**3GPP TSG- WG2 Meeting #131 *R2-25xxxxx***

**Bengaluru, India,**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** | **0559** | **rev** | **1** | **Current version:** |  |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
|  | | | | | | | | |

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

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Introduction of AI/ML Positioning Accuracy Enhancements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Incorporated (Rapporteur) | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | -Core | | | | |  | ***Date:*** | | | 2025-09-05 |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | |  |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduce support for AI/ML positioning accuracy enhancements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Addition of NR DL AI/ML Positioning Method:   * Addition of capability, assistance data, and location information transfer messages for DL AI/ML positioning. * Updates of Common NR Positioning Information Elements to support above messages for DL AI/ML positioning. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | AI/ML positioning accuracy enhancements cannot be supported. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.2, 4.1.3, 6.3, 6.4.2, 6.4.3, 6.5.10.1, 6.5.10.4, 6.5.11.1, 6.5.11.4, 6.5.13 (new), 7.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **x** |  | Other core specifications | | | | TS/TR 38.305 CR 0190 | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Draft version history:  RAN2#129bis:First draft version v00 in R2-2502618.  RAN2#130:v01 (R2-2504129) updates based on  [POST129bis][015][AI PHY] discussion,  as summarized in R2-2504128.  RAN2#131:v02 (R2-2505704) updates based on [POST130][025][AI PHY] discussion,  as summarized in R2-2505703.  Rev1:Implementation of agreements from RAN2#131.  Addition of RAN1 capabilities per R1-2506424. | | | | | | | | |

## 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply.

ADR Accumulated Delta-Range

A‑GNSS Assisted‑GNSS

AI Artificial Intelligence

AoA Angle-of-Arrival

AoD Angle-of-Departure

AP Access Point

ARFCN Absolute Radio Frequency Channel Number

ARP Antenna Reference Point

BDS BeiDou Navigation Satellite System

BIPM Bureau International des Poids et Mesures (International Bureau of Weights and Measures)

BSSID Basic Service Set Identifier

BTS Base Transceiver Station (GERAN)

CID Cell-ID (positioning method)

CNAV Civil Navigation

CRS Cell-specific Reference Signals

DL-AoD Downlink Angle-of-Departure

DL-TDOA Downlink Time Difference Of Arrival

ECEF Earth-Centered, Earth-Fixed

ECGI Evolved Cell Global Identifier

ECI Earth-Centered-Inertial

E‑CID Enhanced Cell-ID (positioning method)

EGNOS European Geostationary Navigation Overlay Service

E-SMLC Enhanced Serving Mobile Location Centre

E-UTRA Evolved Universal Terrestrial Radio Access

E-UTRAN Evolved Universal Terrestrial Radio Access Network

EOP Earth Orientation Parameters

EPDU External Protocol Data Unit

FDMA Frequency Division Multiple Access

FEC Forward Error Correction

FKP (German) Flächen-Korrektur-Parameter (area correction parameter)

FTA Fine Time Assistance

GAGAN GPS Aided Geo Augmented Navigation

GLONASS GLObal'naya NAvigatsionnaya Sputnikovaya Sistema (Engl.: Global Navigation Satellite System)

GNSS Global Navigation Satellite System

GPS Global Positioning System

HA GNSS High-Accuracy GNSS (RTK, PPP)

