**3GPP TSG-RAN WG2 Meeting #119e *R2-2209231***

**Electronic, August 17 – 26, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **37.355** | **CR** | **0378** | **rev** | **1** | **Current version:** |  |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network | **x** |

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| ***Title:*** | Miscellaneous LPP Corrections | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Incorporated (Rapporteur) | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos\_enh-Core | | | | |  | ***Date:*** | | | 2022-09-02 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | | Rel-17 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | 1. In TS 38.133 section 5.6.2.5, 5.6.3.5 and 5.6.4.5 for RSTD measurements, PRS-RSRP measurements and UE Rx-Tx time difference measurements, the reduced sample processing is specified. Based on RAN4’s specification, the actual number of reduced DL-PRS samples (1 or 2) should be decided by UE, not LMF. LMF can only request, subject to UE capability, whether a reduced DL-PRS sample measurement is expected but can not request the explicit number of reduced DL-PRS samples. 2. The field name *lowerRxBeamSweepingThan8-FR2-r17* is used to represent both, the UE capability and to send a request to use a lower Rx beam sweeping factor than 8 for FR2. In addition, "Than8" is not needed in the field name, since reflected in the field description. 3. The *DL-PRS-QCL-InfoReq-r17* in *NR-On-Demand-DL-PRS-Information-r17* is not fully aligned with RAN1 agreements. According to RAN1, the UE may recommend a list of QCL sources. 4. The predefined DL-PRS Configuration information is defined via IEs *NR-DL-PRS-PositioningFrequencyLayer-r16* and *NR-DL-PRS-Info-r16*. However, not all fields in these two IEs are applicable for on-demand DL-PRS (since e.g., TRP dependent). 5. There is no field description for the additional measurements in IEs *NR-DL-TDOA-SignalMeasurementInformation*, *NR-DL-AoD-SignalMeasurementInformation*, and *NR-Multi-RTT-SignalMeasurementInformation.* The restriction on the number of TEGs and per-TEG measurements is not specified. 6. The maximum number of TEG-SRS association changes in *nr-SRS-TxTEG-Set* is not specified. 7. The timing error margins of the UE/TRP Tx TEG, UE Rx TEG and UE RxTx TEG are missing. 8. Various minor mistakes:    1. "UL-PRS" should be "UL SRS for positioning" in LPP section 6.5.8.    2. The field description in IE *NR-DL-PRS-ResourcesCapability* uses the terminology "frequency layer" and "positioning layer", which should be both "positioning frequency layer". | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. The *requestedDL-PRS-ProcessingSamples-r17* is changed to reducedDL-PRS-ProcessingSamples-r17 ENUMERATED { requested, ... }. 2. The field name *lowerRxBeamSweepingThan8-FR2* in IE *NR-DL-PRS-ProcessingCapability* is changed to *supportedLowerRxBeamSweepingFactor-FR2.* The field name *lowerRxBeamSweepingThan8-FR2* in the Request Location Information IEs is changed to *lowerRxBeamSweepingFactor-FR2.* 3. A list of QCL sources has been added to *DL-PRS-QCL-InfoReq-r17*. 4. The field description for IE *NR-DL-PRS-On-Demand-Configurations* is updated to list the applicable fields in IEs *NR-DL-PRS-PositioningFrequencyLayer-r16* and *NR-DL-PRS-Info-r16.* The remaining (i.e., not applicable) fields should be ignored by the receiver. 5. Field description is added, defining when the Rel-17 field for additional measurements is present, the corresponding Rel-16 field should be absent. Description for the number of possible per-TEG measurements and the total number of TEGs is added to the field descriptions for the measurement of DL-TDOA and Multi-RTT (according to RAN1 parameter). 6. Field description is added to *nr-SRS-TxTEG-Set* defining that there can be a maximum of 8 changes in TEG-SRS associations per report (according to RAN1). 7. The timing error margins of the UE/TRP Tx TEG, UE Rx TEG and UE RxTx TEG are added to IEs *NR-DL-PRS-TRP-TEG-Info*, *NR-DL-TDOA-SignalMeasurementInformation*, and *NR-Multi-RTT-SignalMeasurementInformation* according to RAN4. 8. Various minor corrections: 9. "UL-PRS" is changed to "UL SRS for positioning" in LPP section 6.5.8. 10. "frequency layer" and "positioning layer" in the field description for IE *NR-DL-PRS-ResourcesCapability* is changed to "positioning frequency layer". | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | 1. The LMF request message is not aligned with RAN4 specifications. 2. Using the same field name in capability and request messages would be confusing. 3. The UE can not recommend a list of QCL sources in the on-demand PRS request. 4. The UE may consider DL-PRS parameter for requesting a pre-defined on-demand DL-PRS configuration which are not meaningful. 5. The maximum allowable measurements per TEG and the total number of TEGs in a measurement report is not specified. 6. The maximum number of TEG-SRS association changes in *nr-SRS-TxTEG-Set* is not specified. 7. The timing error margins remain undefined. 8. Mistakes remain in the specification. 9. **Impact analysis**   **Impacted functionality:**  Reduced DL-PRS samples processing  **Inter-operability:**  If the network is implemented according to the CR and UE is not, the UE would assume that 1-sample processing is requested.  If the UE is implemented according to the CR and network is not, the network would assume that the results were obtained with 1-sample processing.   1. **Impact analysis**   **Impacted functionality:**  DL-PRS Processing Capabilities, Request Location Information IEs  **Inter-operability:**  No inter-operability problem foreseen.   1. **Impact analysis**   **Impacted functionality:**  On-demand DL-PRS request  **Inter-operability:**  If the network is implemented according to the CR and UE is not, the network would receive the recommended QCL sources for the DL-PRS Resource Set only.  If the UE is implemented according to the CR and network is not, the network would receive the recommended QCL sources for the DL-PRS Resource Set only.   1. **Impact analysis**   **Impacted functionality:**  On-demand DL-PRS request  **Inter-operability:**  If the network is implemented according to the CR and UE is not, the UE may consider DL-PRS parameter in a pre-defined DL-PRS configuration for the on-demand DL-PRS request which are not meaningful.  If the UE is implemented according to the CR and network is not, no interoperability problem is foreseen.   1. **Impact analysis**   **Impacted functionality:**  Additional per-TEG measurements for DL-TDOA and Multi-RTT.  **Inter-operability:**  If the network is implemented according to the CR and UE is not, the network may receive a wrong UE measurement report without the per-TEG measurement restrictions.  If the UE is implemented according to the CR and network is not, no interoperability problem is foreseen.   1. **Impact analysis**   **Impacted functionality:**  TEG-SRS association for Multi-RTT.  **Inter-operability:**  If the network is implemented according to the CR and UE is not, the network may receive a wrong UE report without the TEG-SRS association change restriction.  If the UE is implemented according to the CR and network is not, no interoperability problem is foreseen.   1. **Impact analysis**   **Impacted functionality:**  TRP TxTEG Assistance Data  **Inter-operability:**  If the network is implemented according to the CR and UE is not, the UE would not receive the Tx TEG margin for the TRP.  If the UE is implemented according to the CR and network is not, the UE would not receive the Tx TEG margin for the TRP.  **Impacted functionality:**  UE Rx, Tx, and RxTx TEGs  **Inter-operability:**  If the network is implemented according to the CR and UE is not, the network would not receive the UE TEG margin.  If the UE is implemented according to the CR and network is not, the network would not receive the UE TEG margin.   1. **Impact analysis**   **Impacted functionality:**  NR UL Capability Information, NR DL-PRS Resources Capability  **Inter-operability:**  No inter-operability problem foreseen. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.4.3, 6.5.8.1, 6.5.8.2, 6.5.10.4, 6.5.10.5, 6.5.11.4, 6.5.11.5, 6.5.12.4, 6.5.12.5 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

### 6.4.3 Common NR Positioning Information Elements

#### – *AreaID-CellList*

The IE *AreaID-CellList* provides the NR Cell-IDs of the TRPs belonging to a particular network area where the associated assistance data are valid.

-- ASN1START

AreaID-CellList-r17 ::= SEQUENCE (SIZE(1..maxCellIDsPerArea-r17)) OF NR-Cell-IDs-r17

NR-Cell-IDs-r17 ::= SEQUENCE {

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

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

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

...

}

-- ASN1STOP

| *AreaID-CellList* field descriptions |
| --- |
| ***nr-CellGlobalID***  This field specifies the NR Cell Global ID of the TRP belonging to a particular network area where the associated assistance data are applicable. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the TRP belonging to a particular network area where the associated assistance data are applicable. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |

#### – *DL-PRS-ID-Info*

The IE *DL-PRS-ID-Info* provides the IDs of the reference TRPs' DL-PRS Resources.

-- ASN1START

DL-PRS-ID-Info-r16 ::= SEQUENCE {

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

nr-DL-PRS-ResourceID-List-r16 SEQUENCE (SIZE (1..nrMaxResourceIDs-r16)) OF

NR-DL-PRS-ResourceID-r16

OPTIONAL, -- Need ON

nr-DL-PRS-ResourceSetID-r16 NR-DL-PRS-ResourceSetID-r16

OPTIONAL -- Need ON

}

-- ASN1STOP

| *DL-PRS-ID-Info* field descriptions |
| --- |
| ***nr-DL-PRS-ResourceID-List***  This field provides a list of DL-PRS Resource IDs under the same DL-PRS Resource Set. |

#### – *LCS-GCS-TranslationParameter*

The IE *LCS-GCS-TranslationParameter* provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [44].

-- ASN1START

LCS-GCS-TranslationParameter-r16 ::= SEQUENCE {

alpha-r16 INTEGER (0..359),

alpha-fine-r16 INTEGER (0..9) OPTIONAL, -- Cond AzElFine

beta-r16 INTEGER (0..359),

beta-fine-r16 INTEGER (0..9) OPTIONAL, -- Cond AzElFine

gamma-r16 INTEGER (0..359),

gamma-fine-r16 INTEGER (0..9) OPTIONAL, -- Cond AzElFine

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *AzElFine* | The field is mandatory present if the angles where this IE is used are provided with 0.1 degrees resolution; otherwise it is not present. |

|  |
| --- |
| *LCS-GCS-TranslationParameter* field descriptions |
| ***alpha***  This field specifies the bearing angle α for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 1 degree; range 0 to 359 degrees. |
| ***alpha-fine***  This field provides finer granularity for the *alpha*.  The total bearing angle α is given by *alpha* + *alpha-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |
| ***beta***  This field specifies the downtilt angle β for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 1 degree; range 0 to 359 degrees. |
| ***beta-fine***  This field provides finer granularity for the *beta*.  The total downtilt angle β is given by *beta* + *beta-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |
| ***gamma***  This field specifies the slant angle γ for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 1 degree; range 0 to 359 degrees. |
| ***gamma-fine***  This field provides finer granularity for the *gamma*.  The total slant angle γ is given by *gamma* + *gamma-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |

#### – *LOS-NLOS-Indicator*

The IE *LOS-NLOS-Indicator* provides information on the likelihood of a Line-of-Sight (LOS) propagation path from the source to the receiver.

-- ASN1START

LOS-NLOS-Indicator-r17 ::= SEQUENCE {

indicator-r17 CHOICE {

soft-r17 INTEGER (0..10),

hard-r17 BOOLEAN

},

...

}

-- ASN1STOP

| *LOS-NLOS-Indicator* field descriptions |
| --- |
| ***indicator***  This field provides information on the likelihood of a Line-of-Sight propagation path from the source to the receiver and has the following choices:  - ***soft***: This field specifies the likelihood of a LOS propagation path in the range between 0 and 1 with 0.1 steps resolution. Value '0' indicates NLOS and values '1' through '10' provide an estimate of the propability for a LOS propagation path between source and receiver. Scale factor 0.1; range 0 to 1.  - ***hard***: This field specifies whether the propagation path between source and receiver is estimated to be LOS (true) or NLOS (false). |

#### – *LOS-NLOS-IndicatorGranularity1*

The IE *LOS-NLOS-IndicatorGranularity1* provides information on the *LOS-NLOS-Indicator* granularity.

-- ASN1START

LOS-NLOS-IndicatorGranularity1-r17 ::= ENUMERATED { trpspecific, resourcespecific }

-- ASN1STOP

#### – *LOS-NLOS-IndicatorGranularity2*

The IE *LOS-NLOS-IndicatorGranularity2* provides information on the *LOS-NLOS-Indicator* granularity.

-- ASN1START

LOS-NLOS-IndicatorGranularity2-r17 ::= ENUMERATED { trpspecific, resourcespecific, both }

-- ASN1STOP

#### – *LOS-NLOS-IndicatorType1*

The IE *LOS-NLOS-IndicatorType1* provides information on the *LOS-NLOS-Indicator* type.

-- ASN1START

LOS-NLOS-IndicatorType1-r17 ::= ENUMERATED { hardvalue, softvalue }

-- ASN1STOP

#### – *LOS-NLOS-IndicatorType2*

The IE *LOS-NLOS-IndicatorType2* provides information on the *LOS-NLOS-Indicator* type.

-- ASN1START

LOS-NLOS-IndicatorType2-r17 ::= ENUMERATED { hardvalue, hardAndsoftvalue }

-- ASN1STOP

#### *– NR-AdditionalPathList*

The IE *NR-AdditionalPathList* is used by the target device to provide information about additional paths in association to the TOA measurements associated to NR positioning in the form of a relative time difference and a quality value. The additional path *nr-RelativeTimeDifference* is the detected path timing relative to the detected path timing used for the TOA value, and each additional path can be associated with a quality value *nr-PathQuality.*

-- ASN1START

NR-AdditionalPathList-r16 ::= SEQUENCE (SIZE(1..2)) OF NR-AdditionalPath-r16

NR-AdditionalPathListExt-r17 ::= SEQUENCE (SIZE(1..8)) OF NR-AdditionalPath-r16

NR-AdditionalPath-r16 ::= SEQUENCE {

nr-RelativeTimeDifference-r16 CHOICE {

k0-r16 INTEGER(0..16351),

k1-r16 INTEGER(0..8176),

k2-r16 INTEGER(0..4088),

k3-r16 INTEGER(0..2044),

k4-r16 INTEGER(0..1022),

k5-r16 INTEGER(0..511),

...

},

nr-PathQuality-r16 NR-TimingQuality-r16 OPTIONAL,

...,

[[

nr-DL-PRS-RSRPP-r17 INTEGER (0..126) OPTIONAL

]]

}

-- ASN1STOP

| *NR-AdditionalPathList* field descriptions |
| --- |
| ***nr-RelativeTimeDifference***  This field specifies the additional detected path timing relative to the detected path timing of the reference resource. The mapping of reported values and measured quantity value is defined in TS 38.133 [46] clause 10.1.23.3.3 and 10.1.25.3.3. A positive value indicates that the particular path is later in time than the detected path of the reference; a negative value indicates that the particular path is earlier in time than the detected path of the reference. |
| ***nr-PathQuality***  This field specifies the target device′s best estimate of the quality of the detected timing of the additional path. |
| ***nr-DL-PRS-RSRPP***  This field specifies the DL PRS reference signal received path power (DL PRS-RSRPP) of the *NR-AdditionalPath* reported, as defined in TS 38.215 [36]. The mapping of the quantity is defined as in TS 38.133 [46]. |

#### – *NR-DL-PRS-AssistanceData*

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

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

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

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

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

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

-- ASN1START

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

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

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

NR-DL-PRS-AssistanceDataPerFreq-r16,

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

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

...

}

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

nr-DL-PRS-PositioningFrequencyLayer-r16

NR-DL-PRS-PositioningFrequencyLayer-r16,

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

NR-DL-PRS-AssistanceDataPerTRP-r16,

...

}

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

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

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

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

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

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

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

nr-DL-PRS-ExpectedRSTD-Uncertainty-r16

INTEGER (0..246),

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

...,

[[

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

]],

[[

nr-DL-PRS-ExpectedAoD-or-AoA-r17

NR-DL-PRS-ExpectedAoD-or-AoA-r17 OPTIONAL -- Need ON

]]

}

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

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

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

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

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

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

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

...

}

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

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

integerSubframeOffset-r16 INTEGER (0..9),

...

