**3GPP TSG-RAN WG2 Meeting #121bis-e *R2-23xxxxx***

**Online, April 17 – 26, 2023**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.355** | **CR** | **draft** | **rev** | **-** | **Current version:** | **17.4.0** |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network | **x** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Support of Local Cartesian Coordinates in LPP | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Incorporated | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | TEI18 | | | | |  | ***Date:*** | | | 2023-04-06 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | C |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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:*** | | The geographical coordinates of a TRP may be provided to an LMF in global coordinates (WGS84) or in local Cartesian coordinates as defined in TS 38.455. However, LPP currently supports global coordinates for the TRP locations and UE location estimates only. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Local coordinates are introduced according to TS 23.032. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Location coordinates can only be provided in global coordinates (WGS84). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.4.1, 6.4.2, 6.4.3, 6.5.10.6, 6.5.11.6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 Common IEs

Common IEs comprise IEs that are applicable to more than one LPP positioning method.

### 6.4.1 Common Lower-Level IEs

#### – *AccessTypes*

The IE *AccessTypes* is used to indicate several cellular access types using a bit map.

-- ASN1START

AccessTypes ::= SEQUENCE {

accessTypes BIT STRING { eutra (0),

utra (1),

gsm (2),

nb-iot (3),

nr-v1510 (4) } (SIZE (1..8)),

...

}

-- ASN1STOP

| *AccessTypes* field descriptions |
| --- |
| ***accessTypes***  This field specifies the cellular access type(s). This is represented by a bit string, with a one‑value at the bit position means the particular access type is addressed; a zero‑value means not addressed. |

#### *–* *ARFCN-ValueEUTRA*

The IEs *ARFCN-ValueEUTRA* and *ARFCN-ValueEUTRA-v9a0* are used to indicate the ARFCN of the E-UTRA carrier frequency, as defined in TS 36.331 [12].

-- ASN1START

ARFCN-ValueEUTRA ::= INTEGER (0..maxEARFCN)

ARFCN-ValueEUTRA-v9a0 ::= INTEGER (maxEARFCN-Plus1..maxEARFCN2)

ARFCN-ValueEUTRA-r14 ::= INTEGER (0..maxEARFCN2)

-- ASN1STOP

NOTE: For fields using the original value range, as defined by IE *ARFCN-ValueEUTRA* i.e. without suffix, value *maxEARFCN* indicates that the E-UTRA carrier frequency is indicated by means of an extension.

#### – *ARFCN-ValueNR*

The IE *ARFCN-ValueNR* is used to indicate the ARFCN applicable for a downlink, uplink or bi-directional (TDD) NR global frequency raster, as defined in TS 38.101-2 [34] and TS 38.101-1 [37].

-- ASN1START

ARFCN-ValueNR-r15 ::= INTEGER (0..3279165)

-- ASN1STOP

#### *– ARFCN-ValueUTRA*

The IE *ARFCN-ValueUTRA* is used to indicate the ARFCN of the UTRA carrier frequency, as defined in TS 25.331 [13].

-- ASN1START

ARFCN-ValueUTRA ::= INTEGER (0..16383)

-- ASN1STOP

#### – *CarrierFreq-NB*

The IE *CarrierFreq-NB* is used to provide the NB-IoT carrier frequency, as defined in TS 36.101 [21].

-- ASN1START

CarrierFreq-NB-r14 ::= SEQUENCE {

carrierFreq-r14 ARFCN-ValueEUTRA-r14,

carrierFreqOffset-r14 CarrierFreqOffsetNB-r14 OPTIONAL,

...

}

-- ASN1STOP

| *CarrierFreq-NB* field descriptions |
| --- |
| ***carrierFreq***  This field specifies the ARFCN applicable for the NB-IoT carrier frequency as defined in TS 36.101 [21, Table 5.7.3-1]. |
| ***carrierFreqOffset***  This field specifies the offset of the NB-IoT channel number to EARFCN as defined in TS 36.101 [21]. |

– *CarrierFreqOffsetNB*

The IE *CarrierFreqOffsetNB* is used to provide the offset of the NB-IoT channel number to EARFCN of a NB-IoT carrier.

-- ASN1START

CarrierFreqOffsetNB-r14 ::= ENUMERATED {

v-10, v-9, v-8, v-7, v-6, v-5, v-4, v-3, v-2, v-1, v-0dot5,

v0, v1, v2, v3, v4, v5, v6, v7, v8, v9

}

-- ASN1STOP

| *CarrierFreqOffsetNB field descriptions* |
| --- |
| ***CarrierFreqOffsetNB***  This field specifies the offset of the NB-IoT channel number to EARFCN as defined in TS 36.101 [21]. Value v-10 means -10, v-9 means -9, and so on. |

#### *– CellGlobalIdEUTRA-AndUTRA*

The IE *CellGlobalIdEUTRA-AndUTRA* specifies the global Cell Identifier for E‑UTRA or UTRA, the globally unique identity of a cell in E‑UTRA or UTRA.

-- ASN1START

CellGlobalIdEUTRA-AndUTRA ::= SEQUENCE {

plmn-Identity SEQUENCE {

mcc SEQUENCE (SIZE (3)) OF INTEGER (0..9),

mnc SEQUENCE (SIZE (2..3)) OF INTEGER (0..9)

},

cellIdentity CHOICE {

eutra BIT STRING (SIZE (28)),

utra BIT STRING (SIZE (32))

},

...

}

-- ASN1STOP

| ***CellGlobalIdEUTRA-AndUTRA* field descriptions** |
| --- |
| ***plmn-Identity***  This field identifies the PLMN of the cell as defined in TS 36.331 [12]. |
| ***cellIdentity***  This field defines the identity of the cell within the context of the PLMN as defined in TS 36.331 [12] and TS 25.331 [13]. The size of the bit string allows for the 32-bit extended UTRAN cell ID; in the case the cell ID is shorter, the first bits of the string are set to 0. |

#### *– CellGlobalIdGERAN*

The IE *CellGlobalIdGERAN* specifies the global Cell Identifier for GERAN, the globally unique identity of a cell in GERAN.

-- ASN1START

CellGlobalIdGERAN ::= SEQUENCE {

plmn-Identity SEQUENCE {

mcc SEQUENCE (SIZE (3)) OF INTEGER (0..9),

mnc SEQUENCE (SIZE (2..3)) OF INTEGER (0..9)

},

locationAreaCode BIT STRING (SIZE (16)),

cellIdentity BIT STRING (SIZE (16)),

...

}

-- ASN1STOP

| ***CellGlobalIdGERAN* field descriptions** |
| --- |
| ***plmn-Identity***  This field identifies the PLMN of the cell. |
| ***locationAreaCode***  This field is a fixed length code identifying the location area within a PLMN. |
| ***cellIdentity***  This field specifies the cell Identifier which is unique within the context of the GERAN location area. |

#### *– ECGI*

The IE *ECGI* specifies the Evolved Cell Global Identifier (ECGI), the globally unique identity of a cell in E-UTRA (TS 36.331 [12]).

NOTE: The IE *ECGI* is also used for NB-IoT access.

-- ASN1START

ECGI ::= SEQUENCE {

mcc SEQUENCE (SIZE (3)) OF INTEGER (0..9),

mnc SEQUENCE (SIZE (2..3)) OF INTEGER (0..9),

cellidentity BIT STRING (SIZE (28))

}

-- ASN1STOP

#### *– Ellipsoid-Point*

The IE *Ellipsoid-Point* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

Ellipsoid-Point ::= SEQUENCE {

latitudeSign ENUMERATED {north, south},

degreesLatitude INTEGER (0..8388607), -- 23 bit field

degreesLongitude INTEGER (-8388608..8388607) -- 24 bit field

}

-- ASN1STOP

#### *– Ellipsoid-PointWithUncertaintyCircle*

The IE *Ellipsoid-PointWithUncertaintyCircle* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

Ellipsoid-PointWithUncertaintyCircle ::= SEQUENCE {

latitudeSign ENUMERATED {north, south},

degreesLatitude INTEGER (0..8388607), -- 23 bit field

degreesLongitude INTEGER (-8388608..8388607), -- 24 bit field

uncertainty INTEGER (0..127)

}

-- ASN1STOP

#### *– EllipsoidPointWithUncertaintyEllipse*

The IE *EllipsoidPointWithUncertaintyEllipse* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

EllipsoidPointWithUncertaintyEllipse ::= SEQUENCE {

latitudeSign ENUMERATED {north, south},

degreesLatitude INTEGER (0..8388607), -- 23 bit field

degreesLongitude INTEGER (-8388608..8388607), -- 24 bit field

uncertaintySemiMajor INTEGER (0..127),

uncertaintySemiMinor INTEGER (0..127),

orientationMajorAxis INTEGER (0..179),

confidence INTEGER (0..100)

}

-- ASN1STOP

#### *– EllipsoidPointWithAltitude*

The IE *EllipsoidPointWithAltitude* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

EllipsoidPointWithAltitude ::= SEQUENCE {

latitudeSign ENUMERATED {north, south},

degreesLatitude INTEGER (0..8388607), -- 23 bit field

degreesLongitude INTEGER (-8388608..8388607), -- 24 bit field

altitudeDirection ENUMERATED {height, depth},

altitude INTEGER (0..32767) -- 15 bit field

}

-- ASN1STOP

#### *– EllipsoidPointWithAltitudeAndUncertaintyEllipsoid*

The IE *EllipsoidPointWithAltitudeAndUncertaintyEllipsoid* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

EllipsoidPointWithAltitudeAndUncertaintyEllipsoid ::= SEQUENCE {

latitudeSign ENUMERATED {north, south},

degreesLatitude INTEGER (0..8388607), -- 23 bit field

degreesLongitude INTEGER (-8388608..8388607), -- 24 bit field

altitudeDirection ENUMERATED {height, depth},

altitude INTEGER (0..32767), -- 15 bit field

uncertaintySemiMajor INTEGER (0..127),

uncertaintySemiMinor INTEGER (0..127),

orientationMajorAxis INTEGER (0..179),

uncertaintyAltitude INTEGER (0..127),

confidence INTEGER (0..100)

}

-- ASN1STOP

#### *– EllipsoidArc*

The IE *EllipsoidArc* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

EllipsoidArc ::= SEQUENCE {

latitudeSign ENUMERATED {north, south},

degreesLatitude INTEGER (0..8388607), -- 23 bit field

degreesLongitude INTEGER (-8388608..8388607), -- 24 bit field

innerRadius INTEGER (0..65535), -- 16 bit field,

uncertaintyRadius INTEGER (0..127),

offsetAngle INTEGER (0..179),

includedAngle INTEGER (0..179),

confidence INTEGER (0..100)

}

-- ASN1STOP

#### *– EPDU-Sequence*

The *EPDU-Sequence* contains IEs that are defined externally to LPP by other organizations.

-- ASN1START

EPDU-Sequence ::= SEQUENCE (SIZE (1..maxEPDU)) OF EPDU

maxEPDU INTEGER ::= 16

EPDU ::= SEQUENCE {

ePDU-Identifier EPDU-Identifier,

ePDU-Body EPDU-Body

}

EPDU-Identifier ::= SEQUENCE {

ePDU-ID EPDU-ID,

ePDU-Name EPDU-Name OPTIONAL,

...

