**3GPP TSG RAN WG2 Meeting #110-e Draft R2-2005886**

**Electronic meeting, June 01 - 12, 2020**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR--Form--v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.355** | **CR** | **0261** | **rev** | **1** | **Current version:** | **16.0.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](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 | **X** | Core Network |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Introduction of Release-16 UE positioning capabilities | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Intel Corporation, NTT DoCoMo | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos-Core | | | | |  | ***Date:*** | | | 2020-06-01 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To capture capabilities for NR positioning into stage 3 specification. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | To capature NR positioning UE capabilities. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Capability part for NR positioning is missing in stage 3. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.4.1, 6.4.3.3, 6.5.8.1, 6.5.9.4, 6.5.10.6, 6.5.11.6,6.5.12.6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR... CR TBD ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Revision of R2-2005315 | | | | | | | | |

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)

maxEARFCN INTEGER ::= 65535 -- Maximum value of EUTRA carrier frequency

maxEARFCN-Plus1 INTEGER ::= 65536 -- Lowest value extended EARFCN range

maxEARFCN2 INTEGER ::= 262143 -- Highest value extended EARFCN range

-- 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 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] |

*– 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

*– 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,

highAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15 BOOLEAN OPTIONAL

]]

}

-- ASN1STOP

*– 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 ::= SEQUENCE {

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

]]

}

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. |

– *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. |

#### *– FreqBandIndicatorNR*

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

-- ASN1START

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

-- ASN1STOP

*– 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

/\*\*\*Next change\*\*\*/

### 6.4.3 Common NR Positioning Information Elements

/\*\*\*Next change\*\*\*/

#### 6.4.3.3 Common NR capability Information Elements

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

The IE *NR-DL-PRS-ProcessingCapability* defines the common downlink PRS Processing capability.

-- 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,

...

}

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-ProcessingSysmbols-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

},

...

}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands

-- ASN1STOP

| *NR-DL-PRS-ProcessingCapability* field descriptions |
| --- |
| ***maxSupportedFreqLayers***  Indicates the maximum number of positioning frequency layers supported by UE. |
| ***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 of DL PRS symbol in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE. |
| ***maxNumOfDL-PRS-ResProcessedPerSlot***  Indicates the maximum number of DL PRS resources that UE can process in a slot. SCS: 15kHz, 30kHz, 60kHz are applicable for FR1 bands. SCS: 60kHz, 120kHz are applicable for FR2 bands. |
| ***simulLTE-NR-PRS***  Indicates whether the UE supports parallel processing of LTE PRS and NR PRS. |

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

The IE *NR-DL-PRS-ResourcesCapability* defines the 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}

}

},

...

}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands

maxSimultaneousBands-r16 INTEGER ::= 4 -- Maximum number of simultaneously measured bands

-- ASN1STOP

| *NR-DL-PRS-ResourcesCapability* field descriptions |
| --- |
| ***maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer***  Indicates the maximum number of DL PRS Resource Sets per TRP per 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 layer. |
| ***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 TRP across all frequency layers. 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 BC;  fr2-Only: This is applicable for FR2 only BC;  fr1-FR2Mix: This is applicable for BC 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-QCL-ProcessingCapability*

The IE *NR-DL-PRS-QCL-ProcessingCapability* defines the common UE downlink 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;

-- 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,

...

}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands.

-- ASN1STOP

| *NR-DL-PRS-QCL-ProcessingCapability* field descriptions |
| --- |
| ***ssbFromNeighCellAsQCL***  Indicates the support of SSB from neighbor cell as QCL source of a DL PRS. UE supporthing 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/neighbor cell as QCL source of a DL PRS.  Note: It refers to Type-D support for FR2. |

#### *– 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)) OF

SRS-CapabilityPerBand-r16,

srs-CapabilityBandCombinationList-r16 SRS-CapabilityBandCombinationList-r16,

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,

...

}

SRS-CapabilityBandCombinationList-r16 ::= SEQUENCE (SIZE (1..maxBandComb-r16)) OF SRS-capabilityBandCombination-r16

SRS-capabilityBandCombination-r16 ::= SEQUENCE {

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

...

}

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 NUMERATED {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,

...

}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands.

-- ASN1STOP

| *NR-UL-SRS-Capability* field descriptions |
| --- |
| ***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 spatial relations 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* TS38.331 [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;  - *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* TS38.331 [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* TS38.331 [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* TS38.331 [35]. Otherwise, the UE does not include this field;  - *spatialRelation-SRS-PosBasedOnSSB-Neigh* 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; |

/\*\*\*Next change\*\*\*/

6.5.8 NR UL Positioning

6.5.8.1 NR UL Capability Information

*– NR-UL-ProvideCapabilities*

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

-- ASN1START

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

nr-UL-SRS-Capability-r16 NR-UL-SRS-Capability-r16NR,

...

}

-- ASN1STOP

6.5.8.2 NR UL Capability Information Request

*– NR-UL-RequestCapabilities*

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

-- ASN1START

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

...

}

-- ASN1STOP

6.5.9 NR-ECID Positioning

This clause defines the information elements for NR ECID positioning (TS 38.305 [40]).