}

NR-DL-PRS-ExpectedAoD-or-AoA-r17 ::= CHOICE {

expectedAoD-r17 SEQUENCE {

expectedDL-AzimuthAoD-r17 INTEGER (0..359),

expectedDL-AzimuthAoD-Unc-r17 INTEGER (0..60) OPTIONAL, -- Need OP

expectedDL-ZenithAoD-r17 INTEGER (0..180),

expectedDL-ZenithAoD-Unc-r17 INTEGER (0..30) OPTIONAL -- Need OP

},

expectedAoA-r17 SEQUENCE {

expectedDL-AzimuthAoA-r17 INTEGER (0..359),

expectedDL-AzimuthAoA-Unc-r17 INTEGER (0..60) OPTIONAL, -- Need OP

expectedDL-ZenithAoA-r17 INTEGER (0..180),

expectedDL-ZenithAoA-Unc-r17 INTEGER (0..30) OPTIONAL -- Need OP

}

}

-- ASN1STOP

| *NR-DL-PRS-AssistanceData* field descriptions |
| --- |
| ***nr-DL-PRS-ReferenceInfo***  This field specifies the IDs of the assistance data reference TRP. |
| ***nr-DL-PRS-AssistanceDataList***  This field specifies the DL-PRS resources for each frequency layer. |
| ***nr-SSB-Config***  This field specifies the SSB configuration of the TRPs. |
| ***nr-DL-PRS-PositioningFrequencyLayer***  This field specifies the Positioning Frequency Layer for the *nr-DL-PRS-AssistanceDataPerFreq* field. |
| ***nr-DL-PRS-AssistanceDataPerFreq***  This field specifies the DL-PRS Resources for the TRPs within the Positioning Frequency Layer. |
| ***dl-PRS-ID***  This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resource ID to uniquely identify a DL-PRS Resource, and is associated with a single TRP. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the TRP. When the field *prs-OnlyTP* is included, this field is not included. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, as defined in TS 38.331 [35]. When the field *prs-OnlyTP* is included, this field is not included. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. When the field *prs-OnlyTP* is included, this field is not included. |
| ***nr-DL-PRS-SFN0-Offset***  This field specifies the time offset of the SFN#0 slot#0 for the given TRP with respect to SFN#0 slot#0 of the assistance data reference TRP and comprises the following subfields:  - ***sfn-Offset*** specifies the SFN offset at the TRP antenna location between the assistance data reference TRP and this neighbour TRP.  The offset corresponds to the number of full radio frames counted from the beginning of a radio frame #0 of the assistance data reference TRP to the beginning of the closest subsequent radio frame #0 of this neighbour TRP.  - ***integerSubframeOffset*** specifies the frame boundary offset at the TRP antenna location between the assistance data reference TRP and this neighbour TRP counted in full subframes.  The offset is counted from the beginning of a subframe #0 of the assistance data reference TRP to the beginning of the closest subsequent subframe #0 of this neighbour TRP, rounded down to multiples of subframes. |
| ***nr-DL-PRS-ExpectedRSTD***  This field indicates the RSTD value that the target device is expected to measure between this TRP and the assistance data reference TRP. The *nr-DL-PRS-ExpectedRSTD* field takes into account the expected propagation time difference as well as transmit time difference of PRS positioning occasions between the two TRPs. The resolution is 4×Ts, with Ts=1/(15000\*2048) seconds. |
| ***nr-DL-PRS-ExpectedRSTD-Uncertainty***  This field indicates the uncertainty in *nr-DL-PRS-ExpectedRSTD* value.The uncertainty is related to the location server′s a‑priori estimate of the target device location. The *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty* togetherdefine the search window for the target device.  The resolution R is  - Ts if all PRS resources are in frequency range 2,  - 4×Ts otherwise,  with Ts=1/(15000\*2048) seconds.  The target device may assume that the beginning of the subframe for the PRS of this TRP is received within the search window of size  - [*-nr-*DL*-PRS-ExpectedRSTD-Uncertainty*×R *;* *nr-DL-PRS-ExpectedRSTD-Uncertainty*×R] centred at TREF*+*1 millisecond×N+*nr-DL-PRS-ExpectedRSTD*×4×Ts,  where TREF is the reception time of the beginning of the subframe for the PRS of the assistance data reference TRP at the target device antenna connector, and N can be calculated based on  - *nr-DL-PRS-SFN0-Offset*  - *dl-PRS-Periodicity-and-ResourceSetSlotOffset*  - *dl-PRS-ResourceSlotOffset.* |
| ***nr-DL-PRS-Info***  This field specifies the PRS configuration of the TRP. |
| ***dl-PRS-SubcarrierSpacing***  This field specifies the subcarrier spacing of the DL-PRS Resource. 15, 30, 60 kHz for FR1; 60, 120 kHz for FR2. All DL-PRS Resources and DL-PRS Resource Sets in the same Positioning Frequency layer have the same value of *dl-PRS-SubcarrierSpacing*. |
| ***dl-PRS-ResourceBandwidth***  This field specifies the number of PRBs allocated for the DL-PRS Resource (allocated DL-PRS bandwidth) in multiples of 4 PRBs. All DL-PRS Resources of the DL-PRS Resource Set have the same bandwidth. All DL-PRS Resource Sets belonging to the same Positioning Frequency Layer have the same value of DL-PRS Bandwidth and Start PRB.  Integer value 1 corresponds to 24 PRBs, value 2 corresponds to 28 PRBs, value 3 corresponds to 32 PRBs and so on. |
| ***dl-PRS-StartPRB***  This field specifies the start PRB index defined as offset with respect to reference DL-PRS Point A for the Positioning Frequency Layer. All DL-PRS Resources Sets belonging to the same Positioning Frequency Layer have the same value of *dl-PRS-StartPRB*. |
| ***dl-PRS-PointA***  This field specifies the absolute frequency of the reference resource block for the DL-PRS. Its lowest subcarrier is also known as DL-PRS Point A. A single DL-PRS Point A for DL-PRS Resource allocation is provided per Positioning Frequency Layer. All DL-PRS Resources belonging to the same DL-PRS Resource Set have the same DL-PRS Point A. |
| ***dl-PRS-CombSizeN***  This field specifies the Resource Element spacing in each symbol of the DL-PRS Resource. All DL-PRS Resource Sets belonging to the same Positioning Frequency Layer have the same value of comb size N. |
| ***dl-PRS-CyclicPrefix***  This field specifies the Cyclic Prefix length of the DL-PRS Resource. All DL-PRS Resources Sets belonging to the same Positioning Frequency Layer have the same value of *dl-PRS-CyclicPrefix*. |
| ***prs-OnlyTP***  This field, if present, indicates that the *NR-DL-PRS-AssistanceData* is provided for a PRS-only TP. Whether the field is present or absent should be the same for all the *NR-DL-PRS-AssistanceData* of all the PRS transmitted under the same TP.  The target device shall not assume that any other signals or physical channels are present for the TRP other than DL-PRS. |
| ***nr-DL-PRS-ExpectedAoD-or-AoA***  This field specifies the expected AoD or AoA in the Global Coordinate System (GCS) at the target device location together with uncertainty.  - ***expectedDL-AzimuthAoD***: This field specifies the expected azimuth angle of departure. Scale factor 1 degree; range 0 to 359 degrees.  - ***expectedDL-AzimuthAoD-Unc***: This field specifies the (single-sided) uncertainty of the expected azimuth angle of departure. If this field is absent, it indicates maximum uncertainty (60 degrees). Scale factor 1 degree; range 0 to 60 degrees.  - ***expectedDL-ZenithAoD***: This field specifies the expected elevation angle of departure. Scale factor 1 degree; range 0 to 180 degrees.  - ***expectedDL-ZenithAoD-Unc***: This field specifies the (single-sided) uncertainty of the expected elevation angle of departure. If this field is absent, it indicates maximum uncertainty (30 degrees). Scale factor 1 degree; range 0 to 30 degrees.  - ***expectedDL-AzimuthAoA***: This field specifies the expected azimuth angle of arrival.  Scale factor 1 degree; range 0 to 359 degrees.  - ***expectedDL-AzimuthAoA-Unc***: This field specifies the (single-sided) uncertainty of the expected azimuth angle of arrival. If this field is absent, it indicates maximum uncertainty (60 degrees). Scale factor 1 degree; range 0 to 60 degrees.  - ***expectedDL-ZenithAoA***: This field specifies the expected elevation angle of arrival.  Scale factor 1 degree; range 0 to 180 degrees.  - ***expectedDL-ZenithAoA-Unc***: This field specifies the (single-sided) uncertainty of the expected elevation angle of arrival. If this field is absent, it indicates maximum uncertainty (30 degrees). Scale factor 1 degree; range 0 to 30 degrees. |

#### – *NR-DL-PRS-BeamInfo*

The IE *NR-DL-PRS-BeamInfo* is used by the location server to provide spatial direction information of the DL-PRS Resources.

-- ASN1START

NR-DL-PRS-BeamInfo-r16 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-DL-PRS-BeamInfoPerFreqLayer-r16

NR-DL-PRS-BeamInfoPerFreqLayer-r16 ::= SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

NR-DL-PRS-BeamInfoPerTRP-r16

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

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

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

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

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

associated-DL-PRS-ID-r16 INTEGER (0..255) OPTIONAL, -- Need OP

lcs-GCS-TranslationParameter-r16 LCS-GCS-TranslationParameter-r16

OPTIONAL, -- Need OP

dl-PRS-BeamInfoSet-r16 DL-PRS-BeamInfoSet-r16 OPTIONAL, -- Need OP

...

}

DL-PRS-BeamInfoSet-r16 ::= SEQUENCE (SIZE(1..nrMaxSetsPerTrpPerFreqLayer-r16)) OF

DL-PRS-BeamInfoResourceSet-r16

DL-PRS-BeamInfoResourceSet-r16 ::= SEQUENCE (SIZE(1..nrMaxResourcesPerSet-r16)) OF

DL-PRS-BeamInfoElement-r16

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

dl-PRS-Azimuth-r16 INTEGER (0..359),

dl-PRS-Azimuth-fine-r16 INTEGER (0..9) OPTIONAL, -- Need ON

dl-PRS-Elevation-r16 INTEGER (0..180) OPTIONAL, -- Need ON

dl-PRS-Elevation-fine-r16 INTEGER (0..9) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *NR-DL-PRS-Beam-Info* field descriptions |
| --- |
| ***dl-PRS-ID***  This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resources ID to uniquely identify a DL-PRS Resource. This ID can be associated with multiple DL-PRS Resource Sets associated with a single TRP.  Each TRP should only be associated with one such ID. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP, as defined in TS 38.331 [35]. The server should include this field if it considers that it is needed to resolve ambiguity in the TRP indicated by *nr-PhysCellID*. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***associated-DL-PRS-ID***  This field specifies the *dl-PRS-ID* of the associated TRP from which the beam information and parameters for LCS to GCS translation are adopted. If the field is omitted, the beam information is provided via the *dl-prs-BeamInfoSet* field and the LCS to GCS translation parameter is provided via the *lcs-GCS-TranslationParameter*. If the field is present, the fields *lcs-GCS-TranslationParameter* and *dl-PRS-BeamInfoSet* shall be absent. |
| ***lcs-GCS-TranslationParameter***  This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [44]. If this field and the field associated-DL-PRS-ID are absent, the *dl-PRS-Azimuth* and *dl-PRS-Elevation* are provided in a GCS. |
| ***dl-PRS-BeamInfoSet***  This field provides the DL-PRS beam information for each DL-PRS Resource of the DL-PRS Resource Set associated with this TRP. |
| ***dl-PRS-Azimuth***  This field specifies the azimuth angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the azimuth angle is measured counter-clockwise from geographical North.  For a Local Coordinate System (LCS), the azimuth angle is measured measured counter-clockwise from the x-axis of the LCS.  Scale factor 1 degree; range 0 to 359 degrees. |
| ***dl-PRS-Azimuth-fine***  This field provides finer granularity for the *dl-PRS-Azimuth*.  The total azimuth angle of the boresight direction is given by *dl-PRS-Azimuth* + *dl-PRS-Azimuth-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |
| ***dl-PRS-Elevation***  This field specifies the elevation angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the elevation angle is measured relative to zenith and positive to the horizontal direction (elevation 0 deg. points to zenith, 90 deg to the horizon).  For a Local Coordinate System (LCS), the elevation angle is measured relative to the z-axis of the LCS (elevation 0 deg. points to the z-axis, 90 deg to the x-y plane).  Scale factor 1 degree; range 0 to 180 degrees. |
| ***dl-PRS-Elevation-fine***  This field provides finer granularity for the *dl-PRS-Elevation*.  The total elevation angle of the boresight direction is given by *dl-PRS-Elevation* + *dl-PRS-Elevation-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |

#### – *NR-DL-PRS-ExpectedLOS-NLOS-Assistance*

The IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* is used by the location server to provide the expected likelihood of a LOS propagation path from a TRP to the target device, or for all DL-PRS Resources of the TRP to the target device.

-- ASN1START

NR-DL-PRS-ExpectedLOS-NLOS-Assistance-r17 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-DL-PRS-ExpectedLOS-NLOS-AssistancePerFreqLayer-r17

NR-DL-PRS-ExpectedLOS-NLOS-AssistancePerFreqLayer-r17 ::=

SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

NR-DL-PRS-ExpectedLOS-NLOS-AssistancePerTRP-r17

NR-DL-PRS-ExpectedLOS-NLOS-AssistancePerTRP-r17 ::= SEQUENCE {

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

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

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

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

nr-los-nlos-indicator-r17 CHOICE {

perTrp-r17 LOS-NLOS-Indicator-r17,

perResource-r17 SEQUENCE (SIZE (1..nrMaxSetsPerTrpPerFreqLayer-r16)) OF

NR-DL-PRS-ExpectedLOS-NLOS-AssistancePerResource-r17 },

...

}

NR-DL-PRS-ExpectedLOS-NLOS-AssistancePerResource-r17 ::=

SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF

LOS-NLOS-Indicator-r17

-- ASN1STOP

|  |
| --- |
| *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* field descriptions |
| ***dl-PRS-ID***  This field specifies the DL-PRS ID of the TRP for which the LOS/NLOS Information is provided. |
| ***nr-PhysCellID***  This field specifies the physical Cell-ID of the TRP for which the LOS/NLOS Information is provided, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the TRP for which the LOS/NLOS Information is provided, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***nr-los-nlos-indicator***  This field provides the expected likelihood of a LOS propagation path from a TRP to the target device (choice *perTrp*) or for all DL-PRS Resources of the TRP (choice *perResource*). |

#### *– NR-DL-PRS-Info*

The IE *NR-DL-PRS-Info* defines downlink PRS configuration.

-- ASN1START

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

nr-DL-PRS-ResourceSetList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTrpPerFreqLayer-r16)) OF

NR-DL-PRS-ResourceSet-r16,

...

}

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

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

dl-PRS-Periodicity-and-ResourceSetSlotOffset-r16

NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset-r16,

dl-PRS-ResourceRepetitionFactor-r16 ENUMERATED {n2, n4, n6, n8, n16, n32, ...}

OPTIONAL, -- Need OP

dl-PRS-ResourceTimeGap-r16 ENUMERATED {s1, s2, s4, s8, s16, s32, ...}

OPTIONAL, -- Cond Rep

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

dl-PRS-MutingOption1-r16 DL-PRS-MutingOption1-r16 OPTIONAL, -- Need OP

dl-PRS-MutingOption2-r16 DL-PRS-MutingOption2-r16 OPTIONAL, -- Need OP

dl-PRS-ResourcePower-r16 INTEGER (-60..50),

dl-PRS-ResourceList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF

NR-DL-PRS-Resource-r16,

...

}

DL-PRS-MutingOption1-r16 ::= SEQUENCE {

dl-prs-MutingBitRepetitionFactor-r16

ENUMERATED { n1, n2, n4, n8, ... } OPTIONAL, -- Need OP

nr-option1-muting-r16 NR-MutingPattern-r16,

...

}

DL-PRS-MutingOption2-r16 ::= SEQUENCE {

nr-option2-muting-r16 NR-MutingPattern-r16,

...

}

NR-MutingPattern-r16 ::= CHOICE {

po2-r16 BIT STRING (SIZE(2)),

po4-r16 BIT STRING (SIZE(4)),

po6-r16 BIT STRING (SIZE(6)),

po8-r16 BIT STRING (SIZE(8)),

po16-r16 BIT STRING (SIZE(16)),

po32-r16 BIT STRING (SIZE(32)),

...

}

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

nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16,

dl-PRS-SequenceID-r16 INTEGER (0.. 4095),

dl-PRS-CombSizeN-AndReOffset-r16 CHOICE {

n2-r16 INTEGER (0..1),

n4-r16 INTEGER (0..3),

n6-r16 INTEGER (0..5),

n12-r16 INTEGER (0..11),

...

},

dl-PRS-ResourceSlotOffset-r16 INTEGER (0..nrMaxResourceOffsetValue-1-r16),

dl-PRS-ResourceSymbolOffset-r16 INTEGER (0..12),

dl-PRS-QCL-Info-r16 DL-PRS-QCL-Info-r16 OPTIONAL, --Need ON

...,

[[

dl-PRS-ResourcePrioritySubset-r17 DL-PRS-ResourcePrioritySubset-r17 OPTIONAL -- Need ON

]]

}

DL-PRS-QCL-Info-r16 ::= CHOICE {

ssb-r16 SEQUENCE {

pci-r16 NR-PhysCellID-r16,

ssb-Index-r16 INTEGER (0..63),

rs-Type-r16 ENUMERATED {typeC, typeD, typeC-plus-typeD}

},

dl-PRS-r16 SEQUENCE {

qcl-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16,

qcl-DL-PRS-ResourceSetID-r16 NR-DL-PRS-ResourceSetID-r16

}

}

NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset-r16 ::= CHOICE {

scs15-r16 CHOICE {

n4-r16 INTEGER (0..3),

n5-r16 INTEGER (0..4),

n8-r16 INTEGER (0..7),

n10-r16 INTEGER (0..9),

n16-r16 INTEGER (0..15),

n20-r16 INTEGER (0..19),

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n160-r16 INTEGER (0..159),

n320-r16 INTEGER (0..319),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

...

},

scs30-r16 CHOICE {

n8-r16 INTEGER (0..7),

n10-r16 INTEGER (0..9),

n16-r16 INTEGER (0..15),

n20-r16 INTEGER (0..19),

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n128-r16 INTEGER (0..127),

n160-r16 INTEGER (0..159),

n320-r16 INTEGER (0..319),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

n20480-r16 INTEGER (0..20479),

...

},

scs60-r16 CHOICE {

n16-r16 INTEGER (0..15),

n20-r16 INTEGER (0..19),

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n128-r16 INTEGER (0..127),

n160-r16 INTEGER (0..159),

n256-r16 INTEGER (0..255),

n320-r16 INTEGER (0..319),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

n20480-r16 INTEGER (0..20479),

n40960-r16 INTEGER (0..40959),

...

},

scs120-r16 CHOICE {

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n128-r16 INTEGER (0..127),

n160-r16 INTEGER (0..159),

n256-r16 INTEGER (0..255),

n320-r16 INTEGER (0..319),

n512-r16 INTEGER (0..511),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

n20480-r16 INTEGER (0..20479),

n40960-r16 INTEGER (0..40959),

n81920-r16 INTEGER (0..81919),

...

},

...

}

DL-PRS-ResourcePrioritySubset-r17 ::= SEQUENCE (SIZE (1..maxNumPrioResources-r17)) OF