}

EPDU-ID ::= INTEGER (1..256)

EPDU-Name ::= VisibleString (SIZE (1..32))

EPDU-Body ::= OCTET STRING

-- ASN1STOP

| ***EPDU-Sequence* field descriptions** |
| --- |
| ***EPDU-ID***  This field provides a unique integer ID for the externally defined positioning method. Its value is assigned to the external entity that defines the EPDU. See table External PDU Identifier Definition for a list of external PDU identifiers defined in this version of the specification. |
| ***EPDU-Name***  This field provides an optional character encoding which can be used to provide a quasi-unique name for an external PDU – e.g., by containing the name of the defining organization and/or the name of the associated public or proprietary standard for the EPDU. |
| ***EPDU-Body***  The content and encoding of this field are defined externally to LPP. |

External PDU Identifier Definition

|  |  |  |  |
| --- | --- | --- | --- |
| EPDU-ID | EPDU Defining entity | Method name | Reference |
| 1 | OMA LOC | OMA LPP extensions (LPPe) | OMA-TS-LPPe-V1\_0 [20] |

#### *– FreqBandIndicatorNR*

The IE *FreqBandIndicatorNR* specifies the NR band indicator (TS 38.331 [35]).

-- ASN1START

FreqBandIndicatorNR-r16 ::= INTEGER (1..1024)

-- ASN1STOP

#### – *HA-EllipsoidPointWithAltitudeAndScalableUncertaintyEllipsoid*

The IE *HA-EllipsoidPointWithAltitudeAndScalableUncertaintyEllipsoid* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

HA-EllipsoidPointWithAltitudeAndScalableUncertaintyEllipsoid-r16 ::= SEQUENCE {

degreesLatitude-r16 INTEGER(-2147483648..2147483647),

degreesLongitude-r16 INTEGER(-2147483648..2147483647),

altitude-r16 INTEGER(-64000..1280000),

uncertaintySemiMajor-r16 INTEGER (0..255),

uncertaintySemiMinor-r16 INTEGER (0..255),

orientationMajorAxis-r16 INTEGER (0..179),

horizontalConfidence-r16 INTEGER (0..100),

uncertaintyAltitude-r16 INTEGER (0..255),

verticalConfidence-r16 INTEGER (0..100),

ha-HorizontalExtendedRangeUsed-r16 BOOLEAN,

ha-VerticalExtendedRangeUsed-r16 BOOLEAN

}

-- ASN1STOP

#### – *HA-EllipsoidPointWithScalableUncertaintyEllipse*

The IE *HA-EllipsoidPointWithScalableUncertaintyEllipse* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

HA-EllipsoidPointWithScalableUncertaintyEllipse-r16 ::= SEQUENCE {

degreesLatitude-r16 INTEGER(-2147483648..2147483647),

degreesLongitude-r16 INTEGER(-2147483648..2147483647),

uncertaintySemiMajor-r16 INTEGER (0..255),

uncertaintySemiMinor-r16 INTEGER (0..255),

orientationMajorAxis-r16 INTEGER (0..179),

confidence-r16 INTEGER (0..100),

ha-ExtendedUncertaintyRangeUsed-r16 BOOLEAN

}

-- ASN1STOP

#### *– HighAccuracyEllipsoidPointWithUncertaintyEllipse*

The IE *HighAccuracyEllipsoidPointWithUncertaintyEllipse* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

HighAccuracyEllipsoidPointWithUncertaintyEllipse-r15 ::= SEQUENCE {

degreesLatitude-r15 INTEGER(-2147483648..2147483647),

degreesLongitude-r15 INTEGER(-2147483648..2147483647),

uncertaintySemiMajor-r15 INTEGER (0..255),

uncertaintySemiMinor-r15 INTEGER (0..255),

orientationMajorAxis-r15 INTEGER (0..179),

confidence-r15 INTEGER (0..100)

}

-- ASN1STOP

#### *– HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid*

The IE *HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15 ::= SEQUENCE {

degreesLatitude-r15 INTEGER(-2147483648..2147483647),

degreesLongitude-r15 INTEGER(-2147483648..2147483647),

altitude-r15 INTEGER(-64000..1280000),

uncertaintySemiMajor-r15 INTEGER (0..255),

uncertaintySemiMinor-r15 INTEGER (0..255),

orientationMajorAxis-r15 INTEGER (0..179),

horizontalConfidence-r15 INTEGER (0..100),

uncertaintyAltitude-r15 INTEGER (0..255),

verticalConfidence-r15 INTEGER (0..100)

}

-- ASN1STOP

#### *– HorizontalVelocity*

The IE *HorizontalVelocity* is used to describe a velocity shape as defined in TS 23.032 [15].

-- ASN1START

HorizontalVelocity ::= SEQUENCE {

bearing INTEGER(0..359),

horizontalSpeed INTEGER(0..2047)

}

-- ASN1STOP

#### *– HorizontalWithVerticalVelocity*

The IE *HorizontalWithVerticalVelocity* is used to describe a velocity shape as defined in TS 23.032 [15].

-- ASN1START

HorizontalWithVerticalVelocity ::= SEQUENCE {

bearing INTEGER(0..359),

horizontalSpeed INTEGER(0..2047),

verticalDirection ENUMERATED{upward, downward},

verticalSpeed INTEGER(0..255)

}

-- ASN1STOP

#### *– HorizontalVelocityWithUncertainty*

The IE *HorizontalVelocityWithUncertainty* is used to describe a velocity shape as defined in TS 23.032 [15].

-- ASN1START

HorizontalVelocityWithUncertainty ::= SEQUENCE {

bearing INTEGER(0..359),

horizontalSpeed INTEGER(0..2047),

uncertaintySpeed INTEGER(0..255)

}

-- ASN1STOP

#### *– HorizontalWithVerticalVelocityAndUncertainty*

The IE *HorizontalWithVerticalVelocityAndUncertainty* is used to describe a velocity shape as defined in TS 23.032 [15].

-- ASN1START

HorizontalWithVerticalVelocityAndUncertainty ::= SEQUENCE {

bearing INTEGER(0..359),

horizontalSpeed INTEGER(0..2047),

verticalDirection ENUMERATED{upward, downward},

verticalSpeed INTEGER(0..255),

horizontalUncertaintySpeed INTEGER(0..255),

verticalUncertaintySpeed INTEGER(0..255)

}

-- ASN1STOP

#### *– Local2dPointWithUncertaintyEllipse*

The IE *Local2dPointWithUncertaintyEllipse* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

Local2dPointWithUncertaintyEllipse-r18 ::= SEQUENCE {

localOrigin-r18 ReferencePoint-r16,

cartesianCoordinatesUnits-r18 ENUMERATED { mm, cm, dm, m, ...},

x-value-r18 X-Value-r18,

y-value-r18 Y-Value-r18,

uncertaintySemiMajor-r18 INTEGER (0..127),

uncertaintySemiMinor-r18 INTEGER (0..127),

orientationMajorAxis-r18 INTEGER (0..179),

confidence-r18 INTEGER (0..100)

}

-- ASN1STOP

| ***Local2dPointWithUncertaintyEllipse* field descriptions** |
| --- |
| ***localOrigin***  This field identifies the reference point of the local Cartesian coordinate system. |
| ***cartesianCoordinatesUnits***  This field provides the unit and scale factor for the *x-value* and *y-value* fields. Enumerated values *mm*, *cm*, *dm*, and *m*, correspond to 10-3 metre, 10-2 metre, 10-1 metre and 1 metres, respectively. |
| ***x-value***  This field provides the x-value of the location in the Cartesian coordinate system. Positive value represents easting from reference point (origin) [15]. See IE *RelativeCartesianLocation.* |
| ***y-value***  This field provides the y-value of the location in the Cartesian coordinate system. Positive value represents northing from reference point (origin) [15]. See IE *RelativeCartesianLocation.* |
| ***uncertaintySemiMajor***  This field indicates the semi-major axis of the uncertainty ellipse [15]. |
| ***uncertaintySemiMinor***  This field indicates the semi-minor axis of the uncertainty ellipse [15]. |
| ***orientationMajorAxis***  This field indicates the orientation angle of the major axis [15]. |
| ***confidence***  This field indicates the confidence value [15]. |

#### *– Local3dPointWithUncertaintyEllipsoid*

The IE *Local3dPointWithUncertaintyEllipsoid* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

Local3dPointWithUncertaintyEllipsoid-r18 ::= SEQUENCE {

localOrigin-r18 ReferencePoint-r16,

cartesianCoordinatesUnits-r18 ENUMERATED { mm, cm, dm, m, ...},

x-value-r18 X-Value-r18,

y-value-r18 Y-Value-r18,

z-value-r18 Z-Value-r18,

uncertaintySemiMajor-r18 INTEGER (0..127),

uncertaintySemiMinor-r18 INTEGER (0..127),

orientationMajorAxis-r18 INTEGER (0..179),

uncertaintyAltitude-r18 INTEGER (0..127),

confidence-r18 INTEGER (0..100)

}

-- ASN1STOP

| ***Local3dPointWithUncertaintyEllipsoid* field descriptions** |
| --- |
| ***localOrigin***  This field identifies the reference point of the local Cartesian coordinate system. |
| ***cartesianCoordinatesUnits***  This field provides the unit and scale factor for the *x-value, y-value* and *z-value* fields. Enumerated values *mm*, *cm*, *dm*, and *m*, correspond to 10-3 metre, 10-2 metre, 10-1 metre and 1 metres, respectively. |
| ***x-value***  This field provides the x-value of the location in the Cartesian coordinate system. Positive value represents easting from reference point (origin) [15]. See IE *RelativeCartesianLocation.* |
| ***y-value***  This field provides the y-value of the location in the Cartesian coordinate system. Positive value represents northing from reference point (origin) [15]. See IE *RelativeCartesianLocation.* |
| ***z-value***  This field provides the z-value of the location in the Cartesian coordinate system. Positive value represents height above reference point (origin) [15]. See IE *RelativeCartesianLocation.* |
| ***uncertaintySemiMajor***  This field indicates the semi-major axis of the uncertainty ellipsoid [15]. |
| ***uncertaintySemiMinor***  This field indicates the semi-minor axis of the uncertainty ellipsoid [15]. |
| ***orientationMajorAxis***  This field indicates the orientation angle of the major axis [15]. |
| ***uncertaintyAltitude***  This field indicates the vertical axis of the uncertainty ellipsoid [15]. |
| ***confidence***  This field indicates the confidence value [15]. |

#### *– LocationCoordinateTypes*

The IE *LocationCoordinateTypes* defines a list of possible geographic shapes as defined in TS 23.032 [15].