6.5.9.1 NR-ECID Location Information

– *NR-ECID-ProvideLocationInformation*

The IE *NR-ECID-ProvideLocationInformation* is used by the target device to provide NR ECID location measurements to the location server. It may also be used to provide NR ECID positioning specific error reason.

-- ASN1START

NR-ECID-ProvideLocationInformation-r16 ::= SEQUENCE {

nr-ECID-SignalMeasurementInformation-r16 NR-ECID-SignalMeasurementInformation-r16 OPTIONAL,

nr-ECID-Error-r16 NR-ECID-Error-r16 OPTIONAL,

...

}

-- ASN1STOP

6.5.9.2 NR-ECID Location Information Elements

– *NR-ECID-SignalMeasurementInformation*

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

-- ASN1START

NR-ECID-SignalMeasurementInformation-r16 ::= SEQUENCE {

nr-PrimaryCellMeasuredResults-r16 NR-MeasuredResultsElement-r16,

nr-MeasuredResultsList-r16 NR-MeasuredResultsList-r16 OPTIONAL,

...

}

NR-MeasuredResultsList-r16 ::= SEQUENCE (SIZE(1..32)) OF MeasuredResultsElement-r16

NR-MeasuredResultsElement-r16 ::= SEQUENCE {

systemFrameNumber BIT STRING (SIZE (10)),

trp-ID-r16 TRP-ID-r16 OPTIONAL,

measResultNR-r16 SEQUENCE {

cellResults-r16 SEQUENCE{

resultsSSB-Cell-r16 MeasQuantityResults-r16 OPTIONAL,

resultsCSI-RS-Cell-r16 MeasQuantityResults-r16 OPTIONAL

},

rsIndexResults-r16 SEQUENCE{

resultsSSB-Indexes-r16 ResultsPerSSB-IndexList-r16 OPTIONAL,

resultsCSI-RS-Indexes-r16 ResultsPerCSI-RS-IndexList-r16 OPTIONAL

} OPTIONAL

},

...

}

MeasQuantityResults-r16 ::= SEQUENCE {

nr-RSRP-r16 INTEGER (0..127) OPTIONAL,

nr-RSRQ-r16 INTEGER (0..127) OPTIONAL

}

ResultsPerSSB-IndexList-r16::= SEQUENCE (SIZE (1..64)) OF ResultsPerSSB-Index-r16

ResultsPerSSB-Index-r16 ::= SEQUENCE {

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

ssb-Results-r16 MeasQuantityResults-r16 OPTIONAL

}

ResultsPerCSI-RS-IndexList-r16::= SEQUENCE (SIZE (1..64)) OF ResultsPerCSI-RS-Index-r16

ResultsPerCSI-RS-Index-r16 ::= SEQUENCE {

csi-RS-Index-r16 INTEGER (0..95),

csi-RS-Results-r16 MeasQuantityResults-r16 OPTIONAL

}

-- ASN1STOP

| ***NR-ECID-SignalMeasurementInformation* field descriptions** |
| --- |
| ***systemFrameNumber***  This field specifies the system frame number of the measured cell during which the measurements have been performed. The target device shall include this field if it was able to determine the SFN of the cell at the time of measurement. |
| ***resultsSSB-Cell***  This attribute specifies the SS reference signal received power (SS-RSRP) and quality (SS-RSRQ) measurement aggregated at cell level, as defined in TS 38.331 [35]. |
| ***resultsCSI-RS-Cell***  This attribute specifies the CSI-RS reference signal received power (CSI-RSRP) and quality (CSI-RSRQ) measurement aggregated at cell level, as defined in TS 38.331 [35]. |
| ***ssb-Results***  This attribute specifies the SS reference signal received power (SS-RSRP) and quality (SS-RSRQ) measurement per SSB resource, as defined in TS 38.331 [35]. |
| ***csi-RS-Results***  This attribute specifies the CSI-RS reference signal received power (CSI-RSRP) and quality (CSI-RSRQ) per CSI-RS resource, as defined in TS 38.331 [35]. |
| ***primaryCellMeasuredResults***  This field contains measurements for the primary cell when the target device reports measurements for both primary cell and neighbour cells. This field shall be omitted when the target device reports measurements for the primary cell only, in which case the measurements for the primary cell is reported in the *measuredResultsList*. |

6.5.9.3 NR-ECID Location Information Request

– *NR-ECID-RequestLocationInformation*

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

-- ASN1START

NR-ECID-RequestLocationInformation-r16 ::= SEQUENCE {

requestedMeasurements-r16 BIT STRING { ssrsrpReq (0),

ssrsrqReq (1),

csirsrpReq (2),

csirsrqReq (3) (SIZE(1..8)),

...

