates DL-PRS buffering capability. Value type1 indicates sub-slot/symbol level buffering and value type2 indicates slot level buffering.  - ***durationOfPRS-Processing***: Indicates the duration *N* of DL-PRS symbols in units of ms a UE can process every *T* ms assuming maximum DL-PRS bandwidth provided in *supportedBandwidthPRS* and comprises the following subfields:  - ***durationOfPRS-ProcessingSymbols***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***durationOfPRS-ProcessingSymbolsInEveryTms***: This field specifies the values for *T*. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.  - ***maxNumOfDL-PRS-ResProcessedPerSlot***: Indicates the maximum number of DL-PRS Resources that UE can process in a slot. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands.  NOTE 1: When the target device provides the *durationOfPRS-Processing* capability (*N*, *T*) for any time window defined in TS 38.214 [45] clause 5.1.6.5, the target device should be capable of processing all DL-PRS Resources within , if  - where K is defined in the TS 38.214 [45] clause 5.1.6.5, and  - the number of DL-PRS Resources in each slot does not exceed the *maxNumOfDL-PRS-ResProcessedPerSlot*, and  - the configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) is as specified in TS 38.133 [46].  NOTE 2: If this group of fields is not included, but the IE *NR-DL-PRS-ProcessingCapability* is included in the *ProvideCapabilities* message body, the corresponding fields in IE *NR-DL-PRS-ProcessingCapability* (*supportedBandwidthPRS-r16*, *dl-PRS-BufferType-r16*, *durationOfPRS-Processing-r16,* *maxNumOfDL-PRS-ResProcessedPerSlot-r16*) are also applicable to NR DL AI/ML positioning. |
| ***prs-ProcessingWindowType1A***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 1A refers to the determination of prioritization between DL-PRS and other DL signals/channels in all OFDM symbols within the DL-PRS Processing Window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR. Enumerated value indicates supported priority handing options of DL-PRS:  - *option1*: Support of "st1" and "st3" defined in clause 5.1.6.5 of TS 38.214 [45].  - *option2*: Support of "st1", "st2", and "st3" defined in clause 5.1.6.5 of TS 38.214 [45].  - *option3*: Support of "st1" only defined in clause 5.1.6.5 of TS 38.214 [45].  The UE can include this field only if the UE supports *nr-dl-aiml-prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE 3: Within a DL-PRS processing window, UE measurement is inside the active DL BWP with DL-PRS having the same numerology as the active DL BWP.  NOTE 3a: When the UE determines higher priority for other DL signals/channels over the DL-PRS measurement/processing, the UE is not expected to measure/process DL-PRS. |
| ***prs-ProcessingWindowType1B***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 1B refers to the determination of prioritization between DL-PRS and other DL signals/channels in all OFDM symbols within the DL-PRS processing window. The DL signals/channels from a certain band are affected. Enumerated value indicates supported priority handing options of DL-PRS (see *prs-ProcessingWindowType1A*).  The UE can include this field only if the UE supports *nr-dl-aiml-prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE 4: Within a DL-PRS processing window, UE measurement is inside the active DL BWP with DL-PRS having the same numerology as the active DL BWP.  NOTE 4a: When the UE determines higher priority for other DL signals/channels over the DL-PRS measurement/processing, the UE is not expected to measure/process DL-PRS. |
| ***prs-ProcessingWindowType2***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 2 refers to the determination of prioritization between DL-PRS and other DL signals/channels only in DL-PRS symbols within the DL-PRS processing window. Enumerated value indicates supported priority handing options of DL-PRS (see *prs-ProcessingWindowType1A*).  The UE can include this field only if the UE supports *nr-dl-aiml-prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE 5: Within a DL-PRS processing window, UE measurement is inside the active DL BWP with DL-PRS having the same numerology as the active DL BWP.  NOTE 5a: When the UE determines higher priority for other DL signals/channels over the DL-PRS measurement/processing, the UE is not expected to measure/process DL-PRS. |