-- ASN1START

LocationCoordinateTypes ::= SEQUENCE {

ellipsoidPoint BOOLEAN,

ellipsoidPointWithUncertaintyCircle BOOLEAN,

ellipsoidPointWithUncertaintyEllipse BOOLEAN,

polygon BOOLEAN,

ellipsoidPointWithAltitude BOOLEAN,

ellipsoidPointWithAltitudeAndUncertaintyEllipsoid BOOLEAN,

ellipsoidArc BOOLEAN,

...,

[[

highAccuracyEllipsoidPointWithUncertaintyEllipse-r15

BOOLEAN OPTIONAL, -- Need ON

highAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15

BOOLEAN OPTIONAL -- Need ON

]],

[[

ha-EllipsoidPointWithScalableUncertaintyEllipse-r16

BOOLEAN OPTIONAL, -- Need ON

ha-EllipsoidPointWithAltitudeAndScalableUncertaintyEllipsoid-r16

BOOLEAN OPTIONAL -- Need ON

]],

[[

local2dPointWithUncertaintyEllipse-r18 BOOLEAN OPTIONAL, -- Need ON

local3dPointWithUncertaintyEllipsoid-r18 BOOLEAN OPTIONAL -- Need ON

]]

}

-- ASN1STOP

NOTE: In this version of the specification, the GAD shapes *local2dPointWithUncertaintyEllipse* and *local3dPointWithUncertaintyEllipsoid* are supported for DL-TDOA and DL-AoD only.

#### *– NCGI*

The IE *NCGI* specifies the NR Cell Global Identifier (NCGI) which is used to identify NR cells globally (TS 38.331 [35]).

-- ASN1START

NCGI-r15 ::= SEQUENCE {

mcc-r15 SEQUENCE (SIZE (3)) OF INTEGER (0..9),

mnc-r15 SEQUENCE (SIZE (2..3)) OF INTEGER (0..9),

nr-cellidentity-r15 BIT STRING (SIZE (36))

}

-- ASN1STOP

#### *– NR-PhysCellId*

The IE *NR-PhysCellId* specifies the NR physical cell identifier (TS 38.331 [35]).

-- ASN1START

NR-PhysCellID-r16 ::= INTEGER (0..1007)

-- ASN1STOP

#### *– PeriodicAssistanceDataControlParameters*

The IE *PeriodicAssistanceDataControlParameters* is used in a periodic assistance data delivery procedure as described in clauses 5.2.1a and 5.2.2a.

-- ASN1START

PeriodicAssistanceDataControlParameters-r15 ::= SEQUENCE {

periodicSessionID-r15 PeriodicSessionID-r15,

...,

[[

updateCapabilities-r15 UpdateCapabilities-r15 OPTIONAL -- Need ON

]]

}

PeriodicSessionID-r15 ::= SEQUENCE {

periodicSessionInitiator-r15 ENUMERATED { locationServer, targetDevice, ... },

periodicSessionNumber-r15 INTEGER (0..255),

...

}

UpdateCapabilities-r15 ::= BIT STRING {primaryCellID-r15 (0)} (SIZE(1..8))

-- ASN1STOP

| *PeriodicAssistanceDataControlParameters* field descriptions |
| --- |
| ***periodicSessionID***  This field identifies a particular periodic assistance data delivery session and the initiator of the session. |
| ***updateCapabilities***  This field identifies the capabilities of the sending entity to support an update of periodic assistance data. A bit value set to one indicates a capability is supported and a bit value set to zero indicates a capability is not supported. |

#### *– Polygon*

The IE *Polygon* is used to describe a geographic shape as defined in TS 23.032 [15].

-- ASN1START

Polygon ::= SEQUENCE (SIZE (3..15)) OF PolygonPoints

PolygonPoints ::= SEQUENCE {

latitudeSign ENUMERATED {north, south},

degreesLatitude INTEGER (0..8388607), -- 23 bit field

degreesLongitude INTEGER (-8388608..8388607) -- 24 bit field

}

-- ASN1STOP

#### *– PositioningModes*

The IE *PositioningModes* is used to indicate several positioning modes using a bit map.

-- ASN1START

PositioningModes ::= SEQUENCE {

posModes BIT STRING { standalone (0),

ue-based (1),

ue-assisted (2)

} (SIZE (1..8)),

...

}

-- ASN1STOP

| *PositioningModes* field descriptions |
| --- |
| ***posModes***  This field specifies the positioning mode(s). This is represented by a bit string, with a one‑value at the bit position means the particular positioning mode is addressed; a zero‑value means not addressed. |

#### *– ScheduledLocationTimeSupport*

The IE *ScheduledLocationTimeSupport* is used by the target device to indicate the time bases supported for scheduled location requests.

-- ASN1START

ScheduledLocationTimeSupport-r17 ::= SEQUENCE {

utcTime-r17 ENUMERATED { supported } OPTIONAL,

gnssTime-r17 GNSS-ID-Bitmap OPTIONAL,

e-utraTime-r17 ENUMERATED { supported } OPTIONAL,

nrTime-r17 ENUMERATED { supported } OPTIONAL,

relativeTime-r17 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

#### *– ScheduledLocationTimeSupportPerMode*

The IE *ScheduledLocationTimeSupportPerMode* is used by the target device to indicate the time bases supported for scheduled location requests for each positioning mode indicated by *PositioningModes*.

-- ASN1START

ScheduledLocationTimeSupportPerMode-r17 ::= SEQUENCE {

utcTime-r17 PositioningModes OPTIONAL,

gnssTime-r17 SEQUENCE {

posModes-r17 PositioningModes,

gnss-TimeIDs-r17 GNSS-ID-Bitmap

} OPTIONAL,

e-utraTime-r17 PositioningModes OPTIONAL,

nrTime-r17 PositioningModes OPTIONAL,

relativeTime-r17 PositioningModes OPTIONAL,

...

}

-- ASN1STOP

#### – *SegmentationInfo*

The IE *SegmentationInfo* is used by a sender to indicate that LPP message segmentation is used, as specified in clause 4.3.5.

-- ASN1START

SegmentationInfo-r14 ::= ENUMERATED { noMoreMessages, moreMessagesOnTheWay }

-- ASN1STOP

| *SegmentationInfo* field descriptions |
| --- |
| ***SegmentationInfo***  *noMoreMessages* indicates that this is the only or last LPP message segment used to deliver the entire message body.  *moreMessagesOnTheWay* indicates that this is one of multiple LPP messagesegments used to deliver the entire message body. |

#### *– VelocityTypes*

The IE *VelocityTypes* defines a list of possible velocity shapes as defined in TS 23.032 [15].

-- ASN1START

VelocityTypes ::= SEQUENCE {

horizontalVelocity BOOLEAN,

horizontalWithVerticalVelocity BOOLEAN,

horizontalVelocityWithUncertainty BOOLEAN,

horizontalWithVerticalVelocityAndUncertainty BOOLEAN,

...

}

-- ASN1STOP

### 6.4.2 Common Positioning

#### – *CommonIEsRequestCapabilities*

The *CommonIEsRequestCapabilities* carries common IEs for a Request Capabilities LPP message Type.

-- ASN1START

CommonIEsRequestCapabilities ::= SEQUENCE {

...,

[[

lpp-message-segmentation-req-r14 BIT STRING { serverToTarget (0),

targetToServer (1) } OPTIONAL -- Need ON

]]

}

-- ASN1STOP

| *CommonIEsRequestCapabilities* field descriptions |
| --- |
| ***lpp-message-segmentation-req***  This field, if present, indicates that the target device is requested to provide its LPP message segmentation capabilities.  If bit 0 is set to value 1, it indicates that the server is able to send segmented LPP messages to the target device; if bit 0 is set to value 0 it indicates that the server is not able to send segmented LPP messages to the target device.  If bit 1 is set to value 1, it indicates that the server is able to receive segmented LPP messages from the target device; if bit 1 is set to value 0 it indicates that the server is not able to receive segmented LPP messages from the target device. |

#### – *CommonIEsProvideCapabilities*

The *CommonIEsProvideCapabilities* carries common IEs for a Provide Capabilities LPP message Type.

-- ASN1START

CommonIEsProvideCapabilities ::= SEQUENCE {

...,

[[

segmentationInfo-r14 SegmentationInfo-r14 OPTIONAL, -- Cond Segmentation

lpp-message-segmentation-r14 BIT STRING { serverToTarget (0),

targetToServer (1) } OPTIONAL

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *Segmentation* | This field is optionally present, need OP, if *lpp-message-segmentation-req* has been received from the location server with bit 1 (*targetToServer*) set to value 1. The field shall be omitted if *lpp‑message‑segmentation-req* has not been received in this location session, or has been received with bit 1 (*targetToServer*) set to value 0. |

| *CommonIEsProvideCapabilities* field descriptions |
| --- |
| ***segmentationInfo***  This field indicates whether this *ProvideCapabilities* message is one of many segments, as specified in clause 4.3.5. |
| ***lpp-message-segmentation***  This field, if present, indicates the target device's LPP message segmentation capabilities.  If bit 0 is set to value 1, it indicates that the target device supports receiving segmented LPP messages; if bit 0 is set to value 0 it indicates that the target device does not support receiving segmented LPP messages.  If bit 1 is set to value 1, it indicates that the target device supports sending segmented LPP messages; if bit 1 is set to value 0 it indicates that the target device does not support sending segmented LPP messages. |

#### – *CommonIEsRequestAssistanceData*

The *CommonIEsRequestAssistanceData* carries common IEs for a Request Assistance Data LPP message Type.

-- ASN1START

CommonIEsRequestAssistanceData ::= SEQUENCE {

primaryCellID ECGI OPTIONAL, -- Cond EUTRA

...,

[[

segmentationInfo-r14 SegmentationInfo-r14 OPTIONAL -- Cond Segmentation

]],

[[

periodicAssistanceDataReq-r15

PeriodicAssistanceDataControlParameters-r15

OPTIONAL, -- Cond PerADreq

primaryCellID-r15 NCGI-r15 OPTIONAL -- Cond NR

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *EUTRA* | The field is mandatory present for E-UTRA or NB-IoT access. The field shall be omitted for non-EUTRA and non-NB-IoT user plane support. |
| *Segmentation* | This field is optionally present, need OP, if *lpp-message-segmentation-req* has been received from the location server with bit 1 (*targetToServer*) set to value 1. The field shall be omitted if *lpp‑message‑segmentation-req* has not been received in this location session, or has been received with bit 1 (*targetToServer*) set to value 0. |
| *PerADreq* | The field is mandatory present if the target device requests periodic assistance data delivery. Otherwise it is not present. |
| *NR* | The field is mandatory present for NR access. The field shall be omitted for non-NR user plane support. |

| *CommonIEsRequestAssistanceData* field descriptions |
| --- |
| ***primaryCellID***  This parameter identifies the current primary cell for the target device. |
| ***segmentationInfo***  This field indicates whether this *RequestAssistanceData* message is one of many segments, as specified in clause 4.3.5. |
| ***periodicAssistanceDataReq***  This field indicates a request for periodic assistance data delivery, as specified in clause 5.2.1a. |

#### – *CommonIEsProvideAssistanceData*

The *CommonIEsProvideAssistanceData* carries common IEs for a Provide Assistance Data LPP message Type.