NR-DL-PRSResourcePriorityItem-r17

NR-DL-PRSResourcePriorityItem-r17 ::= SEQUENCE {

nr-DL-PRS-PrioResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16 OPTIONAL, -- Cond NotSame

nr-DL-PRS-PrioResourceID-r17 NR-DL-PRS-ResourceID-r16,

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *Rep* | The field is mandatory present, if *dl-PRS-ResourceRepetitionFactor* is present. Otherwise it is not present. |
| *NotSame* | The field is optionally present, need OP. If the field is absent, the indicated *nr-DL-PRS-PrioResourceID* belongs to the same DL-PRS Resource Set as the *nr-DL-PRS-ResourceID*. |

|  |
| --- |
| *NR-DL-PRS-Info* field descriptions |
| ***nr-DL-PRS-ResourceSetID***  This field specifies the DL-PRS Resource Set ID, which is used to identify the DL-PRS Resource Set of the TRP across all the frequency layers. |
| ***dl-PRS-Periodicity-and-ResourceSetSlotOffset***  This field specifies the periodicity of DL-PRS allocation in slots configured per DL-PRS Resource Set and the slot offset with respect to SFN #0 slot #0 for a TRP where the DL-PRS Resource Set is configured (i.e. slot where the first DL-PRS Resource of DL-PRS Resource Set occurs). |
| ***dl-PRS-ResourceRepetitionFactor***  This field specifies how many times each DL-PRS Resource is repeated for a single instance of the DL-PRS Resource Set. It is applied to all resources of the DL-PRS Resource Set. Enumerated values *n2*, *n4*, *n6*, *n8*, *n16*, *n32* correspond to 2, 4, 6, 8, 16, 32 resource repetitions, respectively. If this field is absent, the value for *dl-PRS-ResourceRepetitionFactor* is 1 (i.e., no resource repetition). |
| ***dl-PRS-ResourceTimeGap***  This field specifies the offset in units of slots between two repeated instances of a DL-PRS Resource corresponding to the same DL-PRS Resource ID within a single instance of the DL-PRS Resource Set. The time duration spanned by one DL-PRS Resource Set containing repeated DL-PRS Resources should not exceed DL-PRS-Periodicity. |
| ***dl-PRS-NumSymbols***  This field specifies the number of symbols per DL-PRS Resource within a slot. |
| ***dl-PRS-MutingOption1***  This field specifies the DL-PRS muting configuration of the TRP for the Option-1 muting, as specified in TS 38.214 [45], and comprises the following sub-fields:  - ***dl-prs-MutingBitRepetitionFactor*** indicates the number of consecutive instances of the DL-PRS Resource Set corresponding to a single bit of the *nr-option1-muting* bit map. Enumerated values *n1*, *n2*, *n4*, *n8* correspond to 1, 2, 4, 8 consecutive instances, respectively. If this sub-field is absent, the value for *dl-prs-MutingBitRepetitionFactor* is *n1*.  - ***nr-option1-muting*** defines a bitmap of the time locations where the DL-PRS Resource is transmitted (value '1') or not (value '0') for a DL-PRS Resource Set, as specified in TS 38.214 [45].  If this field is absent, Option-1 muting is not in use for the TRP. |
| ***dl-PRS-MutingOption2***  This field specifies the DL-PRS muting configuration of the TRP for the Option-2 muting, as specified in TS 38.214 [45], and comprises the following sub-fields:  - ***nr-option2-muting*** defines a bitmap of the time locations where the DL-PRS Resource is transmitted (value '1') or not (value '0'). Each bit of the bitmap corresponds to a single repetition of the DL-PRS Resource within an instance of a DL-PRS Resource Set, as specified in TS 38.214 [45]. The size of this bitmap should be the same as the value for *dl-PRS-ResourceRepetitionFactor*.  If this field is absent, Option-2 muting is not in use for the TRP. |
| ***dl-PRS-ResourcePower***  This field specifies the average EPRE of the resources elements that carry the PRS in dBm that is used for PRS transmission. The UE assumes constant EPRE is used for all REs of a given DL-PRS resource. |
| ***dl-PRS-SequenceID***  This field specifies the sequence Id used to initialize cinit value used in pseudo random generator TS 38.211 [41], clause 5.2.1 for generation of DL-PRS sequence for transmission on a given DL-PRS Resource. |
| ***dl-PRS-CombSizeN-AndReOffset***  This field specifies the Resource Element spacing in each symbol of the DL-PRS Resource and the Resource Element (RE) offset in the frequency domain for the first symbol in a DL-PRS Resource. All DL-PRS Resource Sets belonging to the same Positioning Frequency Layer have the same value of comb size. The relative RE offsets of following symbols are defined relative to the RE Offset in the frequency domain of the first symbol in the DL-PRS Resource according to TS 38.211 [41]. The comb size configuration should be aligned with the comb size configuration for the frequency layer. |
| ***dl-PRS-ResourceSlotOffset***  This field specifies the starting slot of the DL-PRS Resource with respect to the corresponding DL-PRS-Resource Set Slot Offset**.** |
| ***dl-PRS-ResourceSymbolOffset***  This field specifies the starting symbol of the DL-PRS Resource within a slot determined by *dl-PRS-ResourceSlotOffset*. |
| ***dl-PRS-QCL-Info***  This field specifies the QCL indication with other DL reference signals for serving and neighbouring cells and comprises the following subfields:  - ***ssb*** indicates the SSB information for QCL source and comprises the following sub-fields:  - ***pci*** specifies the physical cell ID of the cell with the SSB that is configured as the source reference signal for the DL-PRS. The UE obtains the SSB configuration for the SSB configured as source reference signal for the DL-PRS by indexing to the field *nr-SSB-Config* with this physical cell identity.  - ***ssb-Index*** indicates the index for the SSB configured as the source reference signal for the DL-PRS.  - ***rs-Type*** indicates the QCL type.  - ***dl-PRS*** indicates the PRS information for QCL source reference signal and comprises the followings sub-fields:  - ***qcl-DL-PRS-ResourceID*** specifies DL-PRS Resource ID of the DL-PRS resource used as the source reference signal.  - ***qcl-DL-PRS-ResourceSetID*** indicates the DL-PRS Resource Set ID of the DL-PRS Resource Set used as the source reference signal. |
| ***dl-PRS-ResourcePrioritySubset***  This field provides a subset of DL-PRS Resources, which is associated with *nr-DL-PRS-ResourceID* for the purpose of prioritization of DL-AoD reporting, as specified in TS 38.214 [45].  NOTE: This field is only applicable to DL-AoD positioning method and should be ignored for DL-TDOA and Multi-RTT positioning. |

#### *– 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 are provided, the IE *NR-DL-PRS-ProcessingCapability* applies across the NR positioning methods 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,

...,

[[

supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17

ENUMERATED { m1, m2, ... } OPTIONAL

]]

}

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,

...

},

...,

[[

supportedDL-PRS-ProcessingSamples-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

]]

}

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,

...

},

...

}

-- 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 PRS. |
| ***supportedDL-PRS-ProcessingSamples-RRC-Inactive***  Indicates the UE capability for support of measurements based on measuring M=1 or M=2 samples (instances) of a DL-PRS Resource Set in RRC\_INACTIVE state. |
| ***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, 8, 12, 16, 20, 25, 30, 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. |
| ***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***  Indicates the UE capability for support of measurements based on measuring M=1 or M=2 (instances) of a DL-PRS Resource Set. |
| ***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 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*: UE indicates support of two priority states.  - State 1: DL-PRS is higher priority than all PDCCH/PDSCH/CSI-RS  - State 2: DL-PRS is lower priority than all PDCCH/PDSCH/CSI-RS  - *option2*: UE indicates support of three priority states  - State 1: DL-PRS is higher priority than all PDCCH/PDSCH/CSI-RS  - State 2: DL-PRS is lower priority than PDCCH and URLLC PDSCH and higher priority than other PDSCH/CSI-RS  Note: The URLLC channel corresponds a dynamically scheduled PDSCH whose PUCCH resource for carrying ACK/NAK is marked as high-priority.  - State 3: DL-PRS is lower priority than all PDCCH/PDSCH/CSI-RS  - *option3*: UE indicates support of single priority state  - State 1: DL-PRS is higher priority than all PDCCH/PDSCH/CSI-RS |
| ***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 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*). |
| ***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 PRS processing window. Enumerated value indicates supported priority handing options of DL-PRS (see *prs-ProcessingWindowType1A*). |
| ***prs-ProcessingCapabilityOutsideMGinPPW***  Indicates the DL-PRS Processing Capability outside MG 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 *supportedBandwidthPRS* 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 *supportedBandwidthPRS* 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.  NOTE: A UE that supports one of *prs-ProcessingWindowType1*, *prs-ProcessingWindowType1B* or *prs-ProcessingWindowType2* defined in TS 38.331 [35] shall always support *ppw-dl-PRS-BufferType*, *ppw-durationOfPRS-Processing1*, *ppw-durationOfPRS-Processing2*, and *ppw-maxNumOfDL-PRS-ResProcessedPerSlot*. |
| ***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. |
| ***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. |

NOTE: 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 UE DL-PRS QCL Processing capability. The UE can include this IE only if the UE supports *NR-DL-PRS-ProcessingCapability*. Otherwise, the UE does not include this IE.

In the case of capabilities for multiple NR positioning methods are provided, the IE *NR-DL-PRS-QCL-ProcessingCapability* applies across the NR positioning methods 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 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 PRS from a PRS-only TP is treated as PRS from a non-serving cell. |

#### – *NR-DL-PRS-ResourceID*

The IE *NR-DL-PRS-ResourceID* defines the identity of a DL-PRS Resource of a DL-PRS Resource Set of a TRP.

-- ASN1START

NR-DL-PRS-ResourceID-r16 ::= INTEGER (0..nrMaxNumDL-PRS-ResourcesPerSet-1-r16)

-- ASN1STOP

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

The IE *NR-DL-PRS-ResourcesCapability* defines the DL-PRS resources capability for each positioning method. The UE can include this IE only if the UE supports *NR-DL-PRS-ProcessingCapability*. Otherwise, the UE 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, ...},

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. |

#### – *NR-DL-PRS-ResourceSetID*

The IE *NR-DL-PRS-ResourceSetID* defines the identity of a DL-PRS Resource Set of a TRP.

-- ASN1START

NR-DL-PRS-ResourceSetID-r16 ::= INTEGER (0..nrMaxNumDL-PRS-ResourceSetsPerTRP-1-r16)

-- ASN1STOP

#### – *NR-DL-PRS-TRP-TEG-Info*

The IE *NR-DL-PRS-TRP-TEG-Info* is used by the location server to provide the association information of DL-PRS Resources with TRP Tx TEGs.

-- ASN1START

NR-DL-PRS-TRP-TEG-Info-r17 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-DL-PRS-TRP-TEG-InfoPerFreqLayer-r17

NR-DL-PRS-TRP-TEG-InfoPerFreqLayer-r17 ::= SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

NR-DL-PRS-TRP-TEG-InfoPerTRP-r17

NR-DL-PRS-TRP-TEG-InfoPerTRP-r17 ::= SEQUENCE {

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

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

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

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

dl-PRS-TEG-InfoSet-r17 SEQUENCE (SIZE(1..nrMaxSetsPerTrpPerFreqLayer-r16)) OF

DL-PRS-TEG-InfoPerResourceSet-r17,

...,

[[

nr-TRP-TxTEG-TimingErrorMargin-r17 TEG-TimingErrorMargin-r17 OPTIONAL -- Need ON

]]

}

DL-PRS-TEG-InfoPerResourceSet-r17 ::= SEQUENCE (SIZE(1..nrMaxResourcesPerSet-r16)) OF

DL-PRS-TEG-InfoElement-r17

DL-PRS-TEG-InfoElement-r17 ::= SEQUENCE {

dl-prs-trp-Tx-TEG-ID-r17 INTEGER (0..maxNumOfTRP-TxTEGs-1-r17),

...

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-PRS-TRP-TEG-Info* field descriptions |
| ***dl-PRS-ID***  This field specifies the DL-PRS ID of the TRP for which the TRP Tx TEG information is provided. |
| ***nr-PhysCellID***  This field specifies the physical Cell-ID of the TRP for which the TRP Tx TEG information is provided, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the TRP for which the TRP Tx TEG information is provided, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***dl-PRS-TEG-InfoSet***  This field specifies the TRP Tx TEG ID associated with the transmissions of each DL-PRS Resource of the TRP. The *dl-prs-trp-Tx-TEG-ID* in *dl-PRS-TEG-InfoSet* is associated with the *nr-DL-PRS-ResourceID* of *NR-DL-PRS-Info* using the same structure and order. |
| ***nr-TRP-TxTEG-TimingErrorMargin***  This field specifies the timing error margin value for all the TRP Tx TEGs contained within one *NR-DL-PRS-TRP-TEG-InfoPerTRP*. |

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

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

-- ASN1START

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

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

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

...

}

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

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

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

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

...

}

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

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

...

}

-- ASN1STOP

| *NR-DL-PRS-On-Demand-Configurations* field descriptions |
| --- |
| ***dl-prs-configuration-id***  This field provides an identity for the *On-Demand-DL-PRS-Configuration.* |
| ***nr-DL-PRS-PositioningFrequencyLayer***  This field, together with *nr-DL-PRS-Info*, provides the On-demand DL-PRS Configuration information.  Only the following fields in IE *NR-DL-PRS-PositioningFrequencyLayer* are applicable:  *dl-PRS-ResourceBandwidth*, *dl-PRS-CombSizeN.*  The target device shall ignore the remaining fields in IE *NR-DL-PRS-PositioningFrequencyLayer.* |
| ***nr-DL-PRS-Info***  This field, together with *nr-DL-PRS-PositioningFrequencyLayer*, provides the On-demand DL-PRS Configuration information. Only the following fields in IE *NR-DL-PRS-Info* are applicable:  DL-PRS periodicity in *dl-PRS-Periodicity-and-ResourceSetSlotOffset*, *dl-PRS-ResourceRepetitionFactor*, *dl-PRS-NumSymbols*, comb-size in *dl-PRS-CombSizeN-AndReOffset*, *dl-PRS-QCL-Info*.  The target device shall ignore the remaining fields in IE *NR-DL-PRS-Info.* |

#### – *NR-On-Demand-DL-PRS-Information*

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

-- ASN1START

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

NR-On-Demand-DL-PRS-PerFreqLayer-r17

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

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

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

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

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

OPTIONAL,

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

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

OPTIONAL,

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

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

dl-prs-QCL-InformationReqTRPlist-r17 DL-PRS-QCL-InformationReqTRPlist-r17 OPTIONAL,

...

}

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

DL-PRS-QCL-InformationReqPerTRP-r17

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

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

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

nr-CellGlobalID-r17 NCGI-r15 OPTIONAL,

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

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

DL-PRS-QCL-InfoReq-r17,

...

}

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

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

dl-prs-QCL-InformationReq-r17 CHOICE {

dl-prs-QCL-InfoRecPerResourceSet-r17 DL-PRS-QCL-Info-r16,

dl-prs-QCL-Info-requested-r17 NULL

},

...,

[[

dl-prs-QCL-InfoRecPerResource-r17 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF

DL-PRS-QCL-Info-r16 OPTIONAL

]]

}

-- ASN1STOP

|  |
| --- |
| *NR-On-Demand-DL-PRS-Information* field descriptions |
| ***dl-prs-FrequencyRangeReq***  This field specifies the frequency range for which the on-demand DL-PRS is requested. |
| ***dl-prs-ResourceSetPeriodicityReq***  This field specifies the requested periodicity of the DL-PRS Resource Set in slots. The periodicity depends on the subcarrier spacing (SCS) and takes values  slots, where for SCS of 15, 30, 60 and 120 kHz respectively. μ refers to the target devices current primary cell. |
| ***dl-prs-ResourceBandwidthReq***  This field specifies the requested number of PRBs allocated for the DL-PRS Resource (allocated DL-PRS bandwidth) in multiples of 4 PRBs. Integer value 1 corresponds to 24 PRBs, value 2 corresponds to 28 PRBs, value 3 corresponds to 32 PRBs and so on. |
| ***dl-prs-ResourceRepetitionFactorReq***  This field specifies the requested DL-PRS Resource repetition. Enumerated values *n2*, *n4*, *n6*, *n8*, *n16*, *n32* correspond to 2, 4, 6, 8, 16, 32 resource repetitions, respectively. |
| ***dl-prs-NumSymbolsReq***  This field specifies the requested number of symbols per DL-PRS Resource within a slot. |
| ***dl-prs-CombSizeN-Req***  This field specifies the requested Resource Element spacing in each symbol of the DL-PRS Resource. |
| ***dl-prs-QCL-InformationReqTRPlist***  This field specifies the recommended or requested QCL indication with other DL reference signals.  - ***dl-PRS-ID*** indicates the DL-PRS ID of the TRP for which the QCL information is recommended.  - ***nr-PhysCellID*** indicates the physical Cell-ID of the TRP for which the QCL information is recommended, as defined in TS 38.331 [35].  - ***nr-CellGlobalID*** indicates the NCGI, the globally unique identity of a cell in NR, of the TRP for which the QCL information is recommended, as defined in TS 38.331 [35].  - ***nr-ARFCN*** indicates the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to nr-PhysCellID.  - ***dl-prs-QCL-InformationReqSet*** indicates the recommended QCL information per DL-PRS Resource Set.  - ***nr-DL-PRS-ResourceSetID*** indicates the DL-PRS Resource Set ID for which the QCL information is recommended.  - ***dl-prs-QCL-InformationReq***  - ***dl-prs-QCL-InfoRecPerResourceSet*** indicates a single recommended QCL source for the DL-PRS Resource Set.  - ***dl-prs-QCL-Info-requested*** indicates that the UE requests to provide the QCL information in the assistance data.  - ***dl-prs-QCL-InfoRecPerResource*** indicates a list of recommended QCL sources for the DL-PRS Resource Set. If this field is present, the *dl-prs-QCL-InformationReg* shall be ignored by the receiver. |

#### – *NR-On-Demand-DL-PRS-Request*

The IE *NR-On-Demand-DL-PRS-Request* is used by the target device to request on-demand DL-PRS from a location server.

-- ASN1START

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

dl-prs-StartTime-and-Duration-r17 DL-PRS-StartTime-and-Duration-r17 OPTIONAL,

nr-on-demand-DL-PRS-Information-r17 NR-On-Demand-DL-PRS-Information-r17 OPTIONAL,

dl-prs-configuration-id-PrefList-r17 SEQUENCE (SIZE (1..maxOD-DL-PRS-Configs-r17)) OF   
 DL-PRS-Configuration-ID-r17 OPTIONAL,

...

}

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

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

dl-prs-duration-r17 SEQUENCE {

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

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

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

...

} OPTIONAL,

...

}

-- ASN1STOP

|  |
| --- |
| *NR-On-Demand-DL-PRS-Request* field descriptions |
| ***dl-prs-StartTime-and-Duration***  This field specifies the requested start time and duration for the on-demand DL-PRS and comprises the following subfields:  - ***dl-prs-start-time*** specifies the desired start time for the requested DL-PRS. It indicates the time in seconds from the time the IE *NR-On-Demand-DL-PRS-Request* was received.  - ***dl-prs-duration*** specifies the desired duration of the requested DL-PRS. The desired duration is the sum of the *seconds*, *minutes*, *hours* fields. If this field is included, at least one of the *seconds*, *minutes*, *hours* fields shall be present. |
| ***nr-on-demand-DL-PRS-Information***  This field specifies the on-demand DL-PRS configuration information requested by the target device.  NOTE: If the network provided predefined on-demand DL-PRS configurations (*NR-On-Demand-DL-PRS-Configurations*), the target device can only request explicit parameters (*nr-on-demand-DL-PRS-Information*) within the scope of those configurations. |
| ***dl-prs-configuration-id-PrefList***  This field specifies the on-demand DL-PRS configuration associated with *DL-PRS-Configuration-ID* in IE *NR-On-Demand-DL-PRS-Configurations* the target device wishes to obtain in the order of preference. The first *DL-PRS-Configuration-ID* in the list is the most preferred configuration, the second *DL-PRS-Configuration-ID* the second most preferred, etc. |

#### – *NR-On-Demand-DL-PRS-Configurations-Selected-IndexList*

The IE *NR-On-Demand-DL-PRS-Configurations-Selected-IndexList* is used by the location server to provide the selected available on-demand DL-PRS configurations to the target device.

In the case of available on-demand DL-PRS configurations for multiple NR positioning methods are provided, the *NR-On-Demand-DL-PRS-Configurations* shall be present in only one of *NR-Multi-RTT-ProvideAssistanceData*, *NR-DL-AoD-ProvideAssistanceData*, or *NR-DL-TDOA-ProvideAssistanceData*.

-- ASN1START

NR-On-Demand-DL-PRS-Configurations-Selected-IndexList-r17 ::=

SEQUENCE (SIZE (1..maxOD-DL-PRS-Configs-r17)) OF

DL-PRS-Configuration-ID-r17

-- ASN1STOP

#### *– NR-On-Demand-DL-PRS-Support*

The IE *NR-On-Demand-DL-PRS-Support* defines the target device's on-demand DL-PRS capabilities.

-- ASN1START

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

nr-on-demand-DL-PRS-InformationSup-r17 ENUMERATED { supported } OPTIONAL,

nr-on-demand-DL-PRS-ConfigurationsSup-r17 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

| *NR-On-Demand-DL-PRS-Support* field descriptions |
| --- |
| ***nr-on-demand-DL-PRS-InformationSup***  This field, if present, indicates that the target device supports the IE *NR-On-Demand-DL-PRS-Information* in IE *NR-On-Demand-DL-PRS-Request*. |
| ***nr-on-demand-DL-PRS-ConfigurationsSup***  This field, if present, specifies that the target device supports the *dl-prs-configuration-id-PrefList* in IE *NR-On-Demand-DL-PRS-Request*. |

#### *– NR-PositionCalculationAssistance*

The IE *NR-PositionCalculationAssistance* is used by the location server to provide assistance data 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

]]

}

-- ASN1STOP

| *NR-PositionCalculationAssistance* field descriptions |
| --- |
| ***nr-TRP-LocationInfo***  This field provides the location coordinates of the antenna reference points 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 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-RTD-Info*

The IE *NR-RTD-Info* is used by the location server to provide time synchronization information between a reference TRP and a list of neighbour TRPs.