}

-- ASN1STOP

| ***NR-ECID-RequestLocationInformation* field descriptions** |
| --- |
| ***requestedMeasurements***  This field specifies the NR-ECID measurements requested. This is represented by a bit string, with a one‑value at the bit position means the particular measurement is requested; a zero‑value means not requested. |

6.5.9.4 NR-ECID Capability Information

– *NR-ECID-ProvideCapabilities*

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

-- ASN1START

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

nr-ECID-MeasSupported -r16 BIT STRING { ssrsrpSup (0),

ssrsrqSup (1),

csirsrpSup (2),

csirsrqSup (3) (SIZE(1..8)),

periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

triggeredReporting-r16 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

| *NR-ECID-ProvideCapabilities* field descriptions |
| --- |
| ***nr-ECID-MeasSupported:***  Indicates the supported NR ECID measurements:  - *ssrsrpSup* indicates the UE supports SSB based cell/beam specific RSRP measurement;  - *ssrsqpSup* indicates the UE supports SSB based cell/beam specific RSRQ measurement;  - *csirsrpSup* indicates the UE supports CSI-RS based cell/beam specific RSRP measurement;  - *csirsrqSup* indicates the UE supports CSI-RS based cell/beam specific RSRQ measurement. |

6.5.9.5 NR-ECID Capability Information Request

– *NR-ECID-RequestCapabilities*

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

-- ASN1START

NR-ECID-RequestCapabilities ::= SEQUENCE {

...

}

-- ASN1STOP

6.5.9.6 NR-ECID Error Elements

– *NR-ECID-Error*

The IE *NR-ECID-Error* is used by the location server or target device to provide NR-ECID error reasons to the target device or location server, respectively.

-- ASN1START

NR-ECID-Error-r16 ::= CHOICE {

locationServerErrorCauses-r16 NR-ECID-LocationServerErrorCauses-r16,

targetDeviceErrorCauses-r16 NR-ECID-TargetDeviceErrorCauses-r16,

...

}

-- ASN1STOP

– *NR-ECID-LocationServerErrorCauses*

The IE *NR-ECID-LocationServerErrorCauses* is used by the location server to provide NR-ECID error reasons to the target device.

-- ASN1START

NR-ECID-LocationServerErrorCauses-r16 ::= SEQUENCE {

Cause-r16 ENUMERATED { undefined,

...

},

...

}

-- ASN1STOP

– *NR-ECID-TargetDeviceErrorCauses*

The IE *NR-ECID-TargetDeviceErrorCauses* is used by the target device to provide NR-ECID error reasons to the location server.

-- ASN1START

NR-ECID-TargetDeviceErrorCauses-r16 ::= SEQUENCE {

Cause-r16 ENUMERATED { undefined,

requestedMeasurementNotAvailable,

notAllrequestedMeasurementsPossible,

...

},

ss-RSRPMeasurementNotPossible NULL OPTIONAL,

ss-RSRQMeasurementNotPossible NULL OPTIONAL,

csi-RSRPMeasurementNotPossible NULL OPTIONAL,

csi-RSRQMeasurementNotPossible NULL OPTIONAL,

...

}

-- ASN1STOP

6.5.10 NR-DL-TDOA Positioning

This clause defines the information elements for NR downlink TDOA positioning (TS 38.305 [40]).

6.5.10.1 NR-DL-TDOA Assistance Data

– *NR-DL-TDOA-ProvideAssistanceData*

The IE *NR-DL-TDOA-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑assisted and UE-based NR DL TDOA. It may also be used to provide NR DL TDOA positioning specific error reason.

-- ASN1START

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

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

nr-SelectedDL-PRS-IndexList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers)) OF NR-SelectedDL-PRS-PerFreq-r16 OPTIONAL, -- Need ON

nr-PositionCalculationAssistanceData-r16

NR-PositionCalculationAssistanceData-r16

OPTIONAL, -- Cond UEB

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

...

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *UEB* | The field is mandatory present for the UE based NR-DL-TDOA; otherwise it is not present. |

6.5.10.2 NR-DL-TDOA Assistance Data Request

– *NR-DL-TDOA-RequestAssistanceData*

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

-- ASN1START

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

nr-PhysCellId-r16 NR-PhysCellId-r16 OPTIONAL,

nr-AdType-r16 BIT STRING { dl-prs (0),

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

...

}

-- ASN1STOP

| ***NR-DL-TDOA-RequestAssistanceData* field descriptions** |
| --- |
| ***nr-PhysCellId***  This field specifies the NR physical cell identity of the current primary cell of the target device. |
| ***nr-AdType***  This field indicates the requested assistance data. *dl-prs* means requested assistance data is *nr-DL-PRS-AssistanceData*, *posCalc* means requested assistance data is *nr-PositionCalculationAssistanceData* for UE based positioning. |

6.5.10.3 NR-DL-TDOA Location Information

– *NR-DL-TDOA-ProvideLocationInformation*

The IE *NR-DL-TDOA-ProvideLocationInformation* is used by the target device to provide NR-DL-TDOA location measurements to the location server. It may also be used to provide NR-DL-TDOA positioning specific error reason.

-- ASN1START

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

nr-DL-TDOA-SignalMeasurementInformation-r16

DL-TDOA-SignalMeasurementInformation-r16 OPTIONAL,

nr-dl-tdoa-LocationInformation-r16 NR-DL-TDOA-LocationInformation-r16 OPTIONAL, -- Cond UEB

nr-DL-TDOA-Error-r16 DL-TDOA-Error-r16 OPTIONAL,

...