| ***prs-ProcessingCapabilityOutsideMGinPPW***  Indicates the DL-PRS Processing Capability outside MG of each of the supported PPW Type in the case the UE supports multiple PPW Types in a band and comprises the following subfields:  - ***prsProcessingType***: Indicates the DL-PRS Processing Window Type for which the *prs-ProcessingCapabilityOutsideMGinPPW* are provided.  - ***ppw-dl-PRS-BufferType***: Indicates DL-PRS buffering capability. Value '*type1'* indicates sub-slot/symbol level buffering and value '*type2'* indicates slot level buffering.  - ***ppw-durationOfPRS-Processing1***: Indicates the duration of DL-PRS symbols *N* in units of ms a UE can process every *T* ms assuming maximum DL-PRS bandwidth provided in *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:  - ***ppw-durationOfPRS-ProcessingSymbolsN***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***ppw-durationOfPRS-ProcessingSymbolsT***: This field specifies the values for *T*. Enumerated values indicate 1, 2, 4, 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.  - ***ppw-durationOfPRS-Processing2***: Indicates the duration of DL-PRS symbols *N2* in units of ms a UE can process in*T2* ms assuming maximum DL-PRS bandwidth provided in *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:  - ***ppw-durationOfPRS-ProcessingSymbolsN2***: This field specifies the values for *N2*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12 ms.  - ***ppw-durationOfPRS-ProcessingSymbolsT2***: This field specifies the values for *T2*. Enumerated values indicate 4, 5, 6, 8 ms.  - ***ppw-maxNumOfDL-PRS-ResProcessedPerSlot:*** Indicates the maximum number of DL-PRS resources that UE can process in a slot. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands.  - ***ppw-maxNumOfDL-Bandwidth:*** Indicates the maximum number of DL-PRS bandwidth in MHz, which is supported and reported by UE for DL-PRS measurement outside MG within the PPW.  The UE can include this field only if the UE supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* and *prs-ProcessingWindowType2*. Otherwise, the UE does not include this field.  NOTE 6: A UE that supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* or *prs-ProcessingWindowType2* shall always include the *prs-ProcessingCapabilityOutsideMGinPPW*.  NOTE 7: The (*N*, *T*) UE capability in *ppw-durationOfPRS-Processing1* is interpreted as in NOTE 1, and the UE is expected to receive the DL-PRS within the DL-PRS processing window but the processing of the received DL-PRS may be outside a DL-PRS processing window.  NOTE 8: The (*N2*, *T2*) UE capability in *ppw-durationOfPRS-Processing2* is interpreted such that the UE is capable of measuring up to *N2* ms DL-PRS within a PPW and is capable of completing the DL-PRS processing within the PPW, e.g., if the time duration from the last symbol of the measured DL-PRS Resource(s) inside the PPW to the end of PPW is not smaller than *T2* ms.  NOTE 9: A UE which supports *prs-ProcessingCapabilityOutsideMGinPPW* shall support either *ppw-durationOfPRS-Processing1* or *ppw-durationOfPRS-Processing2*, but not both for each supported type in a band.  NOTE 10: If this group of fields is not included, but the IE *NR-DL-PRS-ProcessingCapability* is included in the *ProvideCapabilities* message body, the corresponding fields in IE *NR-DL-PRS-ProcessingCapability* (*prs-ProcessingCapabilityOutsideMGinPPW-r17*) are also applicable to NR DL AI/ML positioning. |
| ***prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected***  Indicates the UE capability for support of DL-PRS processing capabilities for aggregated DL-PRS processing of 2 PFLs in intra-band contiguous within a MG for RRC\_CONNECTED state and and comprises the following subfields:  - ***maximumOfTwoAggregatedDL-PRS-Bandwidth-FR1***: Indicates the maximum aggregated DL-PRS bandwidth in MHz for FR1, which is supported and reported by UE.  - ***maximumOfTwoAggregatedDL-PRS-Bandwidth-FR2***: Indicates the maximum aggregated DL-PRS bandwidth in MHz for FR2, which is supported and reported by UE.  - ***maximumOfDL-PRS-BandwidthPerPFL-FR1***: Indicates the maximum DL-PRS bandwidth in MHz for FR1, per PFL.  - ***maximumOfDL-PRS-BandwidthPerPFL-FR2***: Indicates the maximum DL-PRS bandwidth in MHz for FR2, per PFL.  - ***dl-PRS-BufferTypeOfBWA***: Indicates the DL-PRS buffering capability.  - ***prs-durationOfTwoPRS-BWA-Processing***: Indicates the duration of DL-PRS symbols *N* in units of ms a UE can process every *T* ms assuming maximum aggregated DL-PRS bandwidth in MHz, which is supported and reported by UE.  - ***prs-durationOfTwoPRS-BWA-ProcessingSymbolsN***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***prs-durationOfTwoPRS-BWA-ProcessingSymbolsT***: This field specifies the values for *T*. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280, 2560 ms.  - ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR1.  - ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR2.  The UE can include this field only if the UE supports *supportedBandwidthPRS, dl-PRS-BufferType, durationOfPRS-Processing* and *maxNumOfDL-PRS-ResProcessedPerSlot*. Otherwise, the UE does not include this field.  NOTE 11: *dl-PRS-BufferTypeOfBWA* follows buffering capability type reported in *dl-PRS-BufferType.*  NOTE 12: The value *N* should be equal or smaller than the value *N* reported by *durationOfPRS-ProcessingSymbols*, or this value *T* should be equal or larger than the value *T* reported by *durationOfPRS-ProcessingSymbolsInEveryTms.*  NOTE 13: Each two linked DL-PRS Resources are counted as 1 resource.  NOTE 14: *maxNumOfAggregatedDL-PRS-ResourcePerSlot* should be equal or smaller than the value reported by *maxNumOfDL-PRS-ResProcessedPerSlot.*  NOTE 15: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL)/measurement gap repetition period (MGRP) of no more than 30%.  NOTE 16: If this group of fields is not included, but the IE *NR-DL-PRS-ProcessingCapability* is included in the *ProvideCapabilities* message body, the corresponding fields in IE *NR-DL-PRS-ProcessingCapability* (*prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected-r18*) are also applicable to NR DL AI/ML positioning. |
| ***prs-BWA-ThreeContiguousIntrabandInMG-RRC-Connected***  Indicates the UE capability for support of DL-PRS processing capabilities for aggregated DL-PRS processing of 3 PFLs in intra-band contiguous within a MG for RRC\_CONNECTED state and comprises the following subfields:  - ***maximumOfThreeAggregatedDL-PRS-Bandwidth-FR1***: Indicates the maximum aggregated DL-PRS bandwidth in MHz of for FR1, which is supported and reported by UE.  - ***maximumOfThreeAggregatedDL-PRS-Bandwidth-FR2***: Indicates the maximum aggregated DL-PRS bandwidth in MHz for FR2, which is supported and reported by UE.  - ***maximumOfDL-PRS-BandwidthPerPFL-FR1***: Indicates the maximum DL-PRS bandwidth in MHz for FR1, per PFL  - ***maximumOfDL-PRS-BandwidthPerPFL-FR2***: Indicates the maximum DL-PRS bandwidth in MHz for FR2, per PFL  - ***dl-PRS-BufferTypeOfBWA***: Indicates the DL-PRS buffering capability.  - ***prs-durationOfThreePRS-BWA-Processing***: Indicates the duration of DL-PRS symbols *N* in units of ms a UE can process every *T* ms assuming maximum aggregated DL-PRS bandwidth in MHz, which is supported and reported by UE.  - ***prs-durationOfThreePRS-BWA-ProcessingSymbolsN***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***prs-durationOfThreePRS-BWA-ProcessingSymbolsT***: This field specifies the values for *T*. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280, 3840 ms.  - ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR1.  - ***maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2***: Indicates the Maximum number of aggregated DL-PRS Resources across aggregated PFLs that UE can process in a slot for FR2.  The UE can include this field only if the UE supports *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected****.*** Otherwise, the UE does not include this field.  NOTE17: *dl-PRS-BufferTypeOfBWA* follows buffering capability type reported in *dl-PRS-BufferType.*  NOTE18: The value *N* should be equal or smaller than the value *N* reported by *durationOfPRS-ProcessingSymbols*, or this value *T* should be equal or larger than the value T reported by *durationOfPRS-ProcessingSymbolsInEveryTms.*  NOTE19: Each three linked DL-PRS Resources are counted as 1 resource.  NOTE20: *maxNumOfAggregatedDL-PRS-ResourcePerSlot* should be equal or smaller than the value reported by *maxNumOfDL-PRS-ResProcessedPerSlot*.  NOTE21: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL)/measurement gap repetition period (MGRP) of no more than 30%.  NOTE 22: If this group of fields is not included, but the IE *NR-DL-PRS-ProcessingCapability* is included in the *ProvideCapabilities* message body, the corresponding fields in IE *NR-DL-PRS-ProcessingCapability* (*prs-BWA-ThreeContiguousIntrabandInMG-RRC-Connected-r18*) are also applicable to NR DL AI/ML positioning. |
| ***supportOfPRS-BWA-WithTwoPFL-Combination***  Indicates whether the UE supports DL-PRS bandwidth aggregation with two PFL combinations. The UE can include this field only if the UE supports *prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected*. Otherwise, the UE does not include this field. |