-- ASN1START

CommonIEsProvideAssistanceData ::= SEQUENCE {

...,

[[

segmentationInfo-r14 SegmentationInfo-r14 OPTIONAL -- Need ON

]],

[[

periodicAssistanceData-r15 PeriodicAssistanceDataControlParameters-r15

OPTIONAL -- Cond PerAD

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *PerAD* | The field is mandatory present in a periodic assistance data delivery session. Otherwise it is not present. |

| *CommonIEsRequestAssistanceData* field descriptions |
| --- |
| ***segmentationInfo***  This field indicates whether this *ProvideAssistanceData* message is one of many segments, as specified in clause 4.3.5. |
| ***periodicAssistanceData***  This field indicates a periodic assistance data delivery, as specified in clauses 5.2.1a and 5.2.2a. |

#### – *CommonIEsRequestLocationInformation*

The *CommonIEsRequestLocationInformation* carries common IEs for a Request Location Information LPP message Type.

-- ASN1START

CommonIEsRequestLocationInformation ::= SEQUENCE {

locationInformationType LocationInformationType,

triggeredReporting TriggeredReportingCriteria OPTIONAL, -- Cond ECID

periodicalReporting PeriodicalReportingCriteria OPTIONAL, -- Need ON

additionalInformation AdditionalInformation OPTIONAL, -- Need ON

qos QoS OPTIONAL, -- Need ON

environment Environment OPTIONAL, -- Need ON

locationCoordinateTypes LocationCoordinateTypes OPTIONAL, -- Need ON

velocityTypes VelocityTypes OPTIONAL, -- Need ON

...,

[[

messageSizeLimitNB-r14 MessageSizeLimitNB-r14 OPTIONAL -- Need ON

]],

[[

segmentationInfo-r14 SegmentationInfo-r14 OPTIONAL -- Need ON

]],

[[

scheduledLocationTime-r17

ScheduledLocationTime-r17 OPTIONAL, -- Need ON

targetIntegrityRisk-r17

TargetIntegrityRisk-r17 OPTIONAL -- Need ON

]]

}

LocationInformationType ::= ENUMERATED {

locationEstimateRequired,

locationMeasurementsRequired,

locationEstimatePreferred,

locationMeasurementsPreferred,

...

}

PeriodicalReportingCriteria ::= SEQUENCE {

reportingAmount ENUMERATED {

ra1, ra2, ra4, ra8, ra16, ra32,

ra64, ra-Infinity

} DEFAULT ra-Infinity,

reportingInterval ENUMERATED {

noPeriodicalReporting, ri0-25,

ri0-5, ri1, ri2, ri4, ri8, ri16, ri32, ri64

}

}

TriggeredReportingCriteria ::= SEQUENCE {

cellChange BOOLEAN,

reportingDuration ReportingDuration,

...

}

ReportingDuration ::= INTEGER (0..255)

AdditionalInformation ::= ENUMERATED {

onlyReturnInformationRequested,

mayReturnAditionalInformation,

...

}

QoS ::= SEQUENCE {

horizontalAccuracy HorizontalAccuracy OPTIONAL, -- Need ON

verticalCoordinateRequest BOOLEAN,

verticalAccuracy VerticalAccuracy OPTIONAL, -- Need ON

responseTime ResponseTime OPTIONAL, -- Need ON

velocityRequest BOOLEAN,

...,

[[ responseTimeNB-r14 ResponseTimeNB-r14 OPTIONAL -- Need ON

]],

[[ horizontalAccuracyExt-r15 HorizontalAccuracyExt-r15 OPTIONAL, -- Need ON

verticalAccuracyExt-r15 VerticalAccuracyExt-r15 OPTIONAL -- Need ON

]]

}

HorizontalAccuracy ::= SEQUENCE {

accuracy INTEGER(0..127),

confidence INTEGER(0..100),

...

}

VerticalAccuracy ::= SEQUENCE {

accuracy INTEGER(0..127),

confidence INTEGER(0..100),

...

}

HorizontalAccuracyExt-r15 ::= SEQUENCE {

accuracyExt-r15 INTEGER(0..255),

confidence-r15 INTEGER(0..100),

...

}

VerticalAccuracyExt-r15 ::= SEQUENCE {

accuracyExt-r15 INTEGER(0..255),

confidence-r15 INTEGER(0..100),

...

}

ResponseTime ::= SEQUENCE {

time INTEGER (1..128),

...,

[[ responseTimeEarlyFix-r12 INTEGER (1..128) OPTIONAL -- Need ON

]],

[[ unit-r15 ENUMERATED { ten-seconds, ... , ten-milli-seconds-v1700 }

OPTIONAL -- Need ON

]]

}

ResponseTimeNB-r14 ::= SEQUENCE {

timeNB-r14 INTEGER (1..512),

responseTimeEarlyFixNB-r14 INTEGER (1..512) OPTIONAL, -- Need ON

...,

[[ unitNB-r15 ENUMERATED { ten-seconds, ... } OPTIONAL -- Need ON

]]

}

Environment ::= ENUMERATED {

badArea,

notBadArea,

mixedArea,

...

}

MessageSizeLimitNB-r14 ::= SEQUENCE {

measurementLimit-r14 INTEGER (1..512) OPTIONAL, -- Need ON

...

}

ScheduledLocationTime-r17 ::= SEQUENCE {

utcTime-r17 UTCTime OPTIONAL, -- Need ON

gnssTime-r17 SEQUENCE {

gnss-TOD-msec-r17 INTEGER (0..3599999),

gnss-TimeID-r17 GNSS-ID

} OPTIONAL, -- Need ON

networkTime-r17 CHOICE {

e-utraTime-r17 SEQUENCE {

lte-PhysCellId-r17 INTEGER (0..503),

lte-ArfcnEUTRA-r17 ARFCN-ValueEUTRA,

lte-CellGlobalId-r17 CellGlobalIdEUTRA-AndUTRA

OPTIONAL, -- Need ON

lte-SystemFrameNumber-r17 INTEGER (0..1023)

},

nrTime-r17 SEQUENCE {

nr-PhysCellID-r17 NR-PhysCellID-r16,

nr-ARFCN-r17 ARFCN-ValueNR-r15,

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

nr-SFN-r17 INTEGER (0..1023),

nr-Slot-r17 CHOICE {

scs15-r17 INTEGER (0..9),

scs30-r17 INTEGER (0..19),

scs60-r17 INTEGER (0..39),

scs120-r17 INTEGER (0..79)

} OPTIONAL -- Need ON

},

...

} OPTIONAL, -- Need ON

relativeTime-r17 INTEGER (1..1024) OPTIONAL -- Need ON

}

TargetIntegrityRisk-r17 ::= INTEGER (10..90)

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *ECID* | The field is optionally present, need ON, if E-CID or NR E-CID is requested. Otherwise it is not present. |