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *UEB* | The field is mandatory present for the UE based NR-DL-TDOA; otherwise it is not present. |

6.5.10.4 NR-DL-TDOA Location Information Elements

– *NR-DL-TDOA-SignalMeasurementInformation*

The IE *NR-DL-TDOA-SignalMeasurementInformation* is used by the target device to provide NR-DL TDOA measurements to the location server. The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP in case RSTD measurements are reported. The first TRP in the list may or may not be the reference TRP indicated in the *NR-DL-PRS-AssistanceData*. Furthermore, the target device selects a reference resource per TRP, and compiles the measurements per TRP based on the selected reference resource.

-- ASN1START

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

dl-PRS-ReferenceInfo-r16 DL-PRS-IdInfo-r16,

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

...

}

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

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

trp-ID-r16 TRP-ID-r16 OPTIONAL,

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-RSTD-r16 INTEGER (0..ffs), -- FFS on the value range

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

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

nr-PRS-RSRP-Result-r16 INTEGER (FFS) OPTIONAL, -- FFS, value range to be decided in RAN4.

nr-DL-TDOA-AdditionalMeasurements-r16 NR-DL-TDOA-AdditionalMeasurements-r16,

...

}

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

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-RSTD-ResultDiff-r16 INTEGER (0..ffs), -- FFS on the value range to be decided in RAN4

dl-PRS-RSRP-ResultDiff-r16 INTEGER (FFS) OPTIONAL, -- FFS on the value range to be decided in RAN4

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

...

}

nrMaxTRPs INTEGER ::= 256 -- Max TRPs per UE

-- ASN1STOP

| ***NR-DL-TDOA-SignalMeasurementInformation* field descriptions** |
| --- |
| ***nr-PRS-RSRP-Result***  This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |
| ***nr-AdditionalPathList***  This field specifies one or more additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-RSTD* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. |
| ***nr-RSTD***  This field specifies the relative timing difference between this neighbour TRP and the PRS reference TRP, as defined in FFS. Mapping of the measured quantity is defined as in FSS. |
| ***nr-TimingMeasQuality***  This field specifies the target device′s best estimate of the quality of the measurement. |

*– NR-DL-TDOA-LocationInformation*

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

-- ASN1START

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

measurementReferenceTime-r16 CHOICE {

systemFrameNumber-r16 NR-TimeStamp-r16,

utc-time-r16 UTCTime,

...

} OPTIONAL,

...

}

-- ASN1STOP

| ***NR-DL-TDOA-LocationInformation* field descriptions** |
| --- |
| ***measurementReferenceTime***  This field specifies the time for which the location estimate is valid. |

6.5.10.5 NR-DL-TDOA Location Information Request

– *NR-DL-TDOA-RequestLocationInformation*

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

-- ASN1START

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

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

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

} (SIZE(1..8)),

nr-AssistanceAvailability-r16 BOOLEAN,

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

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

...

}

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

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

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

timingReportingGranularityFactor-r16 INTEGER (FFS) OPTIONAL -- FFS in RAN4

}

-- ASN1STOP

| ***NR-DL-TDOA-RequestLocationInformation* field descriptions** |
| --- |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***nr-RequestedMeasurements***  This field specifies the NR DL-TDOA measurements requested. This is represented by a bit string, with a one‑value at the bit position means the particular measurement is requested; a zero‑value means not requested. |
| ***nr-DL-PRS-RstdMeasurementInfoRequest***  This field indicates whether the target device is requested to report DL PRS Resource ID(s) or DL PRS Resource Set ID(s) used for determining the timing of each TRP in RSTD measurements. |
| ***maxDL-PRS-RSRP-MeasurementsPerTRP***  This field specifies the maximum number of DL PRS RSRP measurements on different DL PRS resources from the same TRP. |
| ***maxDL-PRS-RSTD-MeasurementsPerTRPPair***  This field specifies the maximum number of. DL PRS RSTD measurements per pair of TRPs. The maximum number is defined across all positioning frequency layers. |
| ***timingReportingGranularityFactor***  This field specifies the reporting granularity for the UE timing measurements (DL RSTD, the UE Rx-Tx time difference). |

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 ENUMERATED { supported } 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. |

#### *– NR-DL-TDOA-MeasurementCapability*

The IE *NR-DL-TDOA-MeasurementCapability* defines the DL-TDOA measurement capability. The UE can include this IE only if the UE supports *NR-DL-PRS-ResourcesCapability* for DL-TDOA. Otherwise, the UE does not include this IE;

-- ASN1START

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

dl-RSTD-MeasurementPerPairOfTRP-FR1-r16 INTEGER (1..4),

dl-RSTD-MeasurementPerPairOfTRP-FR2-r16 INTEGER (1..4),

supportOfDL-PRS-RSRP-MeasFR1-r16 ENUMERATED { supported} OPTIONAL,

supportOfDL-PRS-RSRP-MeasFR2-r16 ENUMERATED { supported} OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-TDOA-MeasurementCapability* field descriptions |
| --- |
| ***dl-RSTD-MeasurementPerPairOfTRP-FR1***  Indicates number of DL RSTD measurements per pair of TRPs on FR1. |
| ***dl-RSTD-MeasurementPerPairOfTRP-FR2***  Indicates number of DL RSTD measurements per pair of TRPs on FR2. |
| ***supportOfDL-PRS-RSRP-MeasFR1***  Indicates whether the UE supports DL PRS RSRP measurement for DL-TDOA on FR1. |
| ***supportOfDL-PRS-RSRP-MeasFR2***  Indicates whether the UE supports DL PRS RSRP measurement for DL-TDOA on FR2. |

6.5.10.7 NR-DL TDOA Capability Information Request

– *NR-DL-TDOA-RequestCapabilities*

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

-- ASN1START

NR-DL-TDOA-RequestCapabilities ::= SEQUENCE {

...