-- ASN1START

NR-RTD-Info-r16 ::= SEQUENCE {

referenceTRP-RTD-Info-r16 ReferenceTRP-RTD-Info-r16,

rtd-InfoList-r16 RTD-InfoList-r16,

...

}

ReferenceTRP-RTD-Info-r16 ::= SEQUENCE {

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

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

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

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

refTime-r16 CHOICE {

systemFrameNumber-r16 BIT STRING (SIZE (10)),

utc-r16 UTCTime,

...

},

rtd-RefQuality-r16 NR-TimingQuality-r16 OPTIONAL, -- Need ON

...

}

RTD-InfoList-r16 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF RTD-InfoListPerFreqLayer-r16

RTD-InfoListPerFreqLayer-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPsPerFreq-r16)) OF RTD-InfoElement-r16

RTD-InfoElement-r16 ::= SEQUENCE {

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

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

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

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

subframeOffset-r16 INTEGER (0..1966079),

rtd-Quality-r16 NR-TimingQuality-r16,

...

}

-- ASN1STOP

| *NR-RTD-Info* field descriptions |
| --- |
| ***referenceTRP-RTD-Info***  This field defines the reference TRP for the RTD and comprises the following sub-fields:  - ***dl-PRS-ID-Ref***: This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resources ID to uniquely identify a DL-PRS Resource, and is associated to the reference TRP.  - ***nr-PhysCellId-Ref***: This field specifies the physical cell identity of the reference TRP.  - ***nr-CellGlobalId-Ref***: This field specifies the NCGI, the globally unique identity of a cell in NR, of the reference TRP.  - ***nr-ARFCN-Ref***: This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*.  - ***refTime***: This field specifies the reference time at which the *rtd-InfoList* is valid. The *systemFrameNumber* choice refers to the SFN of the reference TRP.  - ***rtd-RefQuality***: This field specifies the quality of the timing of reference TRP, used to determine the RTD values provided in *rtd-InfoList*. |
| ***dl-PRS-ID***  This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resources ID to uniquely identify a DL-PRS Resource. This ID can be associated with multiple DL-PRS Resource Sets associated with a single TRP for which the *RTD-InfoElement* is applicable. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the associated TRP for which the *RTD-InfoElement* is applicable, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP for which the *RTD-InfoElement* is applicable, as defined in TS 38.331 [35]. The server should include this field if it considers that it is needed to resolve ambiguity in the TRP indicated by *nr-PhysCellID*. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID* for which the *RTD-InfoElement* is applicable. |
| ***subframeOffset***  This field specifies the subframe boundary offset at the TRP antenna location between the reference TRP and this neighbour TRP in time units  where Hz and  (TS 38.211 [41]).  The offset is counted from the beginning of a subframe #0 of the reference TRP to the beginning of the closest subsequent subframe of this neighbour TRP.  Scale factor 1 Tc. |
| ***rtd-Quality***  This field specifies the quality of the RTD. |

#### – *NR-SelectedDL-PRS-IndexList*

The IE *NR-SelectedDL-PRS-IndexList* is used by the location server to provide the selected DL-PRS Resource of *nr-DL-PRS-AssistanceDataList* to the target device.

In the case of assistance data for multiple NR positioning methods are provided, the IE *NR-DL-PRS-AssistanceData* shall be present in only one of *NR-Multi-RTT-ProvideAssistanceData*, *NR-DL-AoD-ProvideAssistanceData*, or *NR-DL-TDOA-ProvideAssistanceData*.

-- ASN1START

NR-SelectedDL-PRS-IndexList-r16 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-SelectedDL-PRS-PerFreq-r16

NR-SelectedDL-PRS-PerFreq-r16 ::= SEQUENCE {

nr-SelectedDL-PRS-FrequencyLayerIndex-r16 INTEGER (0..nrMaxFreqLayers-1-r16),

nr-SelectedDL-PRS-IndexListPerFreq-r16 SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

NR-SelectedDL-PRS-IndexPerTRP-r16

OPTIONAL, --Need OP

...

}

NR-SelectedDL-PRS-IndexPerTRP-r16 ::= SEQUENCE {

nr-SelectedTRP-Index-r16 INTEGER (0..nrMaxTRPsPerFreq-1-r16),

dl-SelectedPRS-ResourceSetIndexList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTrpPerFreqLayer-r16))

OF DL-SelectedPRS-ResourceSetIndex-r16

OPTIONAL, --Need OP

...

}

DL-SelectedPRS-ResourceSetIndex-r16 ::= SEQUENCE {

nr-DL-SelectedPRS-ResourceSetIndex-r16 INTEGER (0..nrMaxSetsPerTrpPerFreqLayer-1-r16),

dl-SelectedPRS-ResourceIndexList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF

DL-SelectedPRS-ResourceIndex-r16

OPTIONAL --Need OP

}

DL-SelectedPRS-ResourceIndex-r16 ::= SEQUENCE {

nr-DL-SelectedPRS-ResourceIdIndex-r16 INTEGER (0..nrMaxNumDL-PRS-ResourcesPerSet-1-r16),

...

}

-- ASN1STOP

| *NR-SelectedDL-PRS-IndexList* field descriptions |
| --- |
| ***nr-SelectedDL-PRS-FrequencyLayerIndex***  This field indicates the frequency layer provided in IE *NR-DL-PRS-AssistanceData*. Value 0 corresponds to the first frequency layer provided in *nr-DL-PRS-AssistanceDataList* in IE *NR-DL-PRS-AssistanceData*, value 1 to the second frequency layer in *nr-DL-PRS-AssistanceDataList*, and so on. |
| ***nr-SelectedDL-PRS-IndexListPerFreq***  This field provides the list of addressed TRPs of the selected frequency layer. If this field is absent, all DL-PRS Resources of all TRPs of the indicated frequency layer are addressed. |
| ***nr-SelectedTRP-Index***  This field indicates the addressed TRP of the selected frequency layer. Value 0 corresponds to the first entry in *nr-DL-PRS-AssistanceDataPerFreq* provided in IE *NR-DL-PRS-AssistanceData*, value 1 corresponds to the second entry in *nr-DL-PRS-AssistanceDataPerFreq*, and so on. |
| ***dl-SelectedPRS-ResourceSetIndexList***  This field provides the list of addressed DL-PRS Resource Sets of the selected TRPs of the selected frequency layer. If this field is absent, all DL-PRS Resource Sets and Resources of the indicated TRP are addressed. |
| ***nr-DL-SelectedPRS-ResourceSetIndex***  This field indicates the addressed DL-PRS Resource Set of the selected TRP of the selected frequency layer. Value 0 corresponds to the first entry in *nr-DL-PRS-ResourceSetList* in IE *NR-DL-PRS-Info* provided in IE *NR-DL-PRS-AssistanceData*. Value 1 corresponds to the second entry in the *nr-DL-PRS-ResourceSetList* in IE *NR-DL-PRS-Info*. |
| ***dl-SelectedPRS-ResourceIndexList***  This field provides the list of addressed DL-PRS Resources of the selected DL-PRS Resource Set of the selected TRP of the selected frequency layer. If this field is absent, all DL-PRS Resources of the indicated DL-PRS Resource Set are addressed. |
| ***nr-dl-SelectedPRS-ResourceIdIndex***  This field indicates the addressed DL-PRS Resource of the selected DL-PRS Resource Set of the TRP of the selected frequency layer. Value 0 corresponds to the first entry in *dl-PRS-ResourceList* in IE *NR-DL-PRS-Info* provided in IE *NR-DL-PRS-AssistanceData*. Value 1 corresponds to the second entry in the *dl-PRS-ResourceList* in IE *NR-DL-PRS-Info*, and so on. |

#### *– NR-SSB-Config*

The IE *NR-SSB-Config* defines SSB configuration.

-- ASN1START

NR-SSB-Config-r16 ::= SEQUENCE {

nr-PhysCellID-r16 NR-PhysCellID-r16,

nr-ARFCN-r16 ARFCN-ValueNR-r15,

ss-PBCH-BlockPower-r16 INTEGER (-60..50),

halfFrameIndex-r16 INTEGER (0..1),

ssb-periodicity-r16 ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, ...},

ssb-PositionsInBurst-r16 CHOICE {

shortBitmap-r16 BIT STRING (SIZE (4)),

mediumBitmap-r16 BIT STRING (SIZE (8)),

longBitmap-r16 BIT STRING (SIZE (64))

} OPTIONAL, --Need OR

ssb-SubcarrierSpacing-r16 ENUMERATED {kHz15, kHz30, kHz60, kHz120, kHz240, ...},

sfn-SSB-Offset-r16 INTEGER (0..15),

...

}

-- ASN1STOP

| *NR-SSB-Config* field descriptions |
| --- |
| ***nr-ARFCN***  This field specifies the ARFCN of the first RE of SSB's RB#10. |
| ***ss-PBCH-BlockPower***  Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [48], clause 7. |
| ***halfFrameIndex***  Indicates the 5 msec offset of the SSB within a 10 msec system frame. |
| ***ssb-periodicity***  The SSB periodicity in ms for the rate matching purpose. |
| ***ssb-PositionsInBurst***  Indicates the time domain positions of the transmitted SS-blocks in a half frame with SS/PBCH blocks as defined in TS 38.213 [48], clause 4.1. The first/leftmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not transmitted while value 1 indicates that the corresponding SS/PBCH block is transmitted. |
| ***ssb-SubcarrierSpacing***  Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable. |
| ***sfn-SSB-Offset***  Indicates the 10 msec system frame offset of the SSB within the SSB periodicity. Value 0 indicates that the SSB is transmitted in the first system frame; 1 indicates that the SSB is transmitted in the second system frame and so on. This field shall be configured according to the field *ssb-Periodicity* and the indicated system frame shall not exceed the configured SSB periodicity. |

#### *– NR-TimeStamp*

The IE *NR-TimeStamp* defines the UE measurement associated time stamp.

-- ASN1START

NR-TimeStamp-r16 ::= SEQUENCE {

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

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

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

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

nr-SFN-r16 INTEGER (0..1023),

nr-Slot-r16 CHOICE {

scs15-r16 INTEGER (0..9),

scs30-r16 INTEGER (0..19),

scs60-r16 INTEGER (0..39),

scs120-r16 INTEGER (0..79)

},

...

}

-- ASN1STOP

| *NR-TimeStamp* field descriptions |
| --- |
| ***dl-PRS-ID***  This field specifies the DL-PRS ID of the TRP for which the *nr-SFN* is applicable. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***  This field specifies the ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID* associated with the *dl-PRS-ID*. |
| ***nr-SFN***  This field specifies the NR system frame number for the time stamp. |
| ***nr-Slot***  This field specifies the NR slot number within the NR system frame number indicated by *nr-SFN* for the time stamp. |

#### *– NR-TimingQuality*

The IE *NR-TimingQuality* defines the quality of a timing value (e.g., of a TOA measurement).

-- ASN1START

NR-TimingQuality-r16 ::= SEQUENCE {

timingQualityValue-r16 INTEGER (0..31),

timingQualityResolution-r16 ENUMERATED {mdot1, m1, m10, m30, ...},

...

}

-- ASN1STOP

| *NR-TimingQuality* field descriptions |
| --- |
| ***timingQualityValue***  This field provides an estimate of uncertainty of the timing value for which the IE *NR-TimingQuality* is provided in units of metres. |
| ***timingQualityResolution***  This field provides the resolution used in the *timingQualityValue* field. Enumerated values *mdot1*, *m1*, *m10*, *m30* correspond to 0.1, 1, 10, 30 metres, respectively. |

#### – *NR-TRP-BeamAntennaInfo*

The IE *NR-TRP-BeamAntennaInfo* is used by the location server to provide beam antenna information of the TRP.

-- ASN1START

NR-TRP-BeamAntennaInfo-r17 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-TRP-BeamAntennaInfoPerFreqLayer-r17

NR-TRP-BeamAntennaInfoPerFreqLayer-r17 ::= SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

NR-TRP-BeamAntennaInfoPerTRP-r17

NR-TRP-BeamAntennaInfoPerTRP-r17 ::= SEQUENCE {

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

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

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

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

associated-DL-PRS-ID-r17 INTEGER (0..255) OPTIONAL, -- Need OP

lcs-GCS-TranslationParameter-r17 LCS-GCS-TranslationParameter-r16 OPTIONAL, -- Need OP

nr-TRP-BeamAntennaAngles-r17 NR-TRP-BeamAntennaAngles-r17 OPTIONAL, -- Need OP

...

}

NR-TRP-BeamAntennaAngles-r17 ::= SEQUENCE (SIZE(1..3600)) OF

NR-TRP-BeamAntennaInfoAzimuthElevation-r17

NR-TRP-BeamAntennaInfoAzimuthElevation-r17 ::= SEQUENCE {

azimuth-r17 INTEGER (0..359) OPTIONAL, -- Cond Az

azimuth-fine-r17 INTEGER (0..9) OPTIONAL, -- Cond AzOpt

elevationList-r17 SEQUENCE (SIZE(1..1801)) OF ElevationElement-R17,

...

}

ElevationElement-R17 ::= SEQUENCE {

elevation-r17 INTEGER (0..180) OPTIONAL, -- Cond El

elevation-fine-r17 INTEGER (0..9) OPTIONAL, -- Cond ElOpt

beamPowerList-r17 SEQUENCE (SIZE (2..maxNumResourcesPerAngle-r17)) OF

BeamPowerElement-r17,

...

}

BeamPowerElement-r17 ::= SEQUENCE {

nr-dl-prs-ResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16 OPTIONAL, -- Need OP

nr-dl-prs-ResourceID-r17 NR-DL-PRS-ResourceID-r16,

nr-dl-prs-RelativePower-r17 INTEGER (0..30),

nr-dl-prs-RelativePowerFine-r17 INTEGER (0..9) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *Az* | The field is mandatory present if the field *elevation* is absent; otherwise it is optionally present, need ON. |
| *AzOpt* | The field is optionally present, need ON, when *azimuth* is present; otherwise it is not present. |
| *El* | The field is mandatory present if the field *azimuth* is absent; otherwise it is optionally present, need ON. |
| *ElOpt* | The field is optionally present, need ON, when *elevation* is present; otherwise it is not present. |

| *NR-TRP-BeamAntennaInfo* field descriptions |
| --- |
| ***dl-PRS-ID***  This field specifies the DL-PRS ID of the TRP for which the Beam Antenna Information is provided. |
| ***nr-PhysCellID***  This field specifies the physical Cell-ID of the TRP for which the Beam Antenna Information is provided, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the TRP for which the Beam Antenna Information is provided, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***associated-DL-PRS-ID***  This field specifies the *dl-PRS-ID* of the associated TRP from which the beam antenna information is obtained. See the field descriptions for *nr-TRP-BeamAntennaAngles* and *lcs-GCS-TranslationParameter*. |
| ***lcs-GCS-TranslationParameter***  This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [44]. If this field and the *associated-DL-PRS-ID* field are both absent, the *azimuth* and *elevation* are provided in a GCS. If this field is absent and the *associated-DL-PRS-ID* field is present, then the *lcs-GCS-TranslationParameter* for this TRP is obtained from the *lcs-GCS-TranslationParameter* of the associated TRP. |
| ***nr-TRP-BeamAntennaAngles***  This field provides the relative power between DL-PRS Resources per angle per TRP. If this field is absent and the field *associated-DL-PRS-ID* is present, the *nr-TRP-BeamAntennaAngles* for this TRP are obtained from the *nr-TRP-BeamAntennaAngles* of the associated TRP. |
| ***azimuth***  This field specifies the azimuth angle for which the relative power between DL-PRS Resources is provided.  For a Global Coordinate System (GCS), the azimuth angle is measured counter-clockwise from geographical North.  For a Local Coordinate System (LCS), the azimuth angle is measured counter-clockwise from the x-axis of the LCS.  Scale factor 1 degree; range 0 to 359 degrees. |
| ***azimuth-fine***  This field provides finer granularity for the *azimuth*.  The total azimuth angle is given by *azimuth* + *azimuth-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |
| ***elevation***  This field specifies the elevation angle for which the relative power between DL-PRS Resources is provided for the given *azimuth*.  For a Global Coordinate System (GCS), the elevation angle is measured relative to zenith and positive to the horizontal direction (elevation 0 deg. points to zenith, 90 deg to the horizon).  For a Local Coordinate System (LCS), the elevation angle is measured relative to the z-axis of the LCS (elevation 0 deg. points to the z-axis, 90 deg to the x-y plane).  Scale factor 1 degree; range 0 to 180 degrees. |
| ***elevation-fine***  This field provides finer granularity for the *elevation*.  The total elevation angle is given by *elevation* + *elevation-fine.*  Scale factor 0.1 degrees; range 0 to 0.9 degrees. |
| ***beamPowerList***  This field provides the relative power between DL-PRS Resources for the angle given by *azimuth* and *elevation*.  The first *BeamPowerElement* in this list provides the peak power for this angle and is defined as 0dB power; i.e., the first value is set to '0' by the location server. All the remaining *BeamPowerElement*'s in this list provide the relative DL-PRS Resource power relative to this first element in the list. |
| ***nr-dl-prs-ResourceSetID***  This field specifies the DL-PRS Resource Set ID of the DL-PRS Resource for which the *nr-dl-prs-RelativePower* is provided. If this field is absent, the DL-PRS Resource Set ID for this instance of the *beamPowerList* is the same as the DL-PRS Resource Set ID of the previous instance in the *beamPowerList*. This field shall be included at least in the first instance of the *beamPowerList*. |
| ***nr-dl-prs-ResourceID***  This field specifies the DL-PRS Resource for which the *nr-dl-prs-RelativePower* is provided. |
| ***nr-dl-prs-RelativePower***  Except for the first element in *beamPowerList*, this field provides the relative power of the DL-PRS Resource, relative to the first element in the *beamPowerList*.  For the first element in *beamPowerList*, this field provides the peak power for this angle normalised to 0 dB.  Scale factor 1 dB; range 0..-30 dB. |
| ***nr-dl-prs-RelativePowerFine***  This field provides finer granularity for the *nr-dl-prs-RelativePower*.  The total relative power of the DL-PRS Resource is given by *nr-dl-prs-RelativePower* + *nr-dl-prs-RelativePowerFine.*  Scale factor -0.1 dB; range 0 to -0.9 dB.  NOTE: For the first element in *beamPowerList*, this field is not needed. |

#### *–* *NR-TRP-LocationInfo*

The IE *NR-TRP-LocationInfo* is used by the location server to provide the coordinates of the antenna reference points for a set of TRPs. For each TRP, the ARP location can be provided for each associated PRS Resource ID per PRS Resource Set.