# Annex B: TP2

### 6.4.3 Common NR Positioning Information Elements

[…]

#### *– NR-PositionCalculationAssistance*

The IE *NR-PositionCalculationAssistance* is used by the location server to provide assistance data including integrity information to enable UE‑based downlink positioning.

-- ASN1START

NR-PositionCalculationAssistance-r16 ::= SEQUENCE {

nr-TRP-LocationInfo-r16 NR-TRP-LocationInfo-r16 OPTIONAL, -- Need ON

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

nr-RTD-Info-r16 NR-RTD-Info-r16 OPTIONAL, -- Need ON

...,

[[

nr-TRP-BeamAntennaInfo-r17 NR-TRP-BeamAntennaInfo-r17 OPTIONAL, -- Need ON

nr-DL-PRS-Expected-LOS-NLOS-Assistance-r17

NR-DL-PRS-ExpectedLOS-NLOS-Assistance-r17

OPTIONAL, -- Need ON

nr-DL-PRS-TRP-TEG-Info-r17 NR-DL-PRS-TRP-TEG-Info-r17 OPTIONAL -- Need ON

]],

[[

nr-IntegrityServiceParameters-r18 NR-IntegrityServiceParameters-r18 OPTIONAL, -- Need OR

nr-IntegrityServiceAlert-r18 NR-IntegrityServiceAlert-r18 OPTIONAL, -- Need OR

nr-IntegrityRiskParameters-r18 NR-IntegrityRiskParameters-r18 OPTIONAL, -- Need OR

nr-IntegrityParametersTRP-LocationInfo-r18 NR-IntegrityParametersTRP-LocationInfo-r18

OPTIONAL, -- Cond Integrity1

nr-IntegrityParametersDL-PRS-BeamInfo-r18

NR-IntegrityParametersDL-PRS-BeamInfo-r18

OPTIONAL, -- Cond Integrity2

nr-IntegrityParametersRTD-Info-r18 NR-IntegrityParametersRTD-Info-r18

OPTIONAL, -- Cond Integrity3

nr-IntegrityParametersTRP-BeamAntennaInfo-r18 NR-IntegrityParametersTRP-BeamAntennaInfo-r18

OPTIONAL, -- Cond Integrity4

nr-PRU-DL-Info-r18 NR-PRU-DL-Info-r18 OPTIONAL -- Need ON

]],

[[

nr-TRP-LocationInfo-Implicit-r19 NR-TRP-LocationInfo-Implicit-r19 OPTIONAL -- Need ON

]]

}

NR-IntegrityParametersTRP-LocationInfo-r18 ::= SEQUENCE {

trp-ErrorCorrelationTime-r18 INTEGER(0..255) OPTIONAL, -- Need ON

dl-PRS-ResourceSetARP-ErrorCorrelationTime-r18 INTEGER(0..255) OPTIONAL, -- Need ON

dl-PRS-ResourceARP-ErrorCorrelationTime-r18 INTEGER(0..255) OPTIONAL, -- Need ON

...

}

NR-IntegrityParametersDL-PRS-BeamInfo-r18 ::= SEQUENCE {

dl-PRS-BeamInfoErrorCorrelationTime-r18 INTEGER (0..255),

...

}

NR-IntegrityParametersRTD-Info-r18 ::= SEQUENCE {

rtd-ErrorCorrelationTime-r18 INTEGER (0..255),

...