}

-- ASN1STOP

6.5.10.8 NR-DL-TDOA Error Elements

– *NR-DL-TDOA-Error*

The IE *NR-DL-TDOA-Error* is used by the location server or target device to provide NR DL-TDOA error reasons to the target device or location server, respectively.

-- ASN1START

NR-DL-TDOA-Error-r16 ::= CHOICE {

locationServerErrorCauses-r16 NR-DL-TDOA-LocationServerErrorCauses-r16,

targetDeviceErrorCauses-r16 NR-DL-TDOA-TargetDeviceErrorCauses-r16,

...

}

-- ASN1STOP

– *NR-DL-TDOA-LocationServerErrorCauses*

The IE *NR-DL-TDOA-LocationServerErrorCauses* is used by the location server to provide NR DL-TDOA error reasons to the target device.

-- ASN1START

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

cause-r16 ENUMERATED { undefined,

assistanceDataNotSupportedByServer,

assistanceDataSupportedButCurrentlyNotAvailableByServer,

notProvidedAssistanceDataNotSupportedByServer, ...

},

...

}

-- ASN1STOP

– *NR-DL-TDOA-TargetDeviceErrorCauses*

The IE *NR-DL-TDOA-TargetDeviceErrorCauses* is used by the target device to provide NR-DL-TDOA error reasons to the location server.

-- ASN1START

DL-TDOA-TargetDeviceErrorCauses-r16 ::= SEQUENCE {

cause-r16 ENUMERATED { undefined,

assistance-data-missing,

unableToMeasureAnyTRP,

attemptedButUnableToMeasureSomeNeighbourTRPs,

thereWereNotEnoughSignalsReceivedForUeBasedDL-TDOA,

locationCalculationAssistanceDataMissing, ...

},

nr-PRS-RSRPMeasurementNotPossible-r16 NULL OPTIONAL,

nr-RSTDMeasurementNotPossible-r16 NULL OPTIONAL,

...

}

-- ASN1STOP

6.5.11 NR-DL-AoD Positioning

This clause defines the information elements for NR downlink AoD positioning (TS 38.305 [40]).

6.5.11.1 NR-DL-AoD Assistance Data

– *NR-DL-AoD-ProvideAssistanceData*

The IE *NR-DL-AoD-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑assisted NR-DL-Aod. It may also be used to provide NR DL AoD positioning specific error reason.

-- ASN1START

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

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

nr-SelectedDL-PRS-IndexList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers)) OF NR-SelectedDL-PRS-PerFreq-r16 OPTIONAL, -- Need ON

nr-PositionCalculationAssistanceData-r16

NR-PositionCalculationAssistanceData-r16

OPTIONAL, -- Cond UEB

nr-DL-AoD-Error-r16 NR-DL-AoD-Error-r16 OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *UEB* | The field is mandatory present for the UE based NR-DL-TDOA; otherwise it is not present. |

6.5.11.2 NR-DL-AoD Assistance Data Request

– *NR-DL-AoD-RequestAssistanceData*

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

-- ASN1START

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

nr-PhysCellId-r16 NR-PhysCellId-r16 OPTIONAL,

nr-AdType-r16 BIT STRING { dl-prs (0), posCalc (1) } (SIZE (1..8)),

...

}

-- ASN1STOP

| ***NR-DL-AoD-RequestAssistanceData* field descriptions** |
| --- |
| ***nr-PhysCellId***  This field specifies the NR physical cell identity of the current primary cell of the target device. |
| ***nr-AdType***  This field indicates the requested assistance data. *dl-prs* means requested assistance data is *nr-DL-PRS-AssistanceData*, *posCalc* means requested assistance data is *nr-PositionCalculationAssistanceData* for UE based positioning. |

6.5.11.3 NR-DL-AoD Location Information

– *NR-DL-AoD-ProvideLocationInformation*

The IE *NR-DL-AoD-ProvideLocationInformation* is used by the target device to provide NR DL-AoD location measurements to the location server. It may also be used to provide NR DL-AoD positioning specific error reason.

-- ASN1START

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

nr-DL-AoD-SignalMeasurementInformation-r16

NR-DL-AoD-SignalMeasurementInformation-r16 OPTIONAL,

nr-dl-aod-LocationInformation-r16 NR-DL-AoD-LocationInformation-r16 OPTIONAL, -- Cond UEB

nr-DL-AoD-Error-r16 NR-DL-AoD-Error-r16 OPTIONAL,

...