-- ASN1START

NR-TRP-LocationInfo-r16 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-TRP-LocationInfoPerFreqLayer-r16

NR-TRP-LocationInfoPerFreqLayer-r16 ::= SEQUENCE {

referencePoint-r16 ReferencePoint-r16 OPTIONAL, -- Cond NotSameAsPrev

trp-LocationInfoList-r16 SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

TRP-LocationInfoElement-r16,

...

}

TRP-LocationInfoElement-r16 ::= SEQUENCE {

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

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

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

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

associated-DL-PRS-ID-r16 INTEGER (0..255) OPTIONAL, -- Need OP

trp-Location-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

trp-DL-PRS-ResourceSets-r16 SEQUENCE (SIZE(1..nrMaxSetsPerTrpPerFreqLayer-r16)) OF

DL-PRS-ResourceSets-TRP-Element-r16 OPTIONAL, -- Need OP

...

}

DL-PRS-ResourceSets-TRP-Element-r16 ::= SEQUENCE {

dl-PRS-ResourceSetARP-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

dl-PRS-Resource-ARP-List-r16 SEQUENCE (SIZE(1..nrMaxResourcesPerSet-r16)) OF

DL-PRS-Resource-ARP-Element-r16 OPTIONAL, -- Need OP

...

}

DL-PRS-Resource-ARP-Element-r16 ::= SEQUENCE {

dl-PRS-Resource-ARP-location-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *NotSameAsPrev* | The field is mandatory present in the first entry of the *NR-TRP-LocationInfoPerFreqLayer* list; otherwise it is optionally present, need OP. |

| *NR-TRP-LocationInfo* field descriptions |
| --- |
| ***referencePoint***  This field specifies the reference point used to define the TRP location in the *trp-LocationInfoList*. If this field is absent, the reference point is the same as in the previous entry of the *NR-TRP-LocationInfoPerFreqLayer* list. |
| ***trp-LocationInfoList***  This field provides the antenna reference point locations of the DL-PRS Resources for the TRPs and comprises the following sub-fields:  - ***dl-PRS-ID***: This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resources ID to uniquely identify a DL-PRS Resource, and is associated to a single TRP.  - ***nr-PhysCellID***: This field specifies the physical cell identity of the associated TRP.  - ***nr-CellGlobalID***: This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP.  - ***nr-ARFCN***: This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*.  - ***associated-DL-PRS-ID***: This field, if present, specifies the *dl-PRS-ID* of the associated TRP from which the *trp-location* information is adopted. If the field is present, the field *trp-Location* shall be absent.  - ***trp-Location***: This field provides the location of the TRP relative to the *referencePoint* location. If this field is absent the TRP location coincides with the *referencePoint* location, unless the field *associated-dl-PRS-ID*is present, in which case the *trp-Location* is adopted from the associated TRP indicated by *associated-dl-PRS-ID*.  - ***trp-DL-PRS-ResourceSets***: This field provides the antenna reference point location(s) of the DL-PRS Resource Set(s) associated with this TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resource Set(s) coincides with the *trp-Location* location. This field comprises the following sub-fields:  - ***dl-PRS-ResourceSetARP***: This field provides the antenna reference point location of the DL-PRS Resource Set relative to the *trp-Location* location. If this field is absent, the antenna reference point location of this DL-PRS Resource Set coincides with the *trp-Location* location.  - ***dl-PRS-Resource-ARP-List***: This field provides the antenna reference point location(s) of the DL-PRS Resource(s) associated with this Resource Set of the TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resources coincides with the *dl-PRS-ResourceSetARP* location. This field comprises the following sub-fields:  - ***dl-PRS-Resource-ARP-location***: This field provides the antenna reference point location of the DL-PRS Resource associated with the DL-PRS Resource Set of the TRP relative to the *dl-PRS-ResourceSetARP* location. If this field is absent, the antenna reference point location of this DL-PRS Resource coincides with the *dl-PRS-ResourceSetARP* location. |

#### *– NR-UE-TEG-Capability*

The IE *NR-UE-TEG-Capability* defines the TEG capability of the target device.

-- ASN1START

NR-UE-TEG-Capability-r17 ::= SEQUENCE {

nr-UE-TEG-ID-CapabilityBandList-r17 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

NR-UE-TEG-ID-CapabilityPerBand-r17 OPTIONAL,

...

}

NR-UE-TEG-ID-CapabilityPerBand-r17 ::= SEQUENCE {

freqBandIndicatorNR-r17 FreqBandIndicatorNR-r16,

nr-UE-RxTEG-ID-MaxSupport-r17 ENUMERATED {n1, n2, n3, n4, n6, n8} OPTIONAL,

nr-UE-TxTEG-ID-MaxSupport-r17 ENUMERATED {n1, n2, n3, n4, n6, n8} OPTIONAL,

nr-UE-RxTxTEG-ID-MaxSupport-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16,

n24, n32, n36, n48, n64} OPTIONAL,

measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17

ENUMERATED {n2, n3, n4, n6, n8} OPTIONAL,

measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul-r17

ENUMERATED {n1, n2, n3, n4, n6, n8} OPTIONAL,

...

}

-- ASN1STOP

| *NR-UE-TEG-Capability* field descriptions |
| --- |
| ***nr-UE-RxTEG-ID-MaxSupport***  Indicates the maximum number of UE-RxTEGs, which is supported and reported by the UE. This field is applicable for UE assisted DL-TDOA and Multi-RTT positioning.  NOTE: A single value is reported when both Multi-RTT and DL-TDOA are supported. |
| ***nr-UE-TxTEG-ID-MaxSupport***  Indicates the maximum number of UE-TxTEGs, which is supported and reported by the UE. This field is applicable for Multi-RTT and UL-TDOA positioning. |
| ***nr-UE-RxTxTEG-ID-MaxSupport***  Indicates the maximum number of UE-RxTxTEGs, which is supported and reported by the UE. This field is applicable for Multi-RTT positioning. |
| ***measureSameDL-PRS-ResourceWithDifferentRxTEGs***  Indicates the maximum number of different UE-RxTEGs that a UE can support to measure the same DL-PRS Resource of a TRP. This field is applicable for UE assisted DL-TDOA and Multi-RTT positioning. |
| ***measureSameDL-PRS-ResourceWithDifferentRxTEGsSimul***  Indicates the maximum number of UE Rx TEGs for measuring the same DL-PRS Resource simultaneously. This field is applicable for UE assisted DL-TDOA and Multi-RTT positioning. |

#### *– NR-UL-SRS-Capability*

The IE *NR-UL-SRS-Capability* defines the UE uplink SRS capability.

-- ASN1START

NR-UL-SRS-Capability-r16 ::= SEQUENCE {

srs-CapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

SRS-CapabilityPerBand-r16,

srs-PosResourceConfigCA-BandList-r16 SEQUENCE (SIZE (1..nrMaxConfiguredBands-r16)) OF

SRS-PosResourcesPerBand-r16 OPTIONAL,

maxNumberSRS-PosPathLossEstimateAllServingCells-r16

ENUMERATED {n1, n4, n8, n16} OPTIONAL,

maxNumberSRS-PosSpatialRelationsAllServingCells-r16

ENUMERATED {n0, n1, n2, n4, n8, n16} OPTIONAL,

...

}

SRS-CapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

olpc-SRS-Pos-r16 OLPC-SRS-Pos-r16 OPTIONAL,

spatialRelationsSRS-Pos-r16 SpatialRelationsSRS-Pos-r16 OPTIONAL,

...,

[[

posSRS-RRC-Inactive-InInitialUL-BWP-r17 PosSRS-RRC-Inactive-InInitialUL-BWP-r17 OPTIONAL,

posSRS-RRC-Inactive-OutsideInitialUL-BWP-r17

PosSRS-RRC-Inactive-OutsideInitialUL-BWP-r17

OPTIONAL,

olpc-SRS-PosRRC-Inactive-r17 OLPC-SRS-Pos-r16 OPTIONAL,

spatialRelationsSRS-PosRRC-Inactive-r17 SpatialRelationsSRS-Pos-r16 OPTIONAL

]]

}

OLPC-SRS-Pos-r16 ::= SEQUENCE {

olpc-SRS-PosBasedOnPRS-Serving-r16 ENUMERATED {supported} OPTIONAL,

olpc-SRS-PosBasedOnSSB-Neigh-r16 ENUMERATED {supported} OPTIONAL,

olpc-SRS-PosBasedOnPRS-Neigh-r16 ENUMERATED {supported} OPTIONAL,

maxNumberPathLossEstimatePerServing-r16 ENUMERATED {n1, n4, n8, n16} OPTIONAL,

...

}

SpatialRelationsSRS-Pos-r16 ::= SEQUENCE {

spatialRelation-SRS-PosBasedOnSSB-Serving-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnCSI-RS-Serving-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnPRS-Serving-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnSRS-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnSSB-Neigh-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnPRS-Neigh-r16 ENUMERATED {supported} OPTIONAL,

...

}

SRS-PosResourcesPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

maxNumberSRS-PosResourceSetsPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n12, n16},

maxNumberSRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNumberPeriodicSRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNumberAP-SRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64}

OPTIONAL,

maxNumberSP-SRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64}

OPTIONAL,

...

}

PosSRS-RRC-Inactive-InInitialUL-BWP-r17 ::= SEQUENCE {

maxNumOfSRSposResourceSets-r17 ENUMERATED {n1, n2, n4, n8, n12, n16 } OPTIONAL,

maxNumOfPeriodicAndSemiPeristentSRSposResources-r17

ENUMERATED {n1, n2, n4, n8, n16, n32, n64 }

OPTIONAL,

maxNumOfPeriodicAndSemiPeristentSRSposResourcesPerSlot-r17

ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}

OPTIONAL,

maxNumOfPeriodicSRSposResources-r17

ENUMERATED {n1, n2, n4, n8, n16, n32, n64 }

OPTIONAL,

maxNumOfPeriodicSRSposResourcesPerSlot-r17

ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}

OPTIONAL,

maxNumOfSemiPeristentSRSposResources-r17

ENUMERATED {n1, n2, n4, n8, n16, n32, n64} OPTIONAL,

maxNumOfSemiPersistentSRSposResourcesPerSlot-r17

ENUMERATED { n1, n2, n3, n4, n5, n6, n8, n10, n12, n14 }

OPTIONAL,

...

}

PosSRS-RRC-Inactive-OutsideInitialUL-BWP-r17 ::= SEQUENCE {

maxSRSposBandwidthForEachSCS-withinCC-FR1-r17

ENUMERATED { bw5, bw10, bw15, bw20, bw25, bw30, bw35,

bw40, bw45, bw50, bw60, bw70, bw80,

bw90, bw100 } OPTIONAL,

maxSRSposBandwidthForEachSCS-withinCC-FR2-r17

ENUMERATED { bw50, bw100, bw200, bw400 } OPTIONAL,

maxNumOfSRSposResourceSets-r17 ENUMERATED { n1, n2, n4, n8, n12, n16 } OPTIONAL,

maxNumOfPeriodicSRSposResources-r17 ENUMERATED { n1, n2, n4, n8, n16, n32, n64 }

OPTIONAL,

maxNumOfPeriodicSRSposResourcesPerSlot-r17

ENUMERATED { n1, n2, n3, n4, n5, n6, n8, n10, n12, n14 }

OPTIONAL,

differentNumerologyBetweenSRSposAndInitialBWP-r17

ENUMERATED { supported } OPTIONAL,

srsPosWithoutRestrictionOnBWP-r17

ENUMERATED { supported } OPTIONAL,

maxNumOfPeriodicAndSemiPeristentSRSposResources-r17

ENUMERATED {n1, n2, n4, n8, n16, n32, n64} OPTIONAL,

maxNumOfPeriodicAndSemiPeristentSRSposResourcesPerSlot-r17

ENUMERATED { n1, n2, n3, n4, n5, n6, n8, n10,

n12, n14 } OPTIONAL,

differentCenterFreqBetweenSRSposAndInitialBWP-r17

ENUMERATED { supported } OPTIONAL,

maxNumOfSemiPersistentSRSposResources-r17

ENUMERATED { n1, n2, n4, n8, n16, n32, n64 }

OPTIONAL,

maxNumOfSemiPersistentSRSposResourcesPerSlot-r17

ENUMERATED { n1, n2, n3, n4, n5, n6, n8, n10,

n12, n14 } OPTIONAL,

switchingTimeSRS-TX-OtherTX-r17 ENUMERATED { us100, us140, us200, us300, us500 }

OPTIONAL,

...

}

-- ASN1STOP

| *NR-UL-SRS-Capability* field descriptions |
| --- |
| ***srs-PosResourceConfigCA-BandList***  This field indicates the number of SRS for positioning resources supported by the target device. The target device includes this field for each band for the current configured CA band combination. The capability signalling comprises the following parameters.  - ***freqBandIndicatorNR***indicates the current configured NR band of the target device.  - ***maxNumberSRS-PosResourceSetsPerBWP***indicates the maximum number of SRS Resource Sets for positioning supported by the target device per BWP. Enumerated values *n1*, *n2*, *n4*, *n8*, *n12*, *n16* correspond to 1, 2, 4, 8, 12, 16 SRS Resource Sets for positioning, respectively.  - ***maxNumberSRS-PosResourcesPerBWP***indicates the maximum number of periodic, semi-persistent, and aperiodic SRS Resources for positioning supported by the target device per BWP. Enumerated values *n1, n2, n4, n8, n16, n32, n64* correspond to 1, 2, 4, 8, 16, 32, 64 SRS Resources for positioning, respectively.  - ***maxNumberPeriodicSRS-PosResourcesPerBWP***indicates the maximum number of periodic SRS Resources for positioning supported by the target device per BWP. Enumerated values *n1, n2, n4, n8, n16, n32, n64* correspond to 1, 2, 4, 8, 16, 32, 64 periodic SRS Resources for positioning, respectively.  - ***maxNumberAP-SRS-PosResourcesPerBWP***indicates the maximum number of aperiodic SRS Resources for positioning supported by the target device per BWP. Enumerated values *n1, n2, n4, n8, n16, n32, n64* correspond to 1, 2, 4, 8, 16, 32, 64 aperiodic SRS Resources for positioning, respectively.  - ***maxNumberSP-SRS-PosResourcesPerBWP***indicates the maximum number of semi-persistent SRS Resources for positioning supported by the target device per BWP. Enumerated values *n1, n2, n4, n8, n16, n32, n64* correspond to 1, 2, 4, 8, 16, 32, 64 semi-persistent SRS Resources for positioning, respectively. |
| ***maxNumberSRS-PosPathLossEstimateAllServingCells***  Indicates the maximum number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions. The UE shall include this field if the UE supports any of *olpc-SRS-PosBasedOnPRS-Serving, olpc-SRS-PosBasedOnSSB-Neigh* and *olpc-SRS-PosBasedOnPRS-Neigh.* Otherwise, the UE does not include this field. |
| ***maxNumberSRS-PosSpatialRelationsAllServingCells***  indicates the maximum number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions. It is only applied for FR2. The UE can include this field only if the UE supports any of *spatialRelation-SRS-PosBasedOnSSB-Serving*, *spatialRelation-SRS-PosBasedOnCSI-RS-Serving*, *spatialRelation-SRS-PosBasedOnPRS-Serving*, *spatialRelation-SRS-PosBasedOnSSB-Neigh* or *spatialRelation-SRS-PosBasedOnPRS-Neigh*. Otherwise, the UE does not include this field. |
| ***olpc-SRS-Pos***  Indicates whether the UE supports open-loop power control for SRS for positioning. The capability signalling comprises the following parameters.  - ***olpc-SRS-PosBasedOnPRS-Serving***indicates whether the UE supports OLPC for SRS for positioning based on PRS from the serving cell in the same band. The UE can include this field only if the UE supports NR-DL-*PRS-ProcessingCapability* and *srs-PosResources* TS38.331 [35] Otherwise, the UE does not include this field.  - ***olpc-SRS-PosBasedOnSSB-Neigh***indicates whether the UE supports OLPC for SRS for positioning based on SSB from the neighbouring cell in the same band. The UE can include this field only if the UE supports *srs-PosResources* TS 38.331 [35]. Otherwise, the UE does not include this field.  - ***olpc-SRS-PosBasedOnPRS-Neigh***indicates whether the UE supports OLPC for SRS for positioning based on PRS from the neighbouring cell in the same band. The UE can include this field only if the UE supports *olpc-SRS-PosBasedOnPRS-Serving*. Otherwise, the UE does not include this field.  Note: A PRS from a PRS-only TP is treated as PRS from a non-serving cell.  - ***maxNumberPathLossEstimatePerServing***indicates the maximum number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions. The UE shall include this field if the UE supports any of *olpc-SRS-PosBasedOnPRS-Serving, olpc-SRS-PosBasedOnSSB-Neigh* and *olpc-SRS-PosBasedOnPRS-Neigh.* Otherwise, the UE does not include this field. |
| ***spatialRelationsSRS-Pos***  Indicates whether the UE supports spatial relations for SRS for positioning. It is only applicable for FR2. The capability signalling comprises the following parameters.  - ***spatialRelation-SRS-PosBasedOnSSB-Serving*** indicates whether the UE supports spatial relation for SRS for positioning based on SSB from the serving cell in the same band. The UE can include this field only if the UE supports *srs-PosResources* TS 38.331 [35]. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnCSI-RS-Serving*** indicates whether the UE supports spatial relation for SRS for positioning based on CSI-RS from the serving cell in the same band. The UE can include this field only if the UE supports *spatialRelation-SRS-PosBasedOnSSB-Serving*. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnPRS-Serving***indicates whether the UE supports spatial relation for SRS for positioning based on PRS from the serving cell in the same band. The UE can include this field only if the UE supports any of DL-PRS Resources for DL-AoD, DL-PRS Resources for DL-TDOA or DL-PRS Resources for Multi-RTT, or *srs-PosResources* TS 38.331 [35]. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnSRS***indicates whether the UE supports spatial relation for SRS for positioning based on SRS in the same band. The UE can include this field only if the UE supports *srs-PosResources* TS 38.331 [35]. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnSSB-Neig****h* indicates whether the UE supports spatial relation for SRS for positioning based on SSB from the neighbouring cell in the same band. The UE can include this field only if the UE supports *spatialRelation-SRS-PosBasedOnSSB-Serving*. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnPRS-Neigh***indicates whether the UE supports spatial relation for SRS for positioning based on PRS from the neighbouring cell in the same band. The UE can include this field only if the UE supports *spatialRelation-SRS-PosBasedOnPRS-Serving*. Otherwise, the UE does not include this field.  Note: A PRS from a PRS-only TP is treated as PRS from a non-serving cell. |
| ***posSRS-RRC-Inactive-InInitialUL-BWP***  Indicates whether the UE supports positioning SRS transmission in RRC\_INACTIVE state for initial UL BWP.  - ***maxNumOfSRSposResourceSets*** indicates the maximum number of SRS Resource Sets for positioning supported by the UE.  - ***maxNumOfPeriodicAndSemiPeristentSRSposResources*** indicates the maximum number of periodic and semi-persistent SRS Resources for positioning supported by the UE.  - ***maxNumOfPeriodicAndSemiPeristentSRSposResourcesPerSlot***indicates the maximum number of periodic and semi-persistent SRS Resources for positioning per slot supported by the UE.  - ***maxNumOfPeriodicSRSposResources***indicates the maximum number of periodic SRS Resources for positioning supported by the UE.  - ***maxNumOfPeriodicSRSposResourcesPerSlot***indicates the maximum number of periodic SRS Resources for positioning per slot supported by the UE.  - ***maxNumOfSemiPersistentSRSposResources***indicates the maximum number of semi-persistent SRS Resources for positioning supported by the UE.  - ***maxNumOfSemiPersistentSRSposResourcesPerSlot***indicates the maximum number of semi-persistent SRS Resources for positioning per slot supported by the UE. |
| ***posSRS-RRC-Inactive-OutsideInitialUL-BWP***  Indicates whether the UE supports positioning SRS transmission in RRC\_INACTIVE state outside initial UL BWP.  - ***maxSRSposBandwidthForEachSCS-withinCC-FR1*** indicates the maximum SRS bandwidth supported for each SCS that UE supports within a single CC for FR1.  - ***maxSRSposBandwidthForEachSCS-withinCC-FR2*** indicates the maximum SRS bandwidth supported for each SCS that UE supports within a single CC for FR2.  - ***maxNumOfSRSposResourceSets*** indicates the maximum number of SRS Resource Sets for positioning supported by the UE.  - ***maxNumOfPeriodicSRSposResources***indicates the maximum number of periodic SRS Resources for positioning supported by the UE.  - ***maxNumOfPeriodicSRSposResourcesPerSlot***indicates the maximum number of periodic SRS Resources for positioning per slot supported by the UE.  - ***differentNumerologyBetweenSRSposAndInitialBWP***indicates whether different numerology between the SRS and the initial UL BWP is supported by the UE.  - ***srsPosWithoutRestrictionOnBWP*** indicates whether SRS operation without restriction on the BW is supported by the UE; BW of the SRS may not include BW of the CORESET#0 and SSB.  - ***maxNumOfPeriodicAndSemiPeristentSRSposResources*** indicates the maximum number of periodic and semi-persistent SRS Resources for positioning supported by the UE.  - ***maxNumOfPeriodicAndSemiPeristentSRSposResourcesPerSlot*** indicates the maximum number of periodic and semi-persistent SRS Resources for positioning per slot supported by the UE.  - ***differentCenterFreqBetweenSRSposAndInitialBWP*** indicates whether different center frequenecy between the SRS for positioning and the initial UL BWP is supported by the UE.  - ***maxNumOfSemiPersistentSRSposResources***indicates the maximum number of semi-persistent SRS Resources for positioning supported by the UE.  - ***maxNumOfSemiPersistentSRSposResourcesPerSlot***indicates the maximum number of semi-persistent SRS Resources for positioning per slot supported by the UE.  - ***switchingTimeSRS-TX-OtherTX*** indicates the switching time between SRS Tx and other Tx in initial UL BWP or Rx in initial DL-BWP. |
| ***olpc-SRS-PosRRC-Inactive***  Indicates whether the UE supports open-loop power control for SRS for positioning in RRC\_INACTIVE state. |
| ***spatialRelationsSRS-PosRRC-Inactive***  Indicates whether the UE supports spatial relations for SRS for positioning in RRC\_INACTIVE state. |