| *CommonIEsRequestLocationInformation* field descriptions |
| --- |
| ***locationInformationType***  This IE indicates whether the server requires a location estimate or measurements. For '*locationEstimateRequired*', the target device shall return a location estimate if possible, or indicate a location error if not possible. For '*locationMeasurementsRequired*', the target device shall return measurements if possible, or indicate a location error if not possible. For '*locationEstimatePreferred*', the target device shall return a location estimate if possible, but may also or instead return measurements for any requested position methods for which a location estimate is not possible. For '*locationMeasurementsPreferred*', the target device shall return location measurements if possible, but may also or instead return a location estimate for any requested position methods for which return of location measurements is not possible. |
| ***triggeredReporting***  This IE indicates that triggered reporting is requested and comprises the following subfields:  - ***cellChange***: If this field is set to TRUE, the target device provides requested location information each time the primary cell has changed.  - ***reportingDuration***: Maximum duration of triggered reporting in seconds. A value of zero is interpreted to mean an unlimited (i.e. "infinite") duration. The target device should continue triggered reporting for the *reportingDuration* or until an LPP *Abort* or *LPP Error* message is received.  The *triggeredReporting* field should not be included by the location server and shall be ignored by the target device if the *periodicalReporting* IE or *responseTime* IE or *responseTimeNB* IE is included in *CommonIEsRequestLocationInformation.* |
| ***periodicalReporting***  This IE indicates that periodic reporting is requested and comprises the following subfields:  - ***reportingAmount*** indicates the number of periodic location information reports requested. Enumerated values correspond to 1, 2, 4, 8, 16, 32, 64, or infinite/indefinite number of reports. If the *reportingAmount* is '*infinite/indefinite'*, the target device shou-ld continue periodic reporting until an LPP *Abort* message is received. The value '*ra1*' shall not be used by a sender.  - ***reportingInterval*** indicates the interval between location information reports and the response time requirement for the first location information report. Enumerated values ri0-25, ri0-5, ri1, ri2, ri4, ri8, ri16, ri32, ri64 correspond to reporting intervals of 1, 2, 4, 8, 10, 16, 20, 32, and 64 seconds, respectively. Measurement reports containing no measurements or no location estimate are required when a *reportingInterval* expires before a target device is able to obtain new measurements or obtain a new location estimate. The value '*noPeriodicalReporting*' shall not be used by a sender. |
| ***additionalInformation***  This IE indicates whether a target device is allowed to return additional information to that requested. If this IE indicates '*onlyReturnInformationRequested'* then the target device shall not return any additional information to that requested by the server. If this IE indicates '*mayReturnAdditionalInformation'* then the target device may return additional information to that requested by the server. If a location estimate is returned, any additional information is restricted to that associated with a location estimate (e.g. might include velocity if velocity was not requested but cannot include measurements). If measurements are returned, any additional information is restricted to additional measurements (e.g. might include E-CID measurements if A-GNSS measurements were requested but not E-CID measurements). |
| ***qos***  This IE indicates the quality of service and comprises a number of sub-fields. In the case of measurements, some of the sub-fields apply to the location estimate that could be obtained by the server from the measurements provided by the target device assuming that the measurements are the only sources of error. Fields are as follows:  - ***horizontalAccuracy*** indicates the maximum horizontal error in the location estimate at an indicated confidence level. The '*accuracy*' corresponds to the encoded uncertainty as defined in TS 23.032 [15] and '*confidence*' corresponds to confidence as defined in TS 23.032 [15].  - ***verticalCoordinateRequest*** indicates whether a vertical coordinate is required (TRUE) or not (FALSE)  - ***verticalAccuracy*** indicates the maximum vertical error in the location estimate at an indicated confidence level and is only applicable when a vertical coordinate is requested. The '*accuracy*' corresponds to the encoded uncertainty altitude as defined in TS 23.032 [15] and '*confidence*' corresponds to confidence as defined in TS 23.032 [15].  - ***responseTime***  - ***time*** indicates the maximum response time as measured between receipt of the *RequestLocationInformation* and transmission of a *ProvideLocationInformation*. If the *unit* field is absent, this is given as an integer number of seconds between 1 and 128. If the *unit* field is present with enumerated value '*ten-seconds*', the maximum response time is given in units of 10-seconds, between 10 and 1280 seconds. If the *unit* field is present with enumerated value '*ten-milli-seconds*', the maximum response time is given in units of 10-milli-seconds, between 0.01 and 1.28 seconds. If the *periodicalReporting* IE is included in *CommonIEsRequestLocationInformation*, this field should not be included by the location server and shall be ignored by the target device (if included).  - ***responseTimeEarlyFix*** indicates the maximum response time as measured between receipt of the *RequestLocationInformation* and transmission of a *ProvideLocationInformation* containing early location measurements or an early location estimate. If the *unit* field is absent, this is given as an integer number of seconds between 1 and 128. If the *unit* field is present with enumerated value '*ten-seconds*', the maximum response time is given in units of 10-seconds, between 10 and 1280 seconds. If the *unit* field is present with enumerated value '*ten-milli-seconds*', the maximum response time is given in units of 10-milli-seconds, between 0.01 and 1.28 seconds. When this IE is included, a target should send a *ProvideLocationInformation* (or more than one *ProvideLocationInformation* if location information will not fit into a single message) containing early location information according to the *responseTimeEarlyFix* IE and a subsequent *ProvideLocationInformation* (or more than one *ProvideLocationInformation* if location information will not fit into a single message) containing final location information according to the *time* IE. A target shallomit sending a *ProvideLocationInformation* if the early location information is not available at the expiration of the time value in the *responseTimeEarlyFix* IE. A server should set the *responseTimeEarlyFix* IE to a value less than that for the *time* IE. A target shall ignore the *responseTimeEarlyFix* IE if its value is not less than that for the *time* IE.  - ***unit*** indicates the unit of the *time* and *responseTimeEarlyFix* fields. Enumerated value '*ten-seconds*' corresponds to a resolution of 10 seconds. Enumerated value '*ten-milli-seconds*' corresponds to a resolution of 0.01 seconds. If this field is absent, the unit/resolution is 1 second. Enumerated value '*ten-milli-seconds*' is only applicable for NR E-CID Positioning, NR DL-TDOA Positioning, NR DL-AoD Positioning, and NR Multi-RTT Positioning. If the enumerated value '*ten-milli-seconds*' is included for methods others than NR E-CID Positioning, NR DL-TDOA Positioning, NR DL-AoD Positioning, and NR Multi-RTT Positioning the target device shall ignore the *unit* field.  - ***velocityRequest*** indicates whether velocity (or measurements related to velocity) is requested (TRUE) or not (FALSE).  - ***responseTimeNB*** If the *periodicalReporting* IE or *responseTime* IE is included in *CommonIEsRequestLocationInformation*, this field should not be included by the location server and shall be ignored by the target device (if included).  - ***timeNB*** indicates the maximum response time as measured between receipt of the *RequestLocationInformation* and transmission of a *ProvideLocationInformation*. If the *unitNB* field is absent, this is given as an integer number of seconds between 1 and 512. If the *unitNB* field is present, the maximum response time is given in units of 10-seconds, between 10 and 5120 seconds.  - ***responseTimeEarlyFixNB*** indicates the maximum response time as measured between receipt of the *RequestLocationInformation* and transmission of a *ProvideLocationInformation* containing early location measurements or an early location estimate. If the *unitNB* field is absent, this is given as an integer number of seconds between 1 and 512. If the *unitNB* field is present, the maximum response time is given in units of 10-seconds, between 10 and 5120 seconds. When this IE is included, a target should send a *ProvideLocationInformation* (or more than one *ProvideLocationInformation* if location information will not fit into a single message) containing early location information according to the *responseTimeEarlyFixNB* IE and a subsequent *ProvideLocationInformation* (or more than one *ProvideLocationInformation* if location information will not fit into a single message) containing final location information according to the *timeNB* IE. A target shall omit sending a *ProvideLocationInformation* if the early location information is not available at the expiration of the time value in the *responseTimeEarlyFixNB* IE. A server should set the *responseTimeEarlyFixNB* IE to a value less than that for the *timeNB* IE. A target shall ignore the *responseTimeEarlyFixNB* IE if its value is not less than that for the *timeNB* IE.  - ***unitNB*** indicates the unit of the *timeNB* and *responseTimeEarlyFixNB* fields. Enumerated value '*ten-second*' corresponds to a resolution of 10 seconds. If this field is absent, the unit/resolution is 1 second.  - ***horizontalAccuracyExt*** indicates the maximum horizontal error in the location estimate at an indicated confidence level. The '*accuracyExt*' corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and 'confidence' corresponds to confidence as defined in TS 23.032 [15]. This field should not be included by the location server and shall be ignored by the target device if the *horizontalAccuracy* field is included in QoS.  - ***verticalAccuracyExt*** indicates the maximum vertical error in the location estimate at an indicated confidence level and is only applicable when a vertical coordinate is requested. The '*accuracyExt*' corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and '*confidence*' corresponds to confidence as defined in TS 23.032 [15]. This field should not be included by the location server and shall be ignored by the target device if the *verticalAccuracy* field is included in QoS.  All QoS requirements shall be obtained by the target device to the degree possible but it is permitted to return a response that does not fulfill all QoS requirements if some were not attainable. The single exception is *time* and *timeNB* which shall always be fulfilled – even if that means not fulfilling other QoS requirements.  A target device supporting NB-IoT access shall support the *responseTimeNB* IE*.*  A target device supporting HA GNSS shall support the *HorizontalAccuracyExt*, *VerticalAccuracyEx*, and *unit* fields with enumerated value '*ten-seconds*'.  A target device supporting NB-IoT access and HA GNSS shall support the *unitNB* field. |
| ***environment***  This field provides the target device with information about expected multipath and non line of sight (NLOS) in the current area. The following values are defined:  - badArea: possibly heavy multipath and NLOS conditions (e.g. bad urban or urban).  - notBadArea: no or light multipath and usually LOS conditions (e.g. suburban or rural).  - mixedArea: environment that is mixed or not defined.  If this field is absent, a default value of 'mixedArea' applies. |
| ***locationCoordinateTypes***  This field provides a list of the types of location estimate that the target device may return when a location estimate is obtained by the target. |
| ***velocityTypes***  This fields provides a list of the types of velocity estimate that the target device may return when a velocity estimate is obtained by the target. |
| ***messageSizeLimitNB***  This field provides an octet limit on the amount of location information a target device can return.  - ***measurementLimit*** indicates the maximum amount of location information the target device should return in response to the *RequestLocationInformation* message received from the location server. The limit applies to the overall size of the LPP message at LPP level (LPP Provide Location Information), and is specified in steps of 100 octets. The message size limit is then given by the value provided in *measurementLimit* times 100 octets. |
| ***segmentationInfo***  This field indicates whether this *RequestLocationInformation* message is one of many segments, as specified in clause 4.3.5 |
| ***scheduledLocationTime***  This field indicates that the target device is requested to obtain location measurements or location estimate valid at the *scheduledLocationTime* *T* and comprises the following subfields:  - ***utcTime*** provides *T* in UTC in the form of YYMMDDhhmmssZ.  - ***gnssTime*** provides *T* in GNSS system time of the GNSS indicated by *gnss-TimeID*.  - ***gnss-TOD-msec*** specifies the GNSS TOD in 1-milli-second resolution rounded down to the nearest millisecond unit.  - ***networkTime*** provides *T* in E-UTRA or NR network time.  - ***lte-PhysCellId, lte-ArfcnEUTRA, lte-CellGlobalId*** identifies the reference cell (E-UTRA) that is used for the network time.  - ***lte-systemFrameNumber*** specifies the system frame number in E-UTRA.  - ***nr-PhysCellID***, ***nr-ARFCN*** , ***nr-CellGlobalID*** identifies the reference cell (NR) that is used for the network time.  - ***nr-SFN*** specifies the system frame number in NR.  - ***nr-Slot*** specifies the slot number in NR for the indicated subcarrier spacing (SCS). The total NR network time is given by *nr-SFN* + *nr-Slot*.  - ***relativeTime*** provides *T* in seconds from current time, where current time is defined as the time the *CommonIEsRequestLocationInformation* was received.  NOTE 1: A location estimate returned to an LCS Client, AF or UE for a scheduled location time can be treated by the LCS Client, AF or UE as an estimate of the location of the UE at the scheduled location time (see TS 23.273 [42]).  NOTE 2: If this field is present, at least one of *utcTime*, *gnssTime*, *networkTime,* or *relativeTime* shall be present. |
| ***targetIntegrityRisk***  This field indicates the TIR for which the PL is requested. The TIR is calculated by *P*=10-0.1*n* [hour-1] where *n* is the value of *targetIntegrityRisk* and the range is 10-1 to 10-9 per hour. |

#### – *CommonIEsProvideLocationInformation*

The *CommonIEsProvideLocationInformation* carries common IEs for a Provide Location Information LPP message Type.

-- ASN1START

CommonIEsProvideLocationInformation ::= SEQUENCE {

locationEstimate LocationCoordinates OPTIONAL,

velocityEstimate Velocity OPTIONAL,

locationError LocationError OPTIONAL,

...,

[[ earlyFixReport-r12 EarlyFixReport-r12 OPTIONAL

]],

[[ locationSource-r13 LocationSource-r13 OPTIONAL,

locationTimestamp-r13 UTCTime OPTIONAL

]],

[[

segmentationInfo-r14 SegmentationInfo-r14 OPTIONAL -- Cond Segmentation

]],

[[

integrityInfo-r17 IntegrityInfo-r17 OPTIONAL

]]

}

LocationCoordinates ::= CHOICE {

ellipsoidPoint Ellipsoid-Point,

ellipsoidPointWithUncertaintyCircle Ellipsoid-PointWithUncertaintyCircle,

ellipsoidPointWithUncertaintyEllipse EllipsoidPointWithUncertaintyEllipse,

polygon Polygon,

ellipsoidPointWithAltitude EllipsoidPointWithAltitude,

ellipsoidPointWithAltitudeAndUncertaintyEllipsoid

EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,

ellipsoidArc EllipsoidArc,

...,

highAccuracyEllipsoidPointWithUncertaintyEllipse-v1510

HighAccuracyEllipsoidPointWithUncertaintyEllipse-r15,

highAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-v1510

HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15,

ha-EllipsoidPointWithScalableUncertaintyEllipse-v1680 HA-EllipsoidPointWithScalableUncertaintyEllipse-r16,

ha-EllipsoidPointWithAltitudeAndScalableUncertaintyEllipsoid-v1680

HA-EllipsoidPointWithAltitudeAndScalableUncertaintyEllipsoid-r16,

local2dPointWithUncertaintyEllipse-v18xy Local2dPointWithUncertaintyEllipse-r18,

local3dPointWithUncertaintyEllipsoid-v18xy Local3dPointWithUncertaintyEllipsoid-r18

}

Velocity ::= CHOICE {

horizontalVelocity HorizontalVelocity,

horizontalWithVerticalVelocity HorizontalWithVerticalVelocity,

horizontalVelocityWithUncertainty HorizontalVelocityWithUncertainty,

horizontalWithVerticalVelocityAndUncertainty

HorizontalWithVerticalVelocityAndUncertainty,

...

}

LocationError ::= SEQUENCE {

locationfailurecause LocationFailureCause,

...