HPL Horizontal Protection Level

ICD Interface Control Document

IGS International GNSS Service

IOD Issue of Data

IRNSS Indian Regional Navigation Satellite System

IS Interface Specification

LLA Latitude Longitude Altitude

LMF Location Management Function

LOS Line-of-Sight

LPP LTE Positioning Protocol

LPPa LTE Positioning Protocol Annex

LSB Least Significant Bit

MAC Master Auxiliary Concept

MBS Metropolitan Beacon System

MG Measurement Gap

ML Machine Learning

MO-LR Mobile Originated Location Request

MSAS Multi-functional Satellite Augmentation System

MSB Most Significant Bit

msd mean solar day

MT-LR Mobile Terminated Location Request

Multi-RTT Multiple-Round Trip Time

NAV Navigation

NavIC NAVigation with Indian Constellation

NB-IoT NarrowBand Internet of Things

NCGI NR Cell Global Identifier

NICT National Institute of Information and Communications Technology

NI-LR Network Induced Location Request

NLOS Non-Line-of-Sight

NPRS Narrowband Positioning Reference Signals

NR NR Radio Access

NRSRP Narrowband Reference Signal Received Power

NRSRQ Narrowband Reference Signal Received Quality

NTN Non-Terrestrial Network

NTSC National Time Service Center of Chinese Academy of Sciences

OSR Observation Space Representation

OTDOA Observed Time Difference Of Arrival

PBCH Physical Broadcast Channel

PDU Protocol Data Unit

PFL Positioning Frequency Layer

PL Protection Level

PPP Precise Point Positioning

PPW PRS Processing Window

PRB Physical Resource Block

PRC Pseudo‑Range Correction

PRS Positioning Reference Signals

posSIB Positioning System Information Block

PRU Positioning Reference Unit

PZ-90 Parametry Zemli 1990 Goda – Parameters of the Earth Year 1990

QCL Quasi Co-Location

QZS Quasi Zenith Satellite

QZSS Quasi-Zenith Satellite System

QZST Quasi-Zenith System Time

RF Radio Frequency

RP Reception Point

RRC Range‑Rate Correction

Radio Resource Control

RSCP Reference Signal Carrier Phase

RSCPD Reference Signal Carrier Phase Difference

RSRP Reference Signal Received Power

RSRPP Reference Signal Received Path Power

RSRQ Reference Signal Received Quality

RSTD Reference Signal Time Difference

RTK Real-Time Kinematic

RTT Round Trip Time

RU Russia

SBAS Space Based Augmentation System

SET SUPL Enabled Terminal

SFN System Frame Number

SLP SUPL Location Platform

SRS Sounding Reference Signal

SS Synchronization Signal

SSB Synchronization Signal Block, SS/PBCH Block

SSID Service Set Identifier

SSR State Space Representation

STEC Slant TEC

SUPL Secure User Plane Location

SV Space Vehicle

TB Terrestrial Beacon

TBS Terrestrial Beacon System

TEC Total Electron Content

TECU TEC Units

TEG Timing Error Group

TIR Target Integrity Risk

TLM Telemetry

TOA Time Of Arrival

TOD Time Of Day

TOW Time Of Week

TP Transmission Point

TRP Transmission-Reception Point

UDRE User Differential Range Error

ULP User Plane Location Protocol

URA User Range Accuracy

USNO US Naval Observatory

UT1 Universal Time No.1

UTC Coordinated Universal Time

VPL Vertical Protection Level

WAAS Wide Area Augmentation System

WGS‑84 World Geodetic System 1984

WLAN Wireless Local Area Network

### 4.1.3 LPP Position Methods

Internal LPP positioning methods and associated signalling content are defined in this specification.

This version of the specification defines OTDOA (based on LTE signals), A-GNSS, E-CID (based on LTE signals), Sensor, TBS, WLAN, Bluetooth, NR E-CID, NR DL-TDOA, NR DL-AoD, NR Multi-RTT, and NR DL AI/ML positioning methods.

## 6.3 Message Body IEs

#### – *RequestCapabilities*

The *RequestCapabilities* message body in a LPP message is used by the location server to request the target device capability information for LPP and the supported individual positioning methods.

-- ASN1START

RequestCapabilities ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

requestCapabilities-r9 RequestCapabilities-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RequestCapabilities-r9-IEs ::= SEQUENCE {

commonIEsRequestCapabilities CommonIEsRequestCapabilities OPTIONAL, -- Need ON

a-gnss-RequestCapabilities A-GNSS-RequestCapabilities OPTIONAL, -- Need ON

otdoa-RequestCapabilities OTDOA-RequestCapabilities OPTIONAL, -- Need ON

ecid-RequestCapabilities ECID-RequestCapabilities OPTIONAL, -- Need ON

epdu-RequestCapabilities EPDU-Sequence OPTIONAL, -- Need ON

...,

[[ sensor-RequestCapabilities-r13 Sensor-RequestCapabilities-r13 OPTIONAL, -- Need ON

tbs-RequestCapabilities-r13 TBS-RequestCapabilities-r13 OPTIONAL, -- Need ON

wlan-RequestCapabilities-r13 WLAN-RequestCapabilities-r13 OPTIONAL, -- Need ON

bt-RequestCapabilities-r13 BT-RequestCapabilities-r13 OPTIONAL -- Need ON

]],

[[ nr-ECID-RequestCapabilities-r16 NR-ECID-RequestCapabilities-r16 OPTIONAL, -- Need ON

nr-Multi-RTT-RequestCapabilities-r16

NR-Multi-RTT-RequestCapabilities-r16

OPTIONAL, -- Need ON

nr-DL-AoD-RequestCapabilities-r16

NR-DL-AoD-RequestCapabilities-r16 OPTIONAL, -- Need ON

nr-DL-TDOA-RequestCapabilities-r16

NR-DL-TDOA-RequestCapabilities-r16 OPTIONAL, -- Need ON

nr-UL-RequestCapabilities-r16 NR-UL-RequestCapabilities-r16 OPTIONAL -- Need ON

]],

[[

nr-DL-AIML-RequestCapabilities-r19

NR-DL-AIML-RequestCapabilities-r19

OPTIONAL -- Need ON

]]

}

-- ASN1STOP

#### – *ProvideCapabilities*

The *ProvideCapabilities* message body in a LPP message indicates the LPP capabilities of the target device to the location server.