#### – *ReferencePoint*

The IE *ReferencePoint* provides a well-defined location relative to which other locations may be defined.

-- ASN1START

ReferencePoint-r16 ::= SEQUENCE {

referencePointGeographicLocation-r16 CHOICE {

location3D-r16 EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,

ha-location3D-r16 HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15,

...

},

...

}

-- ASN1STOP

| *ReferencePoint* field descriptions |
| --- |
| ***referencePointGeographicLocation***  This field provides the geodetic location of the reference point. |

#### – *RelativeLocation*

The IE *RelativeLocation* provides a location relative to some known reference location.

-- ASN1START

RelativeLocation-r16 ::= SEQUENCE {

milli-arc-second-units-r16 ENUMERATED { mas0-03, mas0-3, mas3, mas30, ...},

height-units-r16 ENUMERATED {mm, cm, m, ...},

delta-latitude-r16 Delta-Latitude-r16,

delta-longitude-r16 Delta-Longitude-r16,

delta-height-r16 Delta-Height-r16,

locationUNC-r16 LocationUncertainty-r16 OPTIONAL, -- Need OP

...

}

Delta-Latitude-r16 ::= SEQUENCE {

delta-Latitude-r16 INTEGER (-1024..1023),

coarse-delta-Latitude-r16 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

Delta-Longitude-r16 ::= SEQUENCE {

delta-Longitude-r16 INTEGER (-1024..1023),

coarse-delta-Longitude-r16 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

Delta-Height-r16 ::= SEQUENCE {

delta-Height-r16 INTEGER (-1024..1023),

coarse-delta-Height-r16 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

LocationUncertainty-r16 ::= SEQUENCE {

horizontalUncertainty-r16 INTEGER (0..255),

horizontalConfidence-r16 INTEGER (0..100),

verticalUncertainty-r16 INTEGER (0..255),

verticalConfidence-r16 INTEGER (0..100)

}

-- ASN1STOP

| *RelativeLocation* field descriptions |
| --- |
| ***milli-arc-second-units***  This field provides the units and scale factor for the *delta-latitude* and *delta-longitude* fields. Enumerated values *mas0-03*, *mas0-3*, *mas3*, and *mas30*, correspond to 0.03, 0.3, 3, and 30 milliarcseconds, respectively. |
| ***height-units***  This field provides the units and scale factor for the *delta-height* field. Enumerated values *mm*, *cm*, and *m* correspond to 10-3 metre, 10-2 metre, and 1 metres, respectively. |
| ***delta-latitude***  This field specifies the delta value in latitude of the desired location, defined as "desired location" minus "reference point location" and comprises the following sub-fields:  - ***delta-Latitude*** specifies the delta value in latitude in the unit provided in *milli-arc-second-units* field.  - ***coarse-delta-Latitude*** specifies the delta value in latitude in 1024 times the size of the unit provided in *milli-arc‑second‑units* field and with the same sign as in the *delta-Latitude* field. If this field is absent, the value for *coarse-delta-Latitude*is zero.  I.e., the full *delta-latitude* is given by:  (*delta-Latitude* × *milli-arc-second-units*)±(*coarse-delta-Latitude* × 1024 × *milli-arc-second-units*) [milli-arc-seconds] |
| ***delta-longitude***  This field specifies the delta value in longitude of the desired location, defined as "desired location" minus "reference point location" and comprises the following sub-fields:  - ***delta-Longitude*** specifies the delta value in longitude in the unit provided in *milli-arc-second-units* field.  - ***coarse-delta-Longitude*** specifies the delta value in longitude in 1024 times the size of the unit provided in *milli-arc‑second‑units* field and with the same sign as in the *delta-Longitude* field. If this field is absent, the value for *coarse-delta-Longitude*is zero.  I.e., the full *delta-longitude* is given by:  (*delta-Longitude* × *milli-arc-second-units*)±(*coarse-delta-Latitude* × 1024 × *milli-arc-second-units*) [milli-arc-seconds] |
| ***delta-height***  This field specifies the delta value in ellipsoidal height of the desired location, defined as "desired location" minus "reference point location" and comprises the following sub-fields:  - ***delta-Height*** specifies the delta value in ellipsoidal height in the unit provided in *height-units* field.  - ***coarse-delta-Height*** specifies the delta value in ellipsoidal height in 1024 times the size of the unit provided in *height-units* field and with the same sign as in the *delta-Height* field. If this field is absent, the value for *coarse-delta-Height*is zero.  I.e., the full *delta-height* is given by:  (*delta-Height* × *height-units*) *±* (*coarse-delta-Height* × 1024 × *height-units*) [metres] |
| ***locationUNC***  This field specifies the uncertainty of the location coordinates and comprises the following sub-fields:  - ***horizontalUncertainty*** indicates the horizontal uncertainty of the ARP latitude/longitude. The ′*horizontalUncertainty*′ corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and ′*horizontalConfidence*′ corresponds to confidence as defined in TS 23.032 [15].  - ***verticalUncertainty*** indicates the vertical uncertainty of the ARP altitude. The '*verticalUncertainty*' corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and '*verticalConfidence*' corresponds to confidence as defined in TS 23.032 [15].  If this field is absent, the uncertainty is the same as for the associated reference point location. |

#### – *TEG-TimingErrorMargin*

The IE *TEG-TimingErrorMargin* defines the timing error margin values of the UE Rx TEGs, UE Tx TEGs, or TRP Tx TEGs. Enumerated value '*tc0*' corresponds to 0 Tc, '*tc2*' corresponds to 2 Tc and so on, where Tc is defined in TS 38.211 [41] clause 4.1.

-- ASN1START

TEG-TimingErrorMargin-r17 ::= ENUMERATED { tc0, tc2, tc4, tc6, tc8, tc12, tc16, tc20, tc24,

tc32, tc40, tc48, tc56, tc64, tc72, tc80 }

-- ASN1STOP

#### – *RxTxTEG-TimingErrorMargin*

The IE *RxTxTEG-TimingErrorMargin* defines the timing error margin values of the UE RxTx TEGs. Enumerated value '*tc0-5*' corresponds to 0.5 Tc, '*tc1*' corresponds to 1 Tc and so on, where Tc is defined in TS 38.211 [41] clause 4.1.

-- ASN1START

RxTxTEG-TimingErrorMargin-r17 ::= ENUMERATED { tc0-5, tc1, tc2, tc4, tc8, tc12, tc16, tc20,

tc24, tc32, tc40, tc48, tc64, tc80, tc96, tc128 }

-- ASN1STOP

## 

### 6.5.8 NR UL Positioning

#### 6.5.8.1 NR UL Capability Information

#### *– NR-UL-ProvideCapabilities*

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

-- ASN1START

NR-UL-ProvideCapabilities-r16 ::= SEQUENCE {

nr-UL-SRS-Capability-r16 NR-UL-SRS-Capability-r16,

...,

[[

nr-UE-TEG-Capability-r17 NR-UE-TEG-Capability-r17 OPTIONAL

]]

}

-- ASN1STOP

| *NR-UL-ProvideCapabilities* field descriptions |
| --- |
| ***nr-UE-TEG-Capability***  Indicates the UE TEG capability. |

#### 6.5.8.2 NR UL Capability Information Request

#### *– NR-UL-RequestCapabilities*

The IE *NR-UL-RequestCapabilities* is used by the location server to request the capability of the target device to support UL SRS for positioning and to request UL SRS for positioning capabilities from a target device.

-- ASN1START

NR-UL-RequestCapabilities-r16 ::= SEQUENCE {

...

}

-- ASN1STOP

#### 6.5.10.4 NR DL-TDOA Location Information Elements

#### – *NR-DL-TDOA-SignalMeasurementInformation*

The IE *NR-DL-TDOA-SignalMeasurementInformation* is used by the target device to provide NR DL-TDOA measurements to the location server.

NOTE 1: The *dl-PRS-ReferenceInfo* defines the "RSTD reference" TRP. The *nr-RSTD's* and *nr-RSTD-ResultDiff*'s in *nr-DL-TDOA-MeasList* are provided relative to the "RSTD reference" TRP.

NOTE 2: The "RSTD reference" TRP may or may not be the same as the "assistance data reference" TRP provided by *nr-DL-PRS-ReferenceInfo* in IE *NR-DL-PRS-AssistanceData.*

NOTE 3: The target device includes a value of zero for the *nr-RSTD* and *nr-RSTD-ResultDiff* of the "RSTD reference" TRP in *nr-DL-TDOA-MeasList*.

-- ASN1START

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

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

nr-DL-TDOA-MeasList-r16 NR-DL-TDOA-MeasList-r16,

...,

[[

nr-UE-RxTEG-TimingErrorMargin-r17 TEG-TimingErrorMargin-r17 OPTIONAL -- Cond UERxTEG

]]

}

NR-DL-TDOA-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-DL-TDOA-MeasElement-r16

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

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

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

nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

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

nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-RSTD-r16 CHOICE {

k0-r16 INTEGER (0..1970049),

k1-r16 INTEGER (0..985025),

k2-r16 INTEGER (0..492513),

k3-r16 INTEGER (0..246257),

k4-r16 INTEGER (0..123129),

k5-r16 INTEGER (0..61565),

...

},

nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

nr-TimingQuality-r16 NR-TimingQuality-r16,

nr-DL-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,

nr-DL-TDOA-AdditionalMeasurements-r16

NR-DL-TDOA-AdditionalMeasurements-r16 OPTIONAL,

...,

[[

nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

nr-DL-PRS-FirstPathRSRP-Result-r17 INTEGER (0..126) OPTIONAL,

nr-los-nlos-Indicator-r17 CHOICE {

perTRP-r17 LOS-NLOS-Indicator-r17,

perResource-r17 LOS-NLOS-Indicator-r17

} OPTIONAL,

nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

nr-DL-TDOA-AdditionalMeasurementsExt-r17

NR-DL-TDOA-AdditionalMeasurementsExt-r17 OPTIONAL

]]

}

NR-DL-TDOA-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF

NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-DL-TDOA-AdditionalMeasurementsExt-r17 ::= SEQUENCE (SIZE (1..maxAddMeasTDOA-r17)) OF

NR-DL-TDOA-AdditionalMeasurementElement-r16

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

nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-RSTD-ResultDiff-r16 CHOICE {

k0-r16 INTEGER (0..8191),

k1-r16 INTEGER (0..4095),

k2-r16 INTEGER (0..2047),

k3-r16 INTEGER (0..1023),

k4-r16 INTEGER (0..511),

k5-r16 INTEGER (0..255),

...

},

nr-TimingQuality-r16 NR-TimingQuality-r16,

nr-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,

nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

...,

[[

nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17) OPTIONAL,

nr-DL-PRS-FirstPathRSRP-ResultDiff-r17

INTEGER (0..61) OPTIONAL,

nr-los-nlos-IndicatorPerResource-r17

LOS-NLOS-Indicator-r17 OPTIONAL,

nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *UERxTEG* | The field is optionally present, need OP, if the field *nr-UE-Rx-TEG-ID* is present; otherwise it is not present. |

| *NR-DL-TDOA-SignalMeasurementInformation* field descriptions |
| --- |
| ***nr-UE-RxTEG-TimingErrorMargin***  This field specifies the UE Rx TEG timing error margin value for all the UE Rx TEGs within one *NR-DL-TDOA-SignalMeasurementInformation*. If the *nr-UE-Rx-TEG-ID* is present and this field is absent, the receiver should consider the UE Rx TEG timing error margin value to be the maximum applicable value as defined in TS 38.133 [46]. |
| ***dl-PRS-ID***  This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resources ID to uniquely identify a DL-PRS Resource. This ID can be associated with multiple DL-PRS Resource Sets associated with a single TRP.  Each TRP should only be associated with one such ID. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***nr-TimeStamp***  This field specifies the time instance at which the TOA and DL PRS-RSRP/RSRPP (if included) measurement is performed. The *nr-SFN* and *nr-Slot* in IE *NR-TimeStamp* correspond to the TRP provided in *dl-PRS-ReferenceInfo* as specified in TS 38.214 [45]. Note, the TOA measurement refers to the TOA of this neighbour TRP or the reference TRP, as applicable, used to determine the *nr-RSTD* or *nr-RSTD-ResultDiff*. |
| ***nr-RSTD***  This field specifies the relative timing difference between this neighbour TRP and the PRS reference TRP, as defined in TS 38.215 [36]. Mapping of the measured quantity is defined as in TS 38.133 [46]. |
| ***nr-AdditionalPathList***  This field specifies one or more additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-RSTD* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. If this field is present, the field *nr-AdditionalPathListExt* shall be absent. |
| ***nr-TimingQuality***  This field specifies the target device′s best estimate of the quality of the TOA measurement. Note, the TOA measurement refers to the TOA of this neighbour TRP or the reference TRP, as applicable, used to determine the *nr-RSTD* or *nr-RSTD-ResultDiff*. |
| ***nr-DL-PRS-RSRP-Result***  This field specifies the NR DL-PRS reference signal received power (DL PRS-RSRP) measurement, as defined in TS 38.215 [36]. The mapping of the quantity is defined as in TS 38.133 [46]. |
| ***nr-UE-Rx-TEG-ID***  This field provides the ID of the UE Rx TEG associated with the TOA measurement. Note, the TOA measurement refers to the TOA of this neighbour TRP or the reference TRP, as applicable, used to determine the *nr-RSTD* or *nr-RSTD-ResultDiff*. When different UE Rx TEGs for RSTD measurements are requested, the maximum number of reported RSTD measurements associated with different DL-PRS Resources per UE Rx TEG per target TRP is 4. |
| ***nr-DL-PRS-FirstPathRSRP-Result***  This field specifies the NR DL-PRS reference signal received path power (DL PRS-RSRPP) of the first detected path in time, as defined in TS 38.215 [36]. The mapping of the measured quantity is defined as in TS 38.133 [46]. |
| ***nr-los-nlos-Indicator***  This field specifies the target device's best estimate of the LOS or NLOS of the TOA measurement for the TRP or resource. Note, the TOA measurement refers to the TOA of this neighbour TRP or the reference TRP, as applicable, used to determine the *nr-RSTD* or *nr-RSTD-ResultDiff*.  NOTE: If the requested type or granularity in *nr-los-nlos-IndicatorRequest* is not possible, the target device may provide a different type and granularity for the estimated *LOS-NLOS-Indicator.* |
| ***nr-AdditionalPathListExt***  This field provides up to 8 additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-RSTD* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. If this field is present, the field *nr-AdditionalPathList* shall be absent. |
| ***nr-DL-TDOA-AdditionalMeasurementsExt***  This field, in addition to the measurements provided in *NR-DL-TDOA-MeasElement*, provides TOA measurements of up to 4 DL-PRS Resources of a TRP with different UE Rx TEGs. For a certain DL-PRS Resource, there can be up to 8 TOA measurement results with respect to different Rx TEGs.  If this field is present, the field *nr-DL-TDOA-AdditionalMeasurements* should not be present. |
| ***nr-RSTD-ResultDiff***  This field provides the additional DL RSTD measurement result relative to *nr-RSTD.* The RSTD value of this measurement is obtained by adding the value of this field to the value of the *nr-RSTD* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-DL-PRS-RSRP-ResultDiff***  This field provides the additional DL-PRS RSRP measurement result relative to *nr-DL-PRS-RSRP-Result.* The DL-PRS RSRP value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-RSRP-Result* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-DL-PRS-FirstPathRSRP-ResultDiff***  This field specifies the additional NR DL PRS reference signal received path power (DL PRS-RSRPP) of the first detected path in time relative to *nr-DL-PRS-FirstPathRSRP-Result*. The DL-PRS RSRPP of first path value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-FirstPathRSRP-Result* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-los-nlos-IndicatorPerResource***  This field specifies the target device's best estimate of the LOS or NLOS of the TOA measurement for the resource. Note, the TOA measurement refers to the TOA of this neighbour TRP or the reference TRP, as applicable, used to determine the *nr-RSTD* or *nr-RSTD-ResultDiff*.  This field may only be present if the field *nr-LOS-NLOS-Indicator* choice indicates *perResource*. |

#### *– NR-DL-TDOA-LocationInformation*

The IE *NR-DL-TDOA-LocationInformation* is included by the target device when location information derived using NR DL-TDOA is provided to the location server.