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *UEB* | The field is mandatory present for the UE based NR-DL-AoD; otherwise it is not present. |

6.5.11.4 NR-DL-AoD Location Information Elements

– *NR-DL-AoD-SignalMeasurementInformation*

The IE *NR-DL-AoD-SignalMeasurementInformation* is used by the target device to provide NR DL AoD measurements to the location server. The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP.

-- ASN1START

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

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

...

}

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

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

trp-ID-r16 TRP-ID-r16 OPTIONAL,

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-PRS-RSRP-Result-r16 INTEGER (FFS) OPTIONAL, -- Need RAN4 inputs on value range

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

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

nr-DL-Aod-AdditionalMeasurements-r16 NR-DL-AoD-AdditionalMeasurements-r16,

...

}

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-PRS-RSRP-ResultDiff-r16 INTEGER (FFS) OPTIONAL, -- Need RAN4 inputs on value range

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

...

}

nrMaxTRPs INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

| ***NR-DL-AoD-SignalMeasurementInformation* field descriptions** |
| --- |
| ***nr-PRS-RSRP-Result***  This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |

– *NR-DL-AoD-LocationInformation*

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

-- ASN1START

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

measurementReferenceTime-r16 CHOICE {

sfn-time-r16 NR-TimeStamp-r16,

utc-time-r16 UTCTime,

...

} OPTIONAL,

...

}

-- ASN1STOP

| ***NR-DL-AoD-LocationInformation* field descriptions** |
| --- |
| ***measurementReferenceTime***  This field specifies the time for which the location estimate is valid. |

6.5.11.5 NR-DL-AoD Location Information Request

– *NR-DL-AoD-RequestLocationInformation*

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

-- ASN1START

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

nr-AssistanceAvailability-r16 BOOLEAN,

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

...

}

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

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

}

-- ASN1STOP

| ***NR-DL-AoD-RequestLocationInformation* field descriptions** |
| --- |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***maxDL-PRS-RSRP-MeasurementsPerTRP***  This field specifies the maximum number of DL PRS RSRP measurements on different DL PRS resources from the same TRP. |

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 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

#### *– NR-DL-AoD-MeasurementCapability*

The IE *NR-DL-AoD-MeasurementCapability* defines the DL-AoD measurement capability. The UE can include this IE only if the UE supports *NR-DL-PRS-ResourcesCapability* for DL-AoD. Otherwise, the UE does not include this IE;

-- ASN1START

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

maxDL-PRS-RSRP-MeasurementFR1-r16 INTEGER (1..8),

maxDL-PRS-RSRP-MeasurementFR2-r16 INTEGER (1..8),

dl-AoD-MeasCapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

DL-AoD-MeasCapabilityPerBand-r16,

...

}

DL-AoD-MeasCapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

simul-NR-DL-AoD-DL-TDOA-r16 ENUMERATED { supported} OPTIONAL,

simul-NR-DL-AoD-Multi-RTT-r16 ENUMERATED { supported} OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-AoD-MeasurementCapability* field descriptions |
| --- |
| ***maxDL-PRS-RSRP-MeasurementFR1***  Indicates the maximum number of DL PRS RSRP measurements on different PRS resources from the same TRP supported by the UE on FR1. |
| ***maxDL-PRS-RSRP-MeasurementFR2***  Indicates the maximum number of DL PRS RSRP measurements on different PRS resources from the same TRP supported by the UE on FR2. |
| ***simul-NR-DL-AoD-DL-TDOA***  Indicates whether the UE supports simultaneous processing for DL-AoD and DL-TDoA measurements. The UE can include this field only if the UE supports DL-TDOA and DL-AoD. Otherwise, the UE does not include this field; |
| ***simul-NR-DL-AoD-Multi-RTT***  Indicates whether the UE supports simultaneous processing for DL AoD and Multi-RTT measurements. The UE can include this field only if the UE supports Multi-RTT, *srs-PosResources* TS38.331 [35] and DL-AoD. Otherwise, the UE does not include this field; |

6.5.11.7 NR-DL AoD Capability Information Request

– *NR-DL-AoD-RequestCapabilities*

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

-- ASN1START

NR-DL-AoD-RequestCapabilities ::= SEQUENCE {

...

}

-- ASN1STOP

6.5.11.8 NR-DL-AoD Error Elements

– *NR-DL-AoD-Error*

The IE *NR-DL-AoD-Error* is used by the location server or target device to provide NR DL-AoD error reasons to the target device or location server, respectively.

-- ASN1START

NR-DL-AoD-Error-r16 ::= CHOICE {

locationServerErrorCauses-r16 NR-DL-AoD-LocationServerErrorCauses-r16,

targetDeviceErrorCauses-r16 NR-DL-AoD-TargetDeviceErrorCauses-r16,

...

}

-- ASN1STOP

– *NR-DL-AoD-LocationServerErrorCauses*

The IE *NR-DL-AoD-LocationServerErrorCauses* is used by the location server to provide NR DL-AoD error reasons to the target device.