-- ASN1START

ProvideCapabilities ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

provideCapabilities-r9 ProvideCapabilities-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

ProvideCapabilities-r9-IEs ::= SEQUENCE {

commonIEsProvideCapabilities CommonIEsProvideCapabilities OPTIONAL,

a-gnss-ProvideCapabilities A-GNSS-ProvideCapabilities OPTIONAL,

otdoa-ProvideCapabilities OTDOA-ProvideCapabilities OPTIONAL,

ecid-ProvideCapabilities ECID-ProvideCapabilities OPTIONAL,

epdu-ProvideCapabilities EPDU-Sequence OPTIONAL,

...,

[[ sensor-ProvideCapabilities-r13 Sensor-ProvideCapabilities-r13 OPTIONAL,

tbs-ProvideCapabilities-r13 TBS-ProvideCapabilities-r13 OPTIONAL,

wlan-ProvideCapabilities-r13 WLAN-ProvideCapabilities-r13 OPTIONAL,

bt-ProvideCapabilities-r13 BT-ProvideCapabilities-r13 OPTIONAL

]],

[[ nr-ECID-ProvideCapabilities-r16 NR-ECID-ProvideCapabilities-r16 OPTIONAL,

nr-Multi-RTT-ProvideCapabilities-r16

NR-Multi-RTT-ProvideCapabilities-r16 OPTIONAL,

nr-DL-AoD-ProvideCapabilities-r16

NR-DL-AoD-ProvideCapabilities-r16 OPTIONAL,

nr-DL-TDOA-ProvideCapabilities-r16

NR-DL-TDOA-ProvideCapabilities-r16 OPTIONAL,

nr-UL-ProvideCapabilities-r16 NR-UL-ProvideCapabilities-r16 OPTIONAL

]],

[[

nr-DL-AIML-ProvideCapabilities-r19

NR-DL-AIML-ProvideCapabilities-r19

OPTIONAL

]]

}

-- ASN1STOP

#### – *RequestAssistanceData*

The *RequestAssistanceData* message body in a LPP message is used by the target device to request assistance data from the location server.

-- ASN1START

RequestAssistanceData ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

requestAssistanceData-r9 RequestAssistanceData-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RequestAssistanceData-r9-IEs ::= SEQUENCE {

commonIEsRequestAssistanceData CommonIEsRequestAssistanceData OPTIONAL,

a-gnss-RequestAssistanceData A-GNSS-RequestAssistanceData OPTIONAL,

otdoa-RequestAssistanceData OTDOA-RequestAssistanceData OPTIONAL,

epdu-RequestAssistanceData EPDU-Sequence OPTIONAL,

...,

[[ sensor-RequestAssistanceData-r14

Sensor-RequestAssistanceData-r14 OPTIONAL,

tbs-RequestAssistanceData-r14 TBS-RequestAssistanceData-r14 OPTIONAL,

wlan-RequestAssistanceData-r14 WLAN-RequestAssistanceData-r14 OPTIONAL

]],

[[ nr-Multi-RTT-RequestAssistanceData-r16 NR-Multi-RTT-RequestAssistanceData-r16 OPTIONAL,

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

nr-DL-TDOA-RequestAssistanceData-r16 NR-DL-TDOA-RequestAssistanceData-r16 OPTIONAL

]],

[[

bt-RequestAssistanceData-r18 BT-RequestAssistanceData-r18 OPTIONAL

]],

[[

nr-DL-AIML-RequestAssistanceData-r19

NR-DL-AIML-RequestAssistanceData-r19

OPTIONAL

]]

}

-- ASN1STOP

#### – *ProvideAssistanceData*

The *ProvideAssistanceData* message body in a LPP message is used by the location server to provide assistance data to the target device either in response to a request from the target device or in an unsolicited manner.