-- ASN1START

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

measurementReferenceTime-r16 CHOICE {

systemFrameNumber-r16 NR-TimeStamp-r16,

utc-time-r16 UTCTime,

...

} OPTIONAL,

...,

[[

locationCoordinates-r17 LocationCoordinates OPTIONAL, -- Cond batch1

locationSource-r17 LocationSource-r13 OPTIONAL -- Cond batch2

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *batch1* | The field is mandatory present if the field *nr-DL-TDOA-LocationInformationInstances* is present in IE *NR-DL-TDOA-ProvideLocationInformation*; otherwise it is not present. |
| *batch2* | The field is optionally present, need ON, if the field *nr-DL-TDOA-LocationInformationInstances* is present in IE *NR-DL-TDOA-ProvideLocationInformation*; otherwise it is not present. |

| *NR-DL-TDOA-LocationInformation* field descriptions |
| --- |
| ***measurementReferenceTime***  This field specifies the time for which the location estimate is valid. |
| ***locationCoordinates***  This field provides a location estimate using one of the geographic shapes defined in TS 23.032 [15]. NOTE 1. |
| ***locationSource***  This field provides the source positioning technology for the location estimate. NOTE 1. |

NOTE 1: In the case of locationCoordinates for multiple NR positioning methods are provided, the locationCoordinates and locationSource shall be present in only one of NR-DL-TDOA-ProvideLocationInformation or NR-DL-AoD-ProvideLocationInformation.

#### 6.5.10.5 NR DL-TDOA Location Information Request

#### – *NR-DL-TDOA-RequestLocationInformation*

The IE *NR-DL-TDOA-RequestLocationInformation* is used by the location server to request NR DL-TDOA location measurements from a target device.

-- ASN1START

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

nr-DL-PRS-RstdMeasurementInfoRequest-r16 ENUMERATED { true } OPTIONAL,-- Need ON

nr-RequestedMeasurements-r16 BIT STRING { prsrsrpReq (0),

firstPathRsrpReq-r17 (1)

} (SIZE(1..8)),

nr-AssistanceAvailability-r16 BOOLEAN,

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

additionalPaths-r16 ENUMERATED { requested } OPTIONAL, -- Need ON

...,

[[

nr-UE-RxTEG-Request-r17 ENUMERATED { requested } OPTIONAL, -- Need ON

nr-los-nlos-IndicatorRequest-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType1-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity1-r17,

...

} OPTIONAL, -- Need ON

additionalPathsExt-r17 ENUMERATED { requested } OPTIONAL, -- Need ON

additionalPathsDL-PRS-RSRP-Request-r17 ENUMERATED { requested } OPTIONAL, -- Need ON

multiMeasInSameReport-r17 ENUMERATED { requested } OPTIONAL -- Need ON

]]

}

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

maxDL-PRS-RSTD-MeasurementsPerTRPPair-r16 INTEGER (1..4) OPTIONAL, -- Need ON

timingReportingGranularityFactor-r16 INTEGER (0..5) OPTIONAL, -- Need ON

...,

[[

measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17

ENUMERATED { n0, n2, n3, n4, n6, n8, ... }

OPTIONAL, -- Need ON

reducedDL-PRS-ProcessingSamples-r17 ENUMERATED { requested, ... } OPTIONAL, -- Need ON

lowerRxBeamSweepingFactor-FR2-r17 ENUMERATED { requested } OPTIONAL -- Need ON

]]

}

-- ASN1STOP

| *NR-DL-TDOA-RequestLocationInformation* field descriptions |
| --- |
| ***nr-DL-PRS-RstdMeasurementInfoRequest***  This field indicates whether the target device is requested to report DL-PRS Resource ID(s) or DL-PRS Resource Set ID(s) used for determining the timing of each TRP in RSTD measurements. |
| ***nr-RequestedMeasurements***  This field specifies the NR DL-TDOA measurements requested. This is represented by a bit string, with a one‑value at the bit position means the particular measurement is requested; a zero‑value means not requested. |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***additionalPaths***  This field, if present, indicates that the target device is requested to provide the *nr-AdditionalPathList* in IE *NR-DL-TDOA-SignalMeasurementInformation*. If this field is present, the field *additionalPathsExt* shall be absent. |
| ***nr-UE-RxTEG-Request***  This field, if present, indicates that the target device is requested to provide the *nr-UE-Rx-TEG-ID* in IE *NR-DL-TDOA-SignalMeasurementInformation.* |
| ***nr-los-nlos-IndicatorRequest***  This field, if present, indicates that the target device is requested to provide the indicated type and granularity of the estimated *LOS-NLOS-Indicator* in the *NR-DL-TDOA-SignalMeasurementInformation*. |
| ***additionalPathsExt***  This field, if present, indicates that the target device is requested to provide the *nr-AdditionalPathListExt* in IE *NR-DL-TDOA-SignalMeasurementInformation*. If this field is present, the field *additionalPaths* shall be absent. |
| ***additionalPathsDL-PRS-RSRP-Request***  This field, if present, indicates that the target device is requested to provide the *nr-DL-PRS-RSRPP* for the additional paths in IE *NR-AdditionalPathList*. |
| ***multiMeasInSameReport***  This field, if present, indicates that the target device is requested to provide multiple measurement instances in a single measurement report; i.e., include the *nr-DL-TDOA-SignalMeasurementInstances* (in the case of UE-assisted mode is requested) or *nr-DL-TDOA-LocationInformationInstances* (in the case of UE-based mode is requested) in IE *NR-DL-TDOA-ProvideLocationInformation.* |
| ***maxDL-PRS-RSTD-MeasurementsPerTRPPair***  This field specifies the maximum number of. DL-PRS RSTD measurements per pair of TRPs. The maximum number is defined across all Positioning Frequency Layers. |
| ***timingReportingGranularityFactor***  This field specifies the recommended reporting granularity for the DL RSTD measurements. Value (0..5) corresponds to (*k0*..*k5*) used for *nr-RSTD* and *nr-RSTD-ResultDiff* in *NR-DL-TDOA-MeasElement*. The UE may select a different granularity value for *nr-RSTD* and *nr-RSTD-ResultDiff*. |
| ***measureSameDL-PRS-ResourceWithDifferentRxTEGs***  This field, if present, indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with *N* different UE Rx TEGs. Enumerated value '*n0*' indicates that the number *N* of different UE Rx TEGs to measure the same DL PRS Resource can be determined by the target device, value '*n2*' indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with 2 different UE Rx TEGs, value '*n3*' indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with 3 different UE Rx TEGs, and so on.  If this field is present, the field *nr-UE-TxTEG-Request* should also be present. |
| ***reducedDL-PRS-ProcessingSamples***  This field, if present and set to '*requested*', indicates that the target device is requested to perform the requested measurements with reduced number of samples (M=1 or M=2) as specified in TS 38.133 [46]. |
| ***lowerRxBeamSweepingFactor-FR2***  This field, if present, indicates that the target device is requested to use a lower Rx beam sweeping factor than 8 for FR2 according to UE's capability. |

#### 6.5.11.4 NR DL-AoD Location Information Elements

#### – *NR-DL-AoD-SignalMeasurementInformation*

The IE *NR-DL-AoD-SignalMeasurementInformation* is used by the target device to provide NR DL-AoD measurements to the location server.

-- ASN1START

NR-DL-AoD-SignalMeasurementInformation-r16 ::= SEQUENCE {

nr-DL-AoD-MeasList-r16 NR-DL-AoD-MeasList-r16,

...

}

NR-DL-AoD-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-DL-AoD-MeasElement-r16

NR-DL-AoD-MeasElement-r16 ::= SEQUENCE {

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

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

nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

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

nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-DL-PRS-RSRP-Result-r16 INTEGER (0..126),

nr-DL-PRS-RxBeamIndex-r16 INTEGER (1..8) OPTIONAL,

nr-DL-AoD-AdditionalMeasurements-r16

NR-DL-AoD-AdditionalMeasurements-r16 OPTIONAL,

...,

[[

nr-DL-PRS-FirstPathRSRP-Result-r17

INTEGER (0..126) OPTIONAL,

nr-los-nlos-Indicator-r17 CHOICE {

perTRP-r17 LOS-NLOS-Indicator-r17,

perResource-r17 LOS-NLOS-Indicator-r17

} OPTIONAL,

nr-DL-AoD-AdditionalMeasurementsExt-r17

NR-DL-AoD-AdditionalMeasurementsExt-r17 OPTIONAL

]]

}

NR-DL-AoD-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..7)) OF

NR-DL-AoD-AdditionalMeasurementElement-r16

NR-DL-AoD-AdditionalMeasurementsExt-r17 ::= SEQUENCE (SIZE (1..maxAddMeasAoD-r17)) OF

NR-DL-AoD-AdditionalMeasurementElement-r17

NR-DL-AoD-AdditionalMeasurementElement-r16 ::= SEQUENCE {

nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..30),

nr-DL-PRS-RxBeamIndex-r16 INTEGER (1..8) OPTIONAL,

...

}

NR-DL-AoD-AdditionalMeasurementElement-r17 ::= SEQUENCE {

nr-DL-PRS-ResourceID-r17 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

nr-TimeStamp-r17 NR-TimeStamp-r16,

nr-DL-PRS-RSRP-ResultDiff-r17 INTEGER (0..30) OPTIONAL, -- Cond rsrp

nr-DL-PRS-RxBeamIndex-r17 INTEGER (1..8) OPTIONAL,

nr-DL-PRS-FirstPathRSRP-ResultDiff-r17 INTEGER (0..61) OPTIONAL, -- Cond rsrpp

nr-los-nlos-IndicatorPerResource-r17 LOS-NLOS-Indicator-r17 OPTIONAL,

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *rsrp* | The field is mandatory present if the field *nr-DL-PRS-FirstPathRSRP-ResultDiff* is absent; otherwise it is optionally present, need ON. |
| *rsrpp* | The field is mandatory present if the field *nr-DL-PRS-RSRP-ResultDiff* is absent; otherwise it is optionally present, need ON. |

| *NR-DL-AoD-SignalMeasurementInformation* field descriptions |
| --- |
| ***dl-PRS-ID***  This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resources ID to uniquely identify a DL-PRS Resource. This ID can be associated with multiple DL-PRS Resource Sets associated with a single TRP.  Each TRP should only be associated with one such ID. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***nr-TimeStamp***  This field specifies the time instance at which the measurement is performed. |
| ***nr-DL-PRS-RSRP-Result***  This field specifies the NR DL-PRS reference signal received power (DL PRS-RSRP) measurement, as defined in TS 38.215 [36]. The mapping of the measured quantity is defined as in TS 38.133 [46]. |
| ***nr-DL-PRS-RxBeamIndex***  This field provides an index of the target device receive beam used for DL-PRS measurements. If the value of the receive beam index for two or more DL PRS measurements is the same, it indicates that the target device receive beam for the two or more DL PRS measurements were made with the same RX beam. The field is mandatory present if at least two DL-PRS RSRP measurements from the same DL-PRS Resource Set have been made with the same RX beam by the target device; otherwise it is not present. |
| ***nr-DL-PRS-FirstPathRSRP-Result***  This field specifies the NR DL PRS reference signal received path power (DL PRS-RSRPP) of the first detected path in time, as defined in TS 38.215 [36]. The mapping of the measured quantity is defined as in TS 38.133 [46]. |
| ***nr-los-nlos-Indicator***  This field specifies the target device's best estimate of the LOS or NLOS of the RSRP or RSRPP of first path measurement for the TRP or resource.  NOTE: If the requested type or granularity in *nr-los-nlos-IndicatorRequest* is not possible, the target device may provide a different type and granularity for the estimated *LOS-NLOS-Indicator.* |
| ***nr-DL-AoD-AdditionalMeasurementsExt***  This field specifies a list of additional PRS RSRP and/or RSRPP measurements of different DL-PRS resources for the same TRP. If this field is present, the field *nr-DL-AoD-AdditionalMeasurements* should not be present. |
| ***nr-DL-PRS-RSRP-ResultDiff***  This field provides the additional DL-PRS RSRP measurement result relative to *nr-DL-PRS-RSRP-Result*. The DL-PRS RSRP value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-RSRP-Result* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-DL-PRS-FirstPathRSRP-ResultDiff***  This field specifies the additional NR DL PRS reference signal received path power (DL PRS-RSRPP) of the first detected path in time relative to *nr-DL-PRS-FirstPathRSRP-Result*. The DL-PRS RSRPP of first path value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-FirstPathRSRP-Result* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-los-nlos-IndicatorPerResource***  This field specifies the target device's best estimate of the LOS or NLOS of the RSRP or RSRPP of first path measurement for the resource.  This field may only be present if the field *nr-LOS-NLOS-Indicator* choice indicates *perResource*. |

#### – *NR-DL-AoD-LocationInformation*

The IE *NR-DL-AoD-LocationInformation* is included by the target device when location information derived using NR DL-AoD is provided to the location server.

-- ASN1START

NR-DL-AoD-LocationInformation-r16 ::= SEQUENCE {

measurementReferenceTime-r16 CHOICE {

sfn-time-r16 NR-TimeStamp-r16,

utc-time-r16 UTCTime,

...

} OPTIONAL,

...,

[[

locationCoordinates-r17 LocationCoordinates OPTIONAL, -- Cond batch1

locationSource-r17 LocationSource-r13 OPTIONAL -- Cond batch2

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *batch1* | The field is mandatory present if the field *nr-DL-AoD-LocationInformationInstances* is present in IE *NR-DL-AoD-ProvideLocationInformation*; otherwise it is not present. |
| *batch2* | The field is optionally present, need ON, if the field *nr-DL-AoD-LocationInformationInstances* is present in IE *NR-DL-AoD-ProvideLocationInformation*; otherwise it is not present. |

| *NR-DL-AoD-LocationInformation* field descriptions |
| --- |
| ***measurementReferenceTime***  This field specifies the time for which the location estimate is valid. |
| ***locationCoordinates***  This field provides a location estimate using one of the geographic shapes defined in TS 23.032 [15]. NOTE 1. |
| ***locationSource***  This field provides the source positioning technology for the location estimate. NOTE 1. |

NOTE 1: In the case of *locationCoordinates* for multiple NR positioning methods are provided, the *locationCoordinates* and *locationSource* shall be present in only one of *NR-DL-TDOA-ProvideLocationInformation* or *NR-DL-AoD-ProvideLocationInformation*.

#### 6.5.11.5 NR DL-AoD Location Information Request

#### – *NR-DL-AoD-RequestLocationInformation*

The IE *NR-DL-AoD-RequestLocationInformation* is used by the location server to request NR DL-AoD location measurements from a target device.

-- ASN1START

NR-DL-AoD-RequestLocationInformation-r16 ::= SEQUENCE {

nr-AssistanceAvailability-r16 BOOLEAN,

nr-DL-AoD-ReportConfig-r16 NR-DL-AoD-ReportConfig-r16,

...,

[[

multiMeasInSameReport-r17 ENUMERATED { requested } OPTIONAL -- Need ON

]]

}

NR-DL-AoD-ReportConfig-r16 ::= SEQUENCE {

maxDL-PRS-RSRP-MeasurementsPerTRP-r16 INTEGER (1..8) OPTIONAL, -- Need ON

...,

[[

maxDL-PRS-RSRP-MeasurementsPerTRP-r17 INTEGER (9..24) OPTIONAL, -- Need ON

maxDL-PRS-RSRPP-MeasurementsPerTRP-r17 INTEGER (1..24) OPTIONAL, -- Need ON

nr-los-nlos-IndicatorRequest-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType1-r17,

granularity-r17

LOS-NLOS-IndicatorGranularity1-r17,

...

} OPTIONAL, -- Need ON

reducedDL-PRS-ProcessingSamples-r17 ENUMERATED { requested, ... }

OPTIONAL, -- Need ON

lowerRxBeamSweepingFactor-FR2-r17 ENUMERATED { requested } OPTIONAL -- Need ON

]]

}

-- ASN1STOP

| *NR-DL-AoD-RequestLocationInformation* field descriptions |
| --- |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***multiMeasInSameReport***  This field, if present, indicates that the target device is requested to provide multiple measurement instances in a single measurement report; i.e., include the *nr-DL-AoD-SignalMeasurementInstances* (in the case of UE-assisted mode is requested) or *nr-DL-AoD-LocationInformationInstances* (in the case of UE-based mode is requested) in IE *NR-DL-TDOA-ProvideLocationInformation.* |
| ***maxDL-PRS-RSRP-MeasurementsPerTRP***  This field specifies the maximum number of DL-PRS RSRP measurements on different DL-PRS Resources from the same TRP. If this field with -r17 suffix is present, the field with -r16 suffix should not be present. |
| ***maxDL-PRS-RSRPP-MeasurementsPerTRP***  This field specifies the maximum number of DL-PRS RSRPP measurements on different DL-PRS Resources from the same TRP. |
| ***nr-los-nlos-IndicatorRequest***  This field, if present, indicates that the target device is requested to provide the indicated type and granularity of the estimated *LOS-NLOS-Indicator* in the *NR-DL-AoD-SignalMeasurementInformation*. |
| ***reducedDL-PRS-ProcessingSamples***  This field, if present and set to '*requested*', indicates that the target device is requested to perform the requested measurements with reduced number of samples (M=1 or M=2) as specified in TS 38.133 [46]. |
| ***lowerRxBeamSweepingFactor-FR2***  This field, if present, indicates that the target device is requested to use a lower Rx beam sweeping factor than 8 for FR2 according to UE's capability. |

#### 6.5.12.4 NR Multi-RTT Location Information Elements

#### – *NR-Multi-RTT-SignalMeasurementInformation*

The IE *NR-Multi-RTT-SignalMeasurementInformation* is used by the target device to provide NR Multi-RTT measurements to the location server.

-- ASN1START

NR-Multi-RTT-SignalMeasurementInformation-r16 ::= SEQUENCE {

nr-Multi-RTT-MeasList-r16 NR-Multi-RTT-MeasList-r16,

nr-NTA-Offset-r16 ENUMERATED { nTA1, nTA2, nTA3, nTA4, ... } OPTIONAL,

...,

[[

nr-SRS-TxTEG-Set-r17 SEQUENCE (SIZE(1..maxTxTEG-Sets-r17)) OF

NR-SRS-TxTEG-Element-r17 OPTIONAL

-- Cond Case2-3

]],

[[

nr-UE-RxTEG-TimingErrorMargin-r17 TEG-TimingErrorMargin-r17 OPTIONAL,-- Cond TEGCase3

nr-UE-TxTEG-TimingErrorMargin-r17 TEG-TimingErrorMargin-r17 OPTIONAL,-- Cond TEGCase2-3

nr-UE-RxTxTEG-TimingErrorMargin-r17 RxTxTEG-TimingErrorMargin-r17 OPTIONAL -- Cond TEGCase1-2

]]

}

NR-Multi-RTT-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-Multi-RTT-MeasElement-r16

NR-Multi-RTT-MeasElement-r16 ::= SEQUENCE {

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

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

nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

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

nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

nr-UE-RxTxTimeDiff-r16 CHOICE {

k0-r16 INTEGER (0..1970049),

k1-r16 INTEGER (0..985025),

k2-r16 INTEGER (0..492513),

k3-r16 INTEGER (0..246257),

k4-r16 INTEGER (0..123129),

k5-r16 INTEGER (0..61565),

...