}

NR-IntegrityParametersTRP-BeamAntennaInfo-r18 ::= SEQUENCE {

trp-BeamAntennaInfoErrorCorrelationTime-r18 INTEGER (0..255),

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *Integrity1* | The field is optionally present, need OR, if *nr-TRP-LocationInfo* is present and *nr-IntegrityTRP-LocationBounds* is present in IE *NR-TRP-LocationInfo;* otherwise it is not present. |
| *Integrity2* | The field is optionally present, need OR, if *nr-DL-PRS-BeamInfo* is present and *nr-IntegrityBeamInfoBounds* is present in IE *NR-DL-PRS-BeamInfo;* otherwise it is not present. |
| *Integrity3* | The field is optionally present, need OR, if *nr-RTD-Info* is present and *nr-IntegrityRTD-InfoBounds* is present in IE *NR-RTD-Info;* otherwise it is not present. |
| *Integrity4* | The field is optionally present, need OR, if *nr-TRP-BeamAntennaInfo* is present and *nr-IntegrityBeamPowerBounds* is present in IE *NR-TRP-BeamAntennaInfo;* otherwise it is not present. |

|  |
| --- |
| *NR-PositionCalculationAssistance* field descriptions |
| ***nr-TRP-LocationInfo***  This field provides the location coordinates of the TRPs and location coordinates of antenna reference points for DL-PRS Resource Set(s) and DL-PRS Resources of the TRPs. |
| ***nr-DL-PRS-BeamInfo***  This field provides the spatial directions of DL-PRS Resources for TRPs. |
| ***nr-RTD-Info***  This field provides the time synchronization information between the reference TRP and neighbour TRPs. |
| ***nr-TRP-BeamAntennaInfo***  This field provides the relative DL-PRS Resource power between DL-PRS Resources per angle per TRP. |
| ***nr-DL-PRS-ExpectedLOS-NLOS-Assistance***  This field provides the expected likelihood of a LOS propagation path from a TRP to the target device. The information is provided per TRP or per DL-PRS Resource. |
| ***nr-DL-PRS-TRP-TEG-Info***  This field provides the TRP Tx TEG ID associated with the transmission of each DL-PRS Resource of the TRP. |
| ***nr-IntegrityServiceParameters***  This field specifiesthe range of Integrity Risk (IR) for which the integrity assistance data are valid. |
| ***nr-IntegrityServiceAlert***  This field indicates whether the corresponding assistance data can be used for integrity related applications. |
| ***trp-ErrorCorrelationTime***  This field specifies the TRP Error Correlation Time which is the upper bound of the correlation time of the TRP error. The time is calculated using:  Range is 1-28,200 s. |
| ***dl-PRS-ResourceSetARP-ErrorCorrelationTime***  This field, if present, specifies the DL-PRS Resource Set ARP Error Correlation Time which is the upper bound of the correlation time of the DL-PRS Resource Set ARP error. The time is calculated using:  Range is 1-28,200 s. |
| ***dl-PRS-ResourceARP-ErrorCorrelationTime***  This field, if present, specifies the DL-PRS Resource ARP Error Correlation Time which is the upper bound of the correlation time of the DL-PRS Resource ARP error. The time is calculated using:  Range is 1-28,200 s. |
| ***rtd-ErrorCorrelationTime***  This field specifies the inter-TRP synchronization error Correlation Time which is the upper bound of the correlation time of the inter-TRP synchronization error. The correlation time is calculated using:  Where *i* is the value given by *rtdErrorCorrelationTime*. Range is 1-28,200 s. |
| ***dl-PRS-BeamInfoErrorCorrelationTime***  This field specifies the Beam Boresight Direction Angle Error Correlation Time which is the upper bound of the correlation time of the DL-PRS Resource angle error. The time is calculated using:  Range is 1-28,200 s. |
| ***trp-BeamAntennaInfoErrorCorrelationTime***  This field specifies the Mean Beam Power Error Correlation Time which is the upper bound of the correlation time of the mean beam power error.  The time is calculated using:  Range is 1-28,200 s. |
| ***nr-PRU-DL-Info***  This field provides the measurements reported by a PRU to the target UE. |
| ***nr-TRP-LocationInfo-Implicit***  This field provides implicit information on location coordinates of the TRPs.  NOTE: This field is only applicable to NR DL AI/ML positioning. |