-- ASN1START

ProvideAssistanceData ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

provideAssistanceData-r9 ProvideAssistanceData-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

ProvideAssistanceData-r9-IEs ::= SEQUENCE {

commonIEsProvideAssistanceData CommonIEsProvideAssistanceData OPTIONAL, -- Need ON

a-gnss-ProvideAssistanceData A-GNSS-ProvideAssistanceData OPTIONAL, -- Need ON

otdoa-ProvideAssistanceData OTDOA-ProvideAssistanceData OPTIONAL, -- Need ON

epdu-Provide-Assistance-Data EPDU-Sequence OPTIONAL, -- Need ON

...,

[[

sensor-ProvideAssistanceData-r14 Sensor-ProvideAssistanceData-r14 OPTIONAL, -- Need ON

tbs-ProvideAssistanceData-r14 TBS-ProvideAssistanceData-r14 OPTIONAL, -- Need ON

wlan-ProvideAssistanceData-r14 WLAN-ProvideAssistanceData-r14 OPTIONAL -- Need ON

]],

[[ nr-Multi-RTT-ProvideAssistanceData-r16

NR-Multi-RTT-ProvideAssistanceData-r16

OPTIONAL, -- Need ON

nr-DL-AoD-ProvideAssistanceData-r16

NR-DL-AoD-ProvideAssistanceData-r16 OPTIONAL, -- Need ON

nr-DL-TDOA-ProvideAssistanceData-r16

NR-DL-TDOA-ProvideAssistanceData-r16

OPTIONAL -- Need ON

]],

[[

bt-ProvideAssistanceData-r18 BT-ProvideAssistanceData-r18 OPTIONAL -- Need ON

]],

[[

nr-DL-AIML-ProvideAssistanceData-r19

NR-DL-AIML-ProvideAssistanceData-r19

OPTIONAL -- Need ON

]]

}

-- ASN1STOP

#### – *RequestLocationInformation*

The *RequestLocationInformation* message body in a LPP message is used by the location server to request positioning measurements or a position estimate from the target device.

-- ASN1START

RequestLocationInformation ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

requestLocationInformation-r9 RequestLocationInformation-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RequestLocationInformation-r9-IEs ::= SEQUENCE {

commonIEsRequestLocationInformation

CommonIEsRequestLocationInformation OPTIONAL, -- Need ON

a-gnss-RequestLocationInformation A-GNSS-RequestLocationInformation OPTIONAL, -- Need ON

otdoa-RequestLocationInformation OTDOA-RequestLocationInformation OPTIONAL, -- Need ON

ecid-RequestLocationInformation ECID-RequestLocationInformation OPTIONAL, -- Need ON

epdu-RequestLocationInformation EPDU-Sequence OPTIONAL, -- Need ON

...,

[[

sensor-RequestLocationInformation-r13

Sensor-RequestLocationInformation-r13

OPTIONAL, -- Need ON

tbs-RequestLocationInformation-r13 TBS-RequestLocationInformation-r13 OPTIONAL, -- Need ON

wlan-RequestLocationInformation-r13 WLAN-RequestLocationInformation-r13 OPTIONAL, -- Need ON

bt-RequestLocationInformation-r13 BT-RequestLocationInformation-r13 OPTIONAL -- Need ON

]],

[[ nr-ECID-RequestLocationInformation-r16

NR-ECID-RequestLocationInformation-r16

OPTIONAL, -- Need ON

nr-Multi-RTT-RequestLocationInformation-r16

NR-Multi-RTT-RequestLocationInformation-r16

OPTIONAL, -- Need ON

nr-DL-AoD-RequestLocationInformation-r16

NR-DL-AoD-RequestLocationInformation-r16

OPTIONAL, -- Need ON

nr-DL-TDOA-RequestLocationInformation-r16

NR-DL-TDOA-RequestLocationInformation-r16

OPTIONAL -- Need ON

]],

[[

nr-DL-AIML-RequestLocationInformation-r19

NR-DL-AIML-RequestLocationInformation-r19

OPTIONAL -- Need ON

]]

}

-- ASN1STOP

| *RequestLocationInformation* field descriptions |
| --- |
| ***commonIEsRequestLocationInformation***  This field specifies the location information type requested by the location server and optionally other configuration information associated with the requested location information. This field should always be included in this version of the protocol. |

#### – *ProvideLocationInformation*

The *ProvideLocationInformation* message body in a LPP message is used by the target device to provide positioning measurements or position estimates to the location server.

-- ASN1START

ProvideLocationInformation ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

provideLocationInformation-r9 ProvideLocationInformation-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

ProvideLocationInformation-r9-IEs ::= SEQUENCE {

commonIEsProvideLocationInformation

CommonIEsProvideLocationInformation OPTIONAL,

a-gnss-ProvideLocationInformation A-GNSS-ProvideLocationInformation OPTIONAL,

otdoa-ProvideLocationInformation OTDOA-ProvideLocationInformation OPTIONAL,

ecid-ProvideLocationInformation ECID-ProvideLocationInformation OPTIONAL,

epdu-ProvideLocationInformation EPDU-Sequence OPTIONAL,

...,

[[

sensor-ProvideLocationInformation-r13

Sensor-ProvideLocationInformation-r13

OPTIONAL,