}

LocationFailureCause ::= ENUMERATED {

undefined,

requestedMethodNotSupported,

positionMethodFailure,

periodicLocationMeasurementsNotAvailable,

...

}

EarlyFixReport-r12 ::= ENUMERATED {

noMoreMessages,

moreMessagesOnTheWay

}

LocationSource-r13 ::= BIT STRING { a-gnss (0),

wlan (1),

bt (2),

tbs (3),

sensor (4),

ha-gnss-v1510 (5),

motion-sensor-v1550 (6),

dl-tdoa-r16 (7),

dl-aod-r16 (8) } (SIZE(1..16))

IntegrityInfo-r17 ::= SEQUENCE {

horizontalProtectionLevel-r17 INTEGER (0..50000),

verticalProtectionLevel-r17 INTEGER (0..50000) OPTIONAL,

achievableTargetIntegrityRisk-r17 INTEGER (10..90) OPTIONAL,

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *Segmentation* | This field is optionally present, need OP, if *lpp-message-segmentation-req* has been received from the location server with bit 1 (*targetToServer*) set to value 1. The field shall be omitted if *lpp‑message‑segmentation-req* has not been received in this location session, or has been received with bit 1 (*targetToServer*) set to value 0. |

| *CommonIEsProvideLocationInformation* field descriptions |
| --- |
| ***locationEstimate***  This field provides a location estimate using one of the geographic shapes defined in TS 23.032 [15]. Coding of the values of the various fields internal to each geographic shape follow the rules in TS 23.032 [15]. The conditions for including this field are defined for the *locationInformationType* field in a Request Location Information message. |
| ***velocityEstimate***  This field provides a velocity estimate using one of the velocity shapes defined in TS 23.032 [15]. Coding of the values of the various fields internal to each velocity shape follow the rules in TS 23.032 [15]. |
| ***locationError***  This field shall be included if and only if a location estimate and measurements are not included in the LPP PDU. The field includes information concerning the reason for the lack of location information. The *LocationFailureCause* '*periodicLocationMeasurementsNotAvailable*' shall be used by the target device if periodic location reporting was requested, but no measurements or location estimate are available when *the reportingInterval* expired. |
| ***earlyFixReport***  This field shall be included if and only if the *ProvideLocationInformation* message contains early location measurements or an early location estimate. The target device shall set the values of this field as follows:  - noMoreMessages: This is the only or last *ProvideLocationInformation* message used to deliver the entire set of early location information.  - moreMessagesOnTheWay: This is one of multiple *ProvideLocationInformation* messages used to deliver the entire set of early location information (if early location information will not fit into a single message).  If this field is included, the IE *SegmentationInfo* shall not be included. |
| ***locationSource***  This field provides the source positioning technology for the location estimate.  NOTE 1: In this version of the specification, the entry 'tbs' is used only for TBS positioning based on MBS signals.  NOTE 2: The entry 'sensor' is used only for positioning technology that uses barometric pressure sensor. The entry 'motion-sensor' is used for positioning technology that uses sensor(s) to detect displacement and movement, e.g. accelerometers, gyros, magnetometers. |
| ***locationTimestamp***  This field provides the UTC time when the location estimate is valid and should take the form of *YYMMDDhhmmssZ*. |
| ***segmentationInfo***  This field indicates whether this *ProvideLocationInformation* message is one of many segments, as specified in clause 4.3.5 |
| ***integrityInfo***  This field provides the integrity result for the *locationEstimate.*  - ***horizontalProtectionLevel*** provides the HPL for the *locationEstimate* along the semi-major axis of the error ellipse. Scale factor 0.01 metre; range 0 – 500 metres.  - ***verticalProtectionLevel*** provides the VPL for the *locationEstimate*. Scale factor 0.01 metre; range 0 – 500 metres.  - ***achievableTargetIntegrityRisk*** indicates the achievable TIR for which the HPL and VPL are provided. The achievable TIR is given by *P*=10-0.1n [hour-1] where *n* is the value of *achievableTargetIntegrityRisk* and the range is 10-1 to 10-9 per hour. If this field is absent, the achievable TIR is the same as the *targetIntegrityRisk* in *CommonIEsRequestLocationInformation*. |

NOTE: Void.

#### *– CommonIEsAbort*

The *CommonIEsAbort* carries common IEs for an Abort LPP message Type.

-- ASN1START

CommonIEsAbort ::= SEQUENCE {

abortCause ENUMERATED {

undefined,

stopPeriodicReporting,

targetDeviceAbort,

networkAbort,

...,

stopPeriodicAssistanceDataDelivery-v1510

}

}

-- ASN1STOP

| *CommonIEsAbort* field descriptions |
| --- |
| ***abortCause***  This IE defines the request to abort an ongoing procedure. The abort cause '*stopPeriodicReporting*' should be used by the location server to stop any ongoing location reporting configured as *periodicalReporting* or *triggeredReporting* in the *CommonIEsRequestLocationInformation*.  The abort cause '*stopPeriodicAssistanceDataDelivery*' should be used by the location server or target device to stop any ongoing periodic assistance data delivery, as specified in clauses 5.2.1a and 5.2.2a. |

#### – *CommonIEsError*

The *CommonIEsError* carries common IEs for an Error LPP message Type.

-- ASN1START

CommonIEsError ::= SEQUENCE {

errorCause ENUMERATED {

undefined,

lppMessageHeaderError,

lppMessageBodyError,

epduError,

incorrectDataValue,

...,

lppSegmentationError-v1450

}

}

-- ASN1STOP

| *CommonIEsError* field descriptions |
| --- |
| *errorCause*  This IE defines the cause for an error. '*lppMessageHeaderError*', '*lppMessageBodyError*' and '*epduError*' is used if a receiver is able to detect a coding error in the LPP header (i.e., in the common fields), LPP message body or in an EPDU, respectively. '*lppSegmentationError*' is used if a receiver detects an error in LPP message segmentation. |

### 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*. |

#### – *CoordinateID*

The IE *CoordinateID* is used to indicate a reference point that defines the origin of a local Cartesian Coordinate System as defined in TS 23.032 [15].

-- ASN1START

CoordinateID-r18 ::= VisibleString (SIZE (1..256))

-- ASN1STOP

#### – *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,

...,

[[

dummy 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-RRC-CONNECTED-r17 ENUMERATED { supported } OPTIONAL,

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

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

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

prs-ProcessingCapabilityOutsideMGinPPW-r17

SEQUENCE (SIZE(1..3)) OF

PRS-ProcessingCapabilityOutsideMGinPPWperType-r17

OPTIONAL,

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

durationOfPRS-Processing-RRC-Inactive-r17 SEQUENCE {

durationOfPRS-ProcessingSymbols-r17 ENUMERATED {nDot125, nDot25, nDot5, n1,

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

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

durationOfPRS-ProcessingSymbolsInEveryTms-r17

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

n160,n320, n640, n1280},

...

} OPTIONAL,

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

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

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

]],

[[

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

]]

}

PRS-ProcessingCapabilityOutsideMGinPPWperType-r17 ::= SEQUENCE {

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

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

ppw-durationOfPRS-Processing1-r17 SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN-r17

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

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

ms40, ms45, ms50 },

ppw-durationOfPRS-ProcessingSymbolsT-r17

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

ms160, ms320, ms640, ms1280 }

} OPTIONAL,

ppw-durationOfPRS-Processing2-r17 SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN2-r17

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

ms6, ms8, ms12 },

ppw-durationOfPRS-ProcessingSymbolsT2-r17

ENUMERATED { ms4, ms5, ms6, ms8 }

} OPTIONAL,

ppw-maxNumOfDL-PRS-ResProcessedPerSlot-r17 SEQUENCE {

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

n16, n24, n32, n48, n64 }

OPTIONAL,

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

n16, n24, n32, n48, n64 }

OPTIONAL,

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

n16, n24, n32, n48, n64 }

OPTIONAL,

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

n16, n24, n32, n48, n64 }

OPTIONAL,

...

},

...,

[[

ppw-maxNumOfDL-Bandwidth-r17 CHOICE {

fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

mhz50, mhz80, mhz100},

fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

} OPTIONAL

]]

}

-- 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. |
| ***dummy***  This field is not used in the specification. If received it shall be ignored by the receiver. |
| ***supportedBandwidthPRS***  Indicates the maximum number of DL-PRS bandwidth in MHz, which is supported and reported by UE. |
| ***dl-PRS-BufferType***  IndicatesDL-PRS buffering capability. Value *type1* indicates sub-slot/symbol level buffering and value *type2* indicates slot level buffering. |
| ***durationOfPRS-Processing***  Indicates the duration *N* of DL-PRS symbols in units of ms a UE can process every T ms assuming maximum DL-PRS bandwidth provided in *supportedBandwidthPRS* and comprises the following subfields:  - ***durationOfPRS-ProcessingSymbols***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 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-RRC-CONNECTED***  Indicates the UE capability for support of measurements based on measuring M=1 or M=2 (instances) of a DL-PRS Resource Set. The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE: This feature is supported for both UE-assisted and UE based positioning. |
| ***prs-ProcessingWindowType1A***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 1A refers to the determination of prioritization between DL-PRS and other DL signals/channels in all OFDM symbols within the 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  The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP. |
| ***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*).  The UE can include this field only if the UE supports prs-ProcessingCapabilityBandList. Otherwise, the UE does not include this field.  NOTE: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP. |
| ***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*).  The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP. |
| ***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 *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:  - ***ppw-durationOfPRS-ProcessingSymbolsN***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***ppw-durationOfPRS-ProcessingSymbolsT***: This field specifies the values for *T*. Enumerated values indicate 1, 2, 4, 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.  - ***ppw-durationOfPRS-Processing2***: Indicates the duration of DL-PRS symbols N2 in units of ms a UE can process inT2 ms assuming maximum DL-PRS bandwidth provided in *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:  - ***ppw-durationOfPRS-ProcessingSymbolsN2***: This field specifies the values for *N2*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12 ms.  - ***ppw-durationOfPRS-ProcessingSymbolsT2***: This field specifies the values for *T2*. Enumerated values indicate 4, 5, 6, 8 ms.  - ***ppw-maxNumOfDL-PRS-ResProcessedPerSlot:*** Indicates the maximum number of DL-PRS resources that UE can process in a slot. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands.  - ***ppw-maxNumOfDL-Bandwidth:*** Indicates the maximum number of DL PRS bandwidth in MHz, which is supported and reported by UE for PRS measurement outside MG within the PPW.  The UE can include this field only if the UE supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* and *prs-ProcessingWindowType2*. Otherwise, the UE does not include this field.  NOTE: 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*, *ppw-maxNumOfDL-PRS-ResProcessedPerSlot,* and *ppw-maxNumOfDL-BandwidthFR1* or *ppw-maxNumOfDL-BandwidthFR2*. |
| ***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. |
| ***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. The UE can include this field only if the UE supports *prs-ProcessingRRC-Inactive* defined in TS 38.331 [35]. Otherwise, the UE does not include this field. |

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

...,

[[

trp-LocationCartesian-r18 RelativeCartesianLocation-r18 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-ResourceSetARP-Cartesian-r18 RelativeCartesianLocation-r18 OPTIONAL -- Need OP