-- ASN1START

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

cause-r16 ENUMERATED { undefined,

assistanceDataNotSupportedByServer,

assistanceDataSupportedButCurrentlyNotAvailableByServer,

notProvidedAssistanceDataNotSupportedByServer,

...

},

...

}

-- ASN1STOP

– *NR-DL-AoD-TargetDeviceErrorCauses*

The IE *NR-DL-AoD-TargetDeviceErrorCauses* is used by the target device to provide NR-DL-AoD error reasons to the location server.

-- ASN1START

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

cause-r16 ENUMERATED { undefined,

assistance-data-missing,

unableToMeasureAnyTRP,

attemptedButUnableToMeasureSomeNeighbourTRPs,

thereWereNotEnoughSignalsReceivedForUeBasedDL-AoD,

locationCalculationAssistanceDataMissing,

...

},

nr-PRS-RSRPMeasurementNotPossible-r16 NULL OPTIONAL,

...

}

-- ASN1STOP

6.5.12 NR-Multi-RTT Positioning

This clause defines the information elements for downlink NR-Multi-RTT positioning (TS 38.305 [40]).

6.5.12.1 NR-Multi-RTT Assistance Data

– *NR-Multi-RTT-ProvideAssistanceData*

The IE *NR-Multi-RTT-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑assisted NR Multi-RTT. It may also be used to provide NR Multi-RTT positioning specific error reason.

-- ASN1START

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

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

nr-SelectedDL-PRS-IndexList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers)) OF NR-SelectedDL-PRS-PerFreq-r16 OPTIONAL, -- Need ON

nr-Multi-RTT-Error-r16 NR-Multi-RTT-Error-r16 OPTIONAL, -- Need ON

...

}

-- ASN1STOP

6.5.12.2 NR-Multi-RTT Assistance Data Request

– *NR-Multi-RTT-RequestAssistanceData*

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

-- ASN1START

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

nr-PhysCellId-r16 NR-PhysCellId-r16 OPTIONAL,

nr-AdType-r16 BIT STRING { dl-prs (0), ul-srs (1) } (SIZE (1..8)),

...

}

-- ASN1STOP

| ***NR-Multi-RTT-RequestAssistanceData* field descriptions** |
| --- |
| ***nr-PhysCellId***  This field specifies the NR physical cell identity of the current primary cell of the target device. |

6.5.12.3 NR-Multi-RTT Location Information

– *NR-Multi-RTT-ProvideLocationInformation*

The IE *NR-Multi-RTT-ProvideLocationInformation* is used by the target device to provide NR Multi-RTT location measurements to the location server. It may also be used to provide NR Multi-RTT positioning specific error reason.

-- ASN1START

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

nr-Multi-RTT-SignalMeasurementInformation-r16 NR-Multi-RTT-SignalMeasurementInformation-r16 OPTIONAL,

nr-Multi-RTT-Error-r16 NR-Multi-RTT-Error-r16 OPTIONAL,

...

}

-- ASN1STOP

6.5.12.4 NR-Multi-RTT Location Information Elements

– *NR-Multi-RTT-SignalMeasurementInformation*

The IE *NR-Multi-RTT-SignalMeasurementInformation* is used by the target device to provide NR Multi-RTT measurements to the location server. The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP.

-- ASN1START

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

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

...

}

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

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

trp-ID-r16 TRP-ID-r16 OPTIONAL,

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

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

nr-UE-RxTxTimeDiff-r16 INTEGER (0..ffs) OPTIONAL, -- FFS on the value range to be decided in RAN4

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

nr-PRS-RSRP-Result-r16 INTEGER (FFS) OPTIONAL, -- FFS, value range to be decided in RAN4.

nr-Multi-RTT-AdditionalMeasurements-r16 NR-Multi-RTT-AdditionalMeasurements-r16,

...

}

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

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

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

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

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

nr-PRS-RSRP-ResultDiff-r16 INTEGER (FFS) OPTIONAL, -- FFS, value range to be decided in RAN4.

nr-UE-RxTxTimeDiffAdditional-r16 INTEGER (0..ffs) OPTIONAL, -- FFS on the value range

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

...

}

nrMaxTRPs INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

| ***NR-Multi-RTT-SignalMeasurementInformation* field descriptions** |
| --- |
| ***nr-PRS-RSRP-Result***  This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |
| ***nr-UE-RxTxTimeDiff***  This field specifies the UE Rx–Tx time difference measurement, as defined in FFS. |
| ***nr-AdditionalPathList***  This field specifies one or more additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-UE-RxTxTimeDiff* value or the *nr-UE-RxTxTimeDiffAdditional* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. |

6.5.12.5 NR-Multi-RTT Location Information Request

– *NR-Multi-RTT-RequestLocationInformation*

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

-- ASN1START

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

nr-RequestedMeasurements-r16 BIT STRING { prsrsrpReq (0)} (SIZE(1..8)),

nr-AssistanceAvailability-r16 BOOLEAN,

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

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

...