},

nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-TimingQuality-r16 NR-TimingQuality-r16,

nr-DL-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,

nr-Multi-RTT-AdditionalMeasurements-r16

NR-Multi-RTT-AdditionalMeasurements-r16 OPTIONAL,

...,

[[

nr-UE-RxTx-TEG-Info-r17 NR-UE-RxTx-TEG-Info-r17 OPTIONAL,

nr-DL-PRS-FirstPathRSRP-Result-r17 INTEGER (0..126) OPTIONAL,

nr-los-nlos-Indicator-r17 CHOICE {

perTRP-r17 LOS-NLOS-Indicator-r17,

perResource-r17 LOS-NLOS-Indicator-r17

} OPTIONAL,

nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

nr-Multi-RTT-AdditionalMeasurementsExt-r17

NR-Multi-RTT-AdditionalMeasurementsExt-r17 OPTIONAL

]]

}

NR-Multi-RTT-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF

NR-Multi-RTT-AdditionalMeasurementElement-r16

NR-Multi-RTT-AdditionalMeasurementsExt-r17 ::= SEQUENCE (SIZE (1..maxAddMeasRTT-r17)) OF

NR-Multi-RTT-AdditionalMeasurementElement-r16

NR-Multi-RTT-AdditionalMeasurementElement-r16 ::= SEQUENCE {

nr-DL-PRS-ResourceID-r16 NR-DL-PRS-ResourceID-r16 OPTIONAL,

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

nr-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,

nr-UE-RxTxTimeDiffAdditional-r16 CHOICE {

k0-r16 INTEGER (0..8191),

k1-r16 INTEGER (0..4095),

k2-r16 INTEGER (0..2047),

k3-r16 INTEGER (0..1023),

k4-r16 INTEGER (0..511),

k5-r16 INTEGER (0..255),

...

},

nr-TimingQuality-r16 NR-TimingQuality-r16,

nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

nr-TimeStamp-r16 NR-TimeStamp-r16,

...,

[[

nr-UE-RxTx-TEG-Info-r17 NR-UE-RxTx-TEG-Info-r17 OPTIONAL,

nr-DL-PRS-FirstPathRSRP-ResultDiff-r17 INTEGER (0..61) OPTIONAL,

nr-los-nlos-IndicatorPerResource-r17 LOS-NLOS-Indicator-r17 OPTIONAL,

nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL

]]

}

NR-SRS-TxTEG-Element-r17 ::= SEQUENCE {

nr-TimeStamp-r17 NR-TimeStamp-r16 OPTIONAL, -- Need OP

nr-UE-Tx-TEG-ID-r17 INTEGER (0..maxNumOfTxTEGs-1-r17),

carrierFreq-r17 SEQUENCE {

absoluteFrequencyPointA-r17 ARFCN-ValueNR-r15,

offsetToPointA-r17 INTEGER (0..2199)

} OPTIONAL,

srs-PosResourceList-r17 SEQUENCE (SIZE (1..maxNumOfSRS-PosResources-r17)) OF

INTEGER (0..maxNumOfSRS-PosResources-1-r17),

...

}

NR-UE-RxTx-TEG-Info-r17 ::= CHOICE {

case1-r17 SEQUENCE {

nr-UE-RxTx-TEG-ID-r17 INTEGER (0..maxNumOfRxTxTEGs-1-r17)

},

case2-r17 SEQUENCE {

nr-UE-RxTx-TEG-ID-r17 INTEGER (0..maxNumOfRxTxTEGs-1-r17),

nr-UE-Tx-TEG-Index-r17 INTEGER (1..maxTxTEG-Sets-r17)

},

case3-r17 SEQUENCE {

nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17),

nr-UE-Tx-TEG-Index-r17 INTEGER (1..maxTxTEG-Sets-r17)

},

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *Case2-3* | The field is mandatory present if the IE *NR-UE-RxTx-TEG-Info* is provided for choice's *case2* and *case3*. Otherwise it is not present. |
| *TEGCase3* | The field is optionally present, need OP, if the IE *NR-UE-RxTx-TEG-Info* is provided for choice *case3*. Otherwise it is not present. |
| *TEGCase2-3* | The field is optionally present, need OP, if the IE *NR-UE-RxTx-TEG-Info* is provided for choice's *case2* and *case3*. Otherwise it is not present. |
| *TEGCase1-2* | The field is optionally present, need OP, if the IE *NR-UE-RxTx-TEG-Info* is provided for choice's *case1* and *case2*. Otherwise it is not present. |

| *NR-Multi-RTT-SignalMeasurementInformation* field descriptions |
| --- |
| ***nr-NTA-Offset***  This field provides the *NTAoffset* used by the target device as specified in TS 38.133 [46], Table 7.1.2-2. Enumerated values nTA1, nTA2, nTA3, and nTA4 correspond to *NTAoffset* of 25600 Tc, 0 Tc, 39936 Tc, and 13792 Tc, respectively. |
| ***nr-SRS-TxTEG-Set***  This field provides the SRS for Positioning Resources associated with a particular UE Tx TEG and comprises the following subfields:  - ***nr-TimeStamp*** specifies the start time for which the *NR-SRS-TxTEG-Element* is valid. If this field is absent, the *nr-TimeStamp* of this instance of the *NR-SRS-TxTEG-Element* of the *nr-SRS-TxTEG-Set* is the same as the *nr-TimeStamp* of the previous instance of the *NR-SRS-TxTEG-Element*. If this field is also absent in the first *NR-SRS-TxTEG-Element* of the *nr-SRS-TxTEG-Set*, all *NR-SRS-TxTEG-Element*'s provided are valid for the measurement period of the *NR-Multi-RTT-SignalMeasurementInformation.*  - ***nr-UE-Tx-TEG-ID*** specifies the ID of this UE Tx TEG.  - ***carrierFreq*** specifies the frequency of the SRS for positioning resources.  - ***srs-PosResourceList*** specifies the SRS for Positioning Resources belonging to this UE Tx TEG.  For each UE Tx TEG, there may be up to 8 changes (different *nr-TimeStamp*) of the TEG-SRS association information provided in *nr-SRS-TxTEG-Set.* |
| ***nr-UE-RxTEG-TimingErrorMargin***  This field specifies the UE Rx TEG timing error margin value for all the UE Rx TEGs within one *NR-Multi-RTT-SignalMeasurementInformation*. If the IE *NR-UE-RxTx-TEG-Info* is present with choice *case3* and this field is absent, the receiver should consider the UE Rx TEG timing error margin value to be the maximum applicable value as defined in TS 38.133 [46]. |
| ***nr-UE-TxTEG-TimingErrorMargin***  This field specifies the UE Tx TEG timing error margin value for all the UE Tx TEGs within one *NR-Multi-RTT-SignalMeasurementInformation*. If the IE *NR-UE-RxTx-TEG-Info* is present with choice *case2* or *case3* and this field is absent, the receiver should consider the UE Tx TEG timing error margin value to be the maximum value available in IE *TEG-TimingErrorMargin*. |
| ***nr-UE-RxTxTEG-TimingErrorMargin***  This field specifies the UE RxTx TEG timing error margin value for all the UE RxTx TEGs within one *NR-Multi-RTT-SignalMeasurementInformation*. If the IE *NR-UE-RxTx-TEG-Info* is present with choice *case1* or *case2* and this field is absent, the receiver should consider the UE RxTx TEG timing error margin value to be the maximum applicable value as defined in TS 38.133 [46]. |
| ***dl-PRS-ID***  This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resources ID to uniquely identify a DL-PRS Resource. This ID can be associated with multiple DL-PRS Resource Sets associated with a single TRP.  Each TRP should only be associated with one such ID. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***nr-UE-RxTxTimeDiff***  This field specifies the UE Rx–Tx time difference measurement, as defined in TS 38.215 [36]. |
| ***nr-AdditionalPathList***  This field specifies one or more additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-UE-RxTxTimeDiff* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. If this field is present, the field *nr-AdditionalPathListExt* shall be absent. |
| ***nr-TimeStamp***  This field specifies the time instance for which the measurement is performed. |
| ***nr-TimingQuality***  This field specifies the target device′s best estimate of the quality of the measurement. |
| ***nr-DL-PRS-RSRP-Result***  This field specifies the NR DL-PRS reference signal received power (DL PRS-RSRP) measurement, as defined in TS 38.215 [36]. The mapping of the quantity is defined as in TS 38.133 [46]. |
| ***nr-UE-RxTx-TEG-Info***  This field provides the ID(s) of the UE TEG associated with the *nr-UE-RxTxTimeDiff* or*nr-UE-RxTxTimeDiffAdditional* measurement. One of the following combinations of TEG IDs can be provided:  - ***case1*** provides the UE RxTx TEG ID;  - ***case2*** provides the UE RxTx TEG ID together with the UE Tx TEG ID. The *nr-UE-Tx-TEG-Index* provides the index to the *nr-SRS-TxTEG-Set* field for the applicable UE Tx TEG ID, where value '1' indicates the first *NR-SRS-TxTEG-Element* in *nr-SRS-TxTEG-Set*, value '2' indicates the second *NR-SRS-TxTEG-Element* in *nr-SRS-TxTEG-Set*, and so on;  - ***case3*** provides the UE Rx TEG ID together with the UE Tx TEG ID. The *nr-UE-Tx-TEG-Index* provides the index to the *nr-SRS-TxTEG-Set* field for the applicable UE Tx TEG ID, where value '1' indicates the first *NR-SRS-TxTEG-Element* in *nr-SRS-TxTEG-Set*, value '2' indicates the second *NR-SRS-TxTEG-Element* in *nr-SRS-TxTEG-Set*, and so on. |
| ***nr-DL-PRS-FirstPathRSRP-Result***  This field specifies the NR DL PRS reference signal received path power (DL PRS-RSRPP) of the first detected path in time, as defined in TS 38.215 [36]. The mapping of the measured quantity is defined as in TS 38.133 [46]. |
| ***nr-los-nlos-Indicator***  This field specifies the target device's best estimate of the LOS or NLOS of the UE Rx-Tx Time Difference, RSRP or RSRPP of first path measurement for the TRP or resource.  NOTE: If the requested type or granularity in *nr-los-nlos-IndicatorRequest* is not possible, the target device may provide a different type and granularity for the estimated *LOS-NLOS-Indicator.* |
| ***nr-AdditionalPathListExt***  This field provides up to 8 additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-UE-RxTxTimeDiff* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. If this field is present, the field *nr-AdditionalPathList* shall be absent. |
| ***nr-Multi-RTT-AdditionalMeasurementsExt***  This field, in addition to the measurements provided in *NR-Multi-RTT-MeasElement*, provides UE Rx-Tx time difference measurements of up to 4 DL-PRS Resources of a TRP with different UE RxTx or UE Rx TEGs. For a certain DL-PRS Resource, there can be up to 8 measurement results with respect to different UE RxTx or UE Rx TEGs. If this field is present, the field *nr-Multi-RTT-AdditionalMeasurements* should not be present. |
| ***nr-DL-PRS-RSRP-ResultDiff***  This field provides the additional DL-PRS RSRP measurement result relative to *nr-DL-PRS-RSRP-Result.* The DL-PRS RSRP value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-RSRP-Result*. The mapping of this field is defined as in TS 38.133 [46]. |
| ***nr-UE-RxTxTimeDiffAdditional***  This field provides the additional UE Rx-Tx Difference measurement result relative to *nr-UE-RxTxTimeDiff.* The UE Rx-Tx Difference value of this measurement is obtained by adding the value of this field to the value of the *nr-UE-RxTxTimeDiff* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-DL-PRS-FirstPathRSRP-ResultDiff***  This field specifies the additional NR DL-PRS reference signal received path power (DL PRS-RSRPP) of the first detected path in time relative to *nr-DL-PRS-FirstPathRSRP-Result*. The DL-PRS RSRPP of first path value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-FirstPathRSRP-Result* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-los-nlos-IndicatorPerResource***  This field specifies the target device's best estimate of the LOS or NLOS of the UE Rx-Tx Time Difference, RSRP or RSRPP of first path measurement for the resource.  This field may only be present if the field *nr-LOS-NLOS-Indicator* choice indicates *perResource*. |

#### 6.5.12.5 NR Multi-RTT Location Information Request

#### – *NR-Multi-RTT-RequestLocationInformation*

The IE *NR-Multi-RTT-RequestLocationInformation* is used by the location server to request NR Multi-RTT location measurements from a target device.

-- ASN1START

NR-Multi-RTT-RequestLocationInformation-r16 ::= SEQUENCE {

nr-UE-RxTxTimeDiffMeasurementInfoRequest-r16

ENUMERATED { true } OPTIONAL, -- Need ON

nr-RequestedMeasurements-r16 BIT STRING { prsrsrpReq (0),

firstPathRsrpReq-r17 (1) } (SIZE(1..8)),

nr-AssistanceAvailability-r16 BOOLEAN,

nr-Multi-RTT-ReportConfig-r16 NR-Multi-RTT-ReportConfig-r16,

additionalPaths-r16 ENUMERATED { requested } OPTIONAL, -- Need ON

...,

[[

nr-UE-RxTxTEG-Request-r17 ENUMERATED { case1, case2, case3, ... }

OPTIONAL, -- Need ON

measureSameDL-PRS-ResourceWithDifferentRxTxTEGs-r17

ENUMERATED { n0, n2, n3, n4, n6, n8, ... }

OPTIONAL, -- Need ON

measureSameDL-PRS-ResourceWithDifferentRxTEGs-r17

ENUMERATED { n0, n2, n3, n4, n6, n8, ... }

OPTIONAL, -- Need ON

reducedDL-PRS-ProcessingSamples-r17

ENUMERATED { requested, ... } OPTIONAL, -- Need ON

nr-los-nlos-IndicatorRequest-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType1-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity1-r17,

...

} OPTIONAL, -- Need ON

additionalPathsExt-r17 ENUMERATED { requested } OPTIONAL, -- Need ON

additionalPathsDL-PRS-RSRP-Request-r17

ENUMERATED { requested } OPTIONAL, -- Need ON

multiMeasInSameReport-r17 ENUMERATED { requested } OPTIONAL, -- Need ON

lowerRxBeamSweepingFactor-FR2-r17 ENUMERATED { requested } OPTIONAL -- Need ON

]]

}

NR-Multi-RTT-ReportConfig-r16 ::= SEQUENCE {

maxDL-PRS-RxTxTimeDiffMeasPerTRP-r16 INTEGER (1..4) OPTIONAL, -- Need ON

timingReportingGranularityFactor-r16 INTEGER (0..5) OPTIONAL -- Need ON

}

-- ASN1STOP

| *NR-Multi-RTT-RequestLocationInformation* field descriptions |
| --- |
| ***nr-UE-RxTxTimeDiffMeasurementInfoRequest***  This field, if present, indicates that the target device is requested to report the DL-PRS Resource ID(s) or DL-PRS Resource Set ID(s) associated with the DL-PRS Resources(s) or the DL-PRS Resource Set(s) which are used in determining the UE Rx-Tx time difference measurements. |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***maxDL-PRS-RxTxTimeDiffMeasPerTRP***  This field specifies the maximum number of UE-Rx-Tx time difference measurements for different DL-PRS Resources or DL-PRS Resource Sets per TRP. |
| ***timingReportingGranularityFactor***  This field specifies the recommended reporting granularity for the UE Rx-Tx time difference measurements. Value (0..5) corresponds to (*k0*..*k5*) used for *nr-UE-RxTxTimeDiff* and *nr-UE-RxTxTimeDiffAdditional* in *NR-Multi-RTT-MeasElement*. The UE may select a different granularity value for *nr-UE-RxTxTimeDiff* and *nr-UE-RxTxTimeDiffAdditional*. |
| ***additionalPaths***  This field, if present, indicates that the target device is requested to provide the *nr-AdditionalPathList* in IE *NR-Multi-RTT-SignalMeasurementInformation*. If this field is present, the field *additionalPathsExt* shall be absent. |
| ***nr-UE-RxTxTEG-Request***  This field, if present, indicates that the target device is requested to provide the *NR-UE-RxTx-TEG-Info* in IE *NR-Multi-RTT-SignalMeasurementInformation.* Enumerated value '*case1*' indicates that the target device is requested to provide the *case1* choice in *NR-UE-RxTx-TEG-Info*, enumerated value '*case2*' indicates that the target device is requested to provide the *case2* choice in *NR-UE-RxTx-TEG-Info*, and so on. |
| ***measureSameDL-PRS-ResourceWithDifferentRxTxTEGs***  This field, if present, indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with *N* different UE RxTx TEGs and with the same UE Tx TEG. Enumerated value '*n0*' indicates that the number *N* of different UE RxTx TEGs to measure the same DL PRS Resource can be determined by the target device, value '*n2*' indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with 2 different UE RxTx TEGs, value '*n3*' indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with 3 different UE RxTx TEGs, and so on.  If this field is present, the field *nr-UE-RxTxTEG-Request* should also be present.  If this field is present, the field *measureSameDL-PRS-ResourceWithDifferentRxTEGs* should not be present. |
| ***measureSameDL-PRS-ResourceWithDifferentRxTEGs***  This field, if present, indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with *N* different UE Rx TEGs. Enumerated value '*n0*' indicates that the number *N* of different UE Rx TEGs to measure the same DL PRS Resource can be determined by the target device, value '*n2*' indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with 2 different UE Rx TEGs, value '*n3*' indicates that the target device is requested to measure the same DL-PRS Resource of a TRP with 3 different UE Rx TEGs, and so on.  If this field is present, the field *nr-UE-RxTxTEG-Request* should also be present.  If this field is present, the field *measureSameDL-PRS-ResourceWithDifferentRxTxTEGs* should not be present. |
| ***reducedDL-PRS-ProcessingSamples***  This field, if present and set to '*requested*', indicates that the target device is requested to perform the requested measurements with reduced number of samples (M=1 or M=2) as specified in TS 38.133 [46]. |
| ***nr-los-nlos-IndicatorRequest***  This field, if present, indicates that the target device is requested to provide the indicated type and granularity of the estimated *LOS-NLOS-Indicator* in the *NR-Multi-RTT-SignalMeasurementInformation*. |
| ***additionalPathsExt***  This field, if present, indicates that the target device is requested to provide the *nr-AdditionalPathListExt* in IE *NR-Multi-RTT-SignalMeasurementInformation*. If this field is present, the field *additionalPaths* shall be absent. |
| ***additionalPathsDL-PRS-RSRP-Request***  This field, if present, indicates that the target device is requested to provide the *nr-DL-PRS-RSRP* for the additional paths in IE *NR-AdditionalPathList*. |
| ***multiMeasInSameReport***  This field, if present, indicates that the target device is requested to provide multiple measurement instances in a single measurement report; i.e., include the *nr-Multi-RTT-SignalMeasurementInstances* in IE *NR-Multi-RTT-ProvideLocationInformation.* |
| ***lowerRxBeamSweepingFactor-FR2***  This field, if present, indicates that the target device is requested to use a lower Rx beam sweeping factor than 8 for FR2 according to UE's capability. |