]]

}

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

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

...,

[[

dl-PRS-Resource-ARP-locationCartesian-r18

RelativeCartesianLocation-r18 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* or *trp-LocationCartesian* information is adopted. If the field is present, the field *trp-Location* and *trp-LocationCartesian* shall be absent.  - ***trp-Location, trp-LocationCartesian***: This field provides the location of the TRP relative to the *referencePoint* location either in geodetic coordinates (*trp-Location*)or local Cartesian coordinates (*trp-LocationCartesian*). 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* or *trp-LocationCartesian* 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/trp-LocationCartesian* location. This field comprises the following sub-fields:  - ***dl-PRS-ResourceSetARP, dl-PRS-ResourceSetARP-Cartesian***: This field provides the antenna reference point location of the DL-PRS Resource Set relative to the *trp-Location* or *trp-LocationCartesian* location. If this field is absent, the antenna reference point location of this DL-PRS Resource Set coincides with the *trp-Location* or *trp-LocationCartesian* 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* or *dl-PRS-ResourceSetARP-Cartesian* location. This field comprises the following sub-fields:  - ***dl-PRS-Resource-ARP-location, dl-PRS-Resource-ARP-locationCartesian***: 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/dl-PRS-ResourceSetARP-Cartesian* location. If this field is absent, the antenna reference point location of this DL-PRS Resource coincides with the *dl-PRS-ResourceSetARP* location or *dl-PRS-Resource-ARP-locationCartesian*. |

NOTE: The locations may be provided in either geodetic coordinates (*RelativeLocation*) or local Cartesian coordinates (*RelativeCartesianLocation*), but not both.

#### *– 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. The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList* and any of *maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer*, *maxNrOfTRP-AcrossFreqs*, *maxNrOfPosLayer*, *maxNrOfDL-PRS-ResourcesPerResourceSet* and *maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer*. Otherwise, the UE does not include this field.  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. For UL-TDOA, the UE can include this field only if the UE supports *supportedSRS-PosResources* defined in TS 38.331 [35]. For Multi-RTT, the UE can include this field only if the UE supports *maxNrOfDL-PRS-ResourcesPerResourceSet,* *maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer* and *supportedSRS-PosResources* defined in TS 38.331 [35]. Otherwise, the UE does not include this field. |
| ***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. The UE can include this field only if the UE supports *maxNrOfDL-PRS-ResourcesPerResourceSet,* *maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer* and *supportedSRS-PosResources* defined in TS 38.331 [35]. Otherwise, the UE does not include this field. |
| ***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. The UE can include this field only if the UE supports *nr-UE-RxTEG-ID-MaxSupport*. Otherwise, the UE does not include this field. |
| ***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. The UE can include this field only if the UE supports *measureSameDL-PRS-ResourceWithDifferentRxTEGs*. Otherwise, the UE does not include this field. |

#### *– 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. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field.  - ***maxNumOfSemiPersistentSRSposResourcesPerSlot***indicates the maximum number of semi-persistent SRS Resources for positioning per slot supported by the UE. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field. |
| ***posSRS-RRC-Inactive-OutsideInitialUL-BWP***  Indicates whether the UE supports positioning SRS transmission in RRC\_INACTIVE state outside initial UL BWP. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field.  - ***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. If the field is absent, the UE only supports same numerology between the SRS and the initial UL BWP.  - ***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. If the field is absent, the UE supports only SRS BW that include the 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. If the field is absent, the UE only supports same center frequency between the SRS for positioning and initial UL BWP.  - ***maxNumOfSemiPersistentSRSposResources***indicates the maximum number of semi-persistent SRS Resources for positioning supported by the UE. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field.  - ***maxNumOfSemiPersistentSRSposResourcesPerSlot***indicates the maximum number of semi-persistent SRS Resources for positioning per slot supported by the UE. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field.  - ***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. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field. |
| ***spatialRelationsSRS-PosRRC-Inactive***  Indicates whether the UE supports spatial relations for SRS for positioning in RRC\_INACTIVE state on FR2. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field. |

#### – *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,

...,

localOrigin-v18xy CoordinateID-r18

},

...

}

-- ASN1STOP

| *ReferencePoint* field descriptions |
| --- |
| ***referencePointGeographicLocation***  This field provides the geodetic or local location of the reference point. The CHOICE *localOrigin* indicates that the reference point has no known geodetic location. |
| ***localOrigin***  This field provides an identifier for the reference point that defines the origin of a local Cartesian coordinate system [15]. |

#### – *RelativeCartesianLocation*

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

-- ASN1START

RelativeCartesianLocation-r18 ::= SEQUENCE {

cartesianCoordinatesUnits-r18 ENUMERATED { mm, cm, dm, m, ...},

x-value-r18 X-Value-r18,

y-value-r18 Y-Value-r18,

z-value-r18 Z-Value-r18,

locationUNC-r18 LocationUncertainty-r16 OPTIONAL, -- Need OP

...

}

X-Value-r18 ::= SEQUENCE {

delta-x-r18 INTEGER (-1024..1023),

coarse-delta-x-r18 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

Y-Value-r18 ::= SEQUENCE {

delta-y-r18 INTEGER (-1024..1023),

coarse-delta-y-r18 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

Z-Value-r18 ::= SEQUENCE {

delta-z-r18 INTEGER (-1024..1023),

coarse-delta-z-r18 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

-- ASN1STOP

|  |
| --- |
| *RelativeCartesianLocation* field descriptions |
| ***cartesianCoordinatesUnits***  This field provides the units and scale factor for the *x-value,* *y-value* and *z-value* fields. Enumerated values *mm*, *cm*, *dm*, and *m*, correspond to 10-3 metre, 10-2 metre, 10-1 metre and 1 metres, respectively. |
| ***x-value***  This field specifies the x-value of the desired location in a Cartesian coordinate system and comprises the following sub-fields:  - ***delta-x*** specifies the delta value on the x-axis of a Cartesian coordinate system in the unit provided in *cartesian-coordinates-units* field.  - ***coarse-delta-x*** specifies the delta value on the x-axis of a Cartesian coordinate system in 1024 times the size of the unit provided in *cartesian-coordinates-units* field and with the same sign as in the *delta-x* field. If this field is absent, the value for *coarse-delta-x*is zero.  I.e., the full *x-value* is given by:  (*delta-x* × *cartesian-coordinates-units*)±(*coarse-delta-x* × 1024 × *cartesian-coordinates-units*) [m]. |
| ***y-value***  This field specifies the y-value of the desired location in a Cartesian coordinate system and comprises the following sub-fields:  - ***delta-y*** specifies the delta value on the y-axis of a Cartesian coordinate system in the unit provided in *cartesian-coordinates-units* field.  - ***coarse-delta-y*** specifies the delta value on the y-axis of a Cartesian coordinate system in 1024 times the size of the unit provided in *cartesian-coordinates-units* field and with the same sign as in the *delta-y* field. If this field is absent, the value for *coarse-delta-y*is zero.  I.e., the full *y-value* is given by:  (*delta-y* × *cartesian-coordinates-units*)±(*coarse-delta-y* × 1024 × *cartesian-coordinates-units*) [m]. |
| ***z-value***  This field specifies the z-value of the desired location in a Cartesian coordinate system and comprises the following sub-fields:  - ***delta-z*** specifies the delta value on the z-axis of a Cartesian coordinate system in the unit provided in *cartesian-coordinates-units* field.  - ***coarse-delta-z*** specifies the delta value on the z-axis of a Cartesian coordinate system in 1024 times the size of the unit provided in *cartesian-coordinates-units* field and with the same sign as in the *delta-z* field. If this field is absent, the value for *coarse-delta-z*is zero.  I.e., the full *z-value* is given by:  (*delta-z* × *cartesian-coordinates-units*)±(*coarse-delta-z* × 1024 × *cartesian-coordinates-units*) [m]. |
| ***locationUNC***  This field specifies the uncertainty of the location coordinates (see IE *RelativeLocation*).  If this field is absent, the uncertainty is the same as for the associated reference point location. |

#### – *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

### 

#### 6.5.10.6 NR DL-TDOA Capability Information

#### – *NR-DL-TDOA-ProvideCapabilities*

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

-- ASN1START

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

nr-DL-TDOA-Mode-r16 PositioningModes,

nr-DL-TDOA-PRS-Capability-r16 NR-DL-PRS-ResourcesCapability-r16,

nr-DL-TDOA-MeasurementCapability-r16 NR-DL-TDOA-MeasurementCapability-r16,

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

nr-DL-PRS-ProcessingCapability-r16 NR-DL-PRS-ProcessingCapability-r16,

additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

periodicalReporting-r16 PositioningModes OPTIONAL,

...,

[[

ten-ms-unit-ResponseTime-r17 PositioningModes OPTIONAL,

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

beamInfoSup (1),

rtdInfoSup (2),

trpTEG-InfoSup (3)

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

nr-los-nlos-AssistanceDataSupport-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType2-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

nr-DL-PRS-ExpectedAoD-or-AoA-Sup-r17 BIT STRING { eAoD (0),

eAoA (1)

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

nr-DL-TDOA-On-Demand-DL-PRS-Support-r17 NR-On-Demand-DL-PRS-Support-r17 OPTIONAL,

nr-los-nlos-IndicatorSupport-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType2-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

additionalPathsExtSupport-r17 ENUMERATED { n4, n6, n8 } OPTIONAL,

scheduledLocationRequestSupported-r17 ScheduledLocationTimeSupportPerMode-r17 OPTIONAL,

nr-dl-prs-AssistanceDataValidity-r17 SEQUENCE {

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

} OPTIONAL,

multiMeasInSameMeasReport-r17 ENUMERATED { supported } OPTIONAL,

mg-ActivationRequest-r17 ENUMERATED { supported } OPTIONAL

]],

[[

locationCoordinateTypes-r18 LocationCoordinateTypes OPTIONAL

]]