}

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

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

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

timingReportingGranularityFactor-r16 INTEGER (FFS) OPTIONAL -- FFS in RAN4

}

-- ASN1STOP

| ***NR-Multi-RTT-RequestLocationInformation* field descriptions** |
| --- |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***maxDL-PRS-RSRP-MeasurementsPerTRP***  This field specifies the maximum number of DL PRS RSRP measurements on different DL PRS resources from the same TRP. |
| ***maxDL-PRS-RxTxTimeDiffMeasPerTRP***  This field specifies the maximum number of UE-Rx-Tx time difference measurements for different DL PRS resources or DL PRS resource sets per TRP. |
| ***timingReportingGranularityFactor***  This field specifies the reporting granularity for the UE timing measurements (DL RSTD, the UE Rx-Tx time difference). |

6.5.12.6 NR-Multi-RTT Capability Information

– *NR-Multi-RTT-ProvideCapabilities*

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

-- ASN1START

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

nr-Multi-RTT-PRS-Capability-r16  NR-DL-PRS-ResourcesCapability-r16,

nr-Multi-RTT-MeasurementCapability-r16 NR-Multi-RTT-MeasurementCapability-r16,

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

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

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

additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

#### *– NR-Multi-RTT-MeasurementCapability*

The IE *NR-Multi-RTT-MeasurementCapability* defines the Multi-RTT measurement capability. The UE can include this IE only if the UE supports *NR-DL-PRS-ResourcesCapability* for Multi-RTT. Otherwise, the UE does not include this IE;

-- ASN1START

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

maxNrOfRx-TX-MeasFR1-r16 INTEGER (1..4) OPTIONAL,

maxNrOfRx-TX-MeasFR2-r16 INTEGER (1..4) OPTIONAL,

supportOfRSRP-MeasFR1-r16 ENUMERATED { supported} OPTIONAL,

supportOfRSRP-MeasFR2-r16 ENUMERATED { supported} OPTIONAL,

srs-AssocPRS-MultiLayersFR1-r16 ENUMERATED { supported} OPTIONAL,

srs-AssocPRS-MultiLayersFR2-r16 ENUMERATED { supported} OPTIONAL,

...

}

-- ASN1STOP

| *NR-Multi-RTT-MeasurementCapability* field descriptions |
| --- |
| ***maxNrOfRx-TX-MeasFR1***  Indicates the maximum number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set on FR1. |
| ***maxNrOfRx-TX-MeasFR2***  Indicates the maximum number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set on FR2. |
| ***srs-AssocPRS-MultiLayersFR1***  Indicates whether the UE supports measurements derived on one or more DL PRS resource/resource sets which may be in different positioning frequency layers for SRS transmitted in a single CC. PRS and SRS may be on different bands. This is for FR1 only. |
| ***srs-AssocPRS-MultiLayersFR2***  Indicates whether the UE supports measurements derived on one or more DL PRS resource/resource sets which may be in different positioning frequency layers for SRS transmitted in a single CC. PRS and SRS may be on different bands. This is for FR2 only. |
| ***supportOfRSRP-MeasFR1***  Indicates whether the UE supports RSRP measurement for Multi-RTT on FR1. |
| ***supportOfRSRP-MeasFR2***  Indicates whether the UE supports RSRP measurement for Multi-RTT on FR2. |

6.5.12.7 NR-Multi-RTT Capability Information Request

– *NR-Multi-RTT-RequestCapabilities*

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

-- ASN1START

NR-Multi-RTT-RequestCapabilities ::= SEQUENCE {

...

}

-- ASN1STOP

6.5.12.8 NR-Multi-RTT Error Elements

– *NR-Multi-RTT-Error*

The IE *NR-Multi-RTT-Error* is used by the location server or target device to provide NR Multi-RTT error reasons to the target device or location server, respectively.

-- ASN1START

NR-Multi-RTT-Error-r16 ::= CHOICE {

locationServerErrorCauses-r16 NR-Multi-RTT-LocationServerErrorCauses-r16,

targetDeviceErrorCauses-r16 NR-Multi-RTT-TargetDeviceErrorCauses-r16,

...

}

-- ASN1STOP

– *NR-Multi-RTT-LocationServerErrorCauses*

The IE *NR-Multi-RTT-LocationServerErrorCauses* is used by the location server to provide NR Multi-RTT error reasons to the target device.

-- ASN1START

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

cause-r16 ENUMERATED { undefined,

assistanceDataNotSupportedByServer,

assistanceDataSupportedButCurrentlyNotAvailableByServer,

...

},

...

}

-- ASN1STOP

– *NR-Multi-RTT-TargetDeviceErrorCauses*

The IE *NR-Multi-RTT-TargetDeviceErrorCauses* is used by the target device to provide NR Multi-RTT error reasons to the location server.

-- ASN1START

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

cause-r16 ENUMERATED { undefined,

dl-assistance-data-missing,

unableToMeasureAnyTRP,

attemptedButUnableToMeasureSomeNeighbourTRPs,

ul-srs-configuration-missing,

unableToTransmit-ul-prs,

...

},

nr-PRS-RSRPMeasurementNotPossible-r16 NULL OPTIONAL,

nr-UERxTxMeasurementNotPossible-r16 NULL OPTIONAL,

...

}

-- ASN1STOP

*– End of LPP-PDU-Definitions*

-- ASN1START

END

-- ASN1STOP