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-TDOA-ProvideCapabilities* field descriptions |
| ***nr-DL-TDOA-Mode***  This field specifies the NR DL-TDOA mode(s) supported by the target device. |
| ***periodicalReporting***  This field, if present, specifies the positioning modes for which the target device supports *periodicalReporting.* This is represented by a bit string, with a one‑value at the bit position means *periodicalReporting* for the positioning mode is supported; a zero‑value means not supported. If this field is absent, the target device does not support *periodicalReporting* in *CommonIEsRequestLocationInformation*. |
| ***ten-ms-unit-ResponseTime***  This field, if present, specifies the positioning modes for which the target device supports the enumerated value '*ten-milli-seconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. This is represented by a bit string, with a one‑value at the bit position means '*ten-milli-seconds'* response time unit for the positioning mode is supported; a zero‑value means not supported. If this field is absent, the target device does not support '*ten-milli-seconds'* response time unitin *CommonIEsRequestLocationInformation*. |
| ***nr-PosCalcAssistanceSupport***  This field indicates the Position Calculation Assistance Data supported by the target device for UE-based DL-TDOA. This is represented by a bit string, with a one‑value at the bit position means the particular assistance data is supported; a zero‑value means not supported.  - bit 0 indicates whether the field *nr-TRP-LocationInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 1 indicates whether the field *nr-DL-PRS-BeamInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 2 indicates whether the field *nr-RTD-Info* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 3 indicates whether the field *nr-DL-PRS-TRP-TEG-Info* in IE *NR-PositionCalculationAssistance* is supported or not. The UE can indicate this bit only if the UE supports *prs-ProcessingCapabilityBandList* and any of *maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer*, *maxNrOfTRP-AcrossFreqs*, *maxNrOfPosLayer*, *maxNrOfDL-PRS-ResourcesPerResourceSet* and *maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer*. Otherwise, the UE does not include this field. |
| ***nr-los-nlos-AssistanceDataSupport***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* in IE *NR-PositionCalculationAssistance*:  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in *LOS-NLOS-Indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistance*.  - *granularity* indicates whether the target device supports *nr-los-nlos-indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* '*per-trp*', '*per-resource*', or both.  The UE can include this field only if the UE supports one of *maxDL-PRS-RSRP-MeasurementFR1*, *maxDL-PRS-RSRP-MeasurementFR2*, *dl-RSTD-MeasurementPerPairOfTRP-FR1*, *dl-RSTD-MeasurementPerPairOfTRP-FR*2, *maxNrOfRx-TX-MeasFR1*, *maxNrOfRx-TX-MeasFR2*, *supportOfRSRP-MeasFR1* and *supportOfRSRP-MeasFR2*. Otherwise, the UE does not include this field.  NOTE: A single value is reported when both Multi-RTT and DL-TDOA are supported. |
| ***nr-DL-PRS-ExpectedAoD-or-AoA-Sup***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedAoD-or-AoA* in *NR-DL-PRS-AssistanceData.* |
| ***nr-DL-TDOA-On-Demand-DL-PRS-Support***  This field, if present, indicates that the target device supports on-demand DL-PRS requests. |
| ***nr-los-nlos-IndicatorSupport***  This field, if present, indicates that the target device supports *nr-los-nlos-Indicator* reporting in IE *NR-DL-TDOA-SignalMeasurementInformation*.  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in IE *LOS-NLOS-Indicator.*  - *granularity* indicates whether the target device supports *LOS-NLOS-Indicator* reporting per TRP, per DL-PRS Resource, or both. |
| ***additionalPathsExtSupport***  This field, if present, indicates that the target device supports the *nr-AdditionalPathListExt* reporting in IE *NR-DL-TDOA-SignalMeasurementInformation*. The enumerated value indicates the number of additional paths supported by the target device.  NOTE: The *supportOfDL-PRS-FirstPathRSRP* in IE *NR-DL-TDOA-MeasurementCapability* also applies to the additional paths. |
| ***scheduledLocationRequestSupported***  This field, if present, specifies the positioning modes for which the target device supports scheduled location requests – i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* – and the time base(s) supported for the scheduled location time for each positioning mode. If this field is absent, the target device does not support scheduled location requests. |
| ***nr-dl-prs-AssistanceDataValidity***  This field, if present, indicates that the target device supports validity conditions for pre-configured assistance data and comprises the following subfields:  - ***area-validity*** indicates that the target device supports pre-configured assistance data with area validity. The integer number indicates the maximum number of areas the target device supports*.* |
| ***multiMeasInSameMeasReport***  This field, if present, indicates that the target device supports multiple measurement instances in a single measurement report. |
| ***mg-ActivationRequest***  This field, if present, indicates that the target device supports low latency measurement gap activation request for DL-PRS measurements. The UE can include this field only if the UE supports *mg-ActivationRequestPRS-Meas* and *mg-ActivationCommPRS-Meas* defined in TS 38.331 [35]. |
| ***locationCoordinateTypes***  This field indicates the geographical location coordinate types that a target device supports for UE-based DL-TDOA. TRUE indicates that a location coordinate type is supported and FALSE that it is not. |

#### 6.5.11.6 NR DL-AoD Capability Information

#### – *NR-DL-AoD-ProvideCapabilities*

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

-- ASN1START

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

nr-DL-AoD-Mode-r16 PositioningModes,

nr-DL-AoD-PRS-Capability-r16 NR-DL-PRS-ResourcesCapability-r16,

nr-DL-AoD-MeasurementCapability-r16 NR-DL-AoD-MeasurementCapability-r16,

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

nr-DL-PRS-ProcessingCapability-r16 NR-DL-PRS-ProcessingCapability-r16,

periodicalReporting-r16 PositioningModes OPTIONAL,

...,

[[

ten-ms-unit-ResponseTime-r17 PositioningModes OPTIONAL,

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

beamInfoSup (1),

rtdInfoSup (2),

beamAntInfoSup (3)

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

nr-los-nlos-AssistanceDataSupport-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType2-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

nr-DL-PRS-ExpectedAoD-or-AoA-Sup-r17 BIT STRING { eAoD (0),

eAoA (1)

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

nr-DL-PRS-BeamInfoSup-r17 ENUMERATED { sameSet, differentSet, sameOrDifferentSet }

OPTIONAL,

dl-PRS-ResourcePrioritySubset-Sup-r17 ENUMERATED { supported } OPTIONAL,

nr-DL-AoD-On-Demand-DL-PRS-Support-r17 NR-On-Demand-DL-PRS-Support-r17 OPTIONAL,

nr-los-nlos-IndicatorSupport-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType2-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

scheduledLocationRequestSupported-r17 ScheduledLocationTimeSupportPerMode-r17

OPTIONAL,

nr-dl-prs-AssistanceDataValidity-r17 SEQUENCE {

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

...

} OPTIONAL,

multiMeasInSameMeasReport-r17 ENUMERATED { supported } OPTIONAL,

mg-ActivationRequest-r17 ENUMERATED { supported } OPTIONAL

]],

[[

locationCoordinateTypes-r18 LocationCoordinateTypes OPTIONAL

]]

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-AoD-ProvideCapabilities* field descriptions |
| ***nr-DL-AoD-Mode***  This field specifies the NR DL-AoD mode(s) supported by the target device. |
| ***periodicalReporting***  This field, if present, specifies the positioning modes for which the target device supports *periodicalReporting.* This is represented by a bit string, with a one‑value at the bit position means *periodicalReporting* for the positioning mode is supported; a zero‑value means not supported. If this field is absent, the target device does not support *periodicalReporting* in *CommonIEsRequestLocationInformation*. |
| ***ten-ms-unit-ResponseTime***  This field, if present, specifies the positioning modes for which the target device supports the enumerated value '*ten-milli-seconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. This is represented by a bit string, with a one‑value at the bit position means '*ten-milli-seconds'* response time unit for the positioning mode is supported; a zero‑value means not supported. If this field is absent, the target device does not support '*ten-milli-seconds'* response time unitin *CommonIEsRequestLocationInformation*. |
| ***nr-PosCalcAssistanceSupport***  This field indicates the Position Calculation Assistance Data supported by the target device for UE-based DL-AoD. This is represented by a bit string, with a one‑value at the bit position means the particular assistance data is supported; a zero‑value means not supported.  - bit 0 indicates whether the field *nr-TRP-LocationInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 1 indicates whether the field *nr-DL-PRS-BeamInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 2 indicates whether the field *nr-RTD-Info* in IE *NR-PositionCalculationAssistance* is supported or not. The UE can indicate this bit only if the UE supports *prs-ProcessingCapabilityBandList* and any of *maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer*, *maxNrOfTRP-AcrossFreqs*, *maxNrOfPosLayer*, *maxNrOfDL-PRS-ResourcesPerResourceSet* and *maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer*. Otherwise, the UE does not include this field;  - bit 3 indicates whether the field *nr-TRP-BeamAntennaInfo* in IE *NR-PositionCalculationAssistance* is supported or not. |
| ***nr-los-nlos-AssistanceDataSupport***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* in IE *NR-PositionCalculationAssistance*:  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in *LOS-NLOS-Indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistance*.  - *granularity* indicates whether the target device supports *nr-los-nlos-indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistanc*e 'per-trp', '*per-resource*', or both.  The UE can include this field only if the UE supports one of *maxDL-PRS-RSRP-MeasurementFR1*, *maxDL-PRS-RSRP-MeasurementFR2,dl-RSTD-MeasurementPerPairOfTRP-FR1, dl-RSTD-MeasurementPerPairOfTRP-FR2, maxNrOfRx-TX-MeasFR1, maxNrOfRx-TX-MeasFR2, supportOfRSRP-MeasFR1* and *supportOfRSRP-MeasFR2* . Otherwise, the UE does not include this field.  NOTE: A single value is reported when both Multi-RTT and DL-TDOA are supported. |
| ***nr-DL-PRS-ExpectedAoD-or-AoA-Sup***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedAoD-or-AoA* in *NR-DL-PRS-AssistanceData.* |
| ***nr-DL-PRS-BeamInfoSup***  This field, if present, indicates that the target device supports the *NR-DL-PRS-BeamInfo* in IE *NR-DL-AoD-ProvideAssistanceData.* |
| ***dl-PRS-ResourcePrioritySubset-Sup***  This field, if present, indicates that the target device supports the *DL-PRS-ResourcePrioritySubset* in IE *NR-DL-PRS-Info.* Enumerated value indicates the supported resource set relationship for the target DL-PRS Resource and the associated subset. |
| ***nr-DL-AoD-On-Demand-DL-PRS-Support***  This field, if present, indicates that the target device supports on-demand DL-PRS requests. |
| ***nr-los-nlos-IndicatorSupport***  This field, if present, indicates that the target device supports *nr-los-nlos-Indicator* reporting in IE *NR-DL-AoD-SignalMeasurementInformation*.  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in IE *LOS-NLOS-Indicator.*  - *granularit*y indicates whether the target device supports *LOS-NLOS-Indicator* reporting per TRP, per DL-PRS Resource, or both. |
| ***scheduledLocationRequestSupported***  This field, if present, specifies the positioning modes for which the target device supports scheduled location requests – i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* – and the time base(s) supported for the scheduled location time for each positioning mode. If this field is absent, the target device does not support scheduled location requests. |
| ***nr-dl-prs-AssistanceDataValidity***  This field, if present, indicates that the target device supports validity conditions for pre-configured assistance data and comprises the following subfields:  - ***area-validity*** indicates that the target device supports pre-configured assistance data with area validity. The integer number indicates the maximum number of areas the target device supports. |
| ***multiMeasInSameMeasReport***  This field, if present, indicates that the target device supports multiple measurement instances in a single measurement report. |
| ***mg-ActivationRequest***  This field, if present, indicates that the target device supports low latency measurement gap activation request for DL-PRS measurements. The UE can include this field only if the UE supports *mg-ActivationRequestPRS-Meas* and *mg-ActivationCommPRS-Meas* defined in TS 38.331 [35]. |
| ***locationCoordinateTypes***  This field indicates the geographical location coordinate types that a target device supports for UE-based DL-AoD. TRUE indicates that a location coordinate type is supported and FALSE that it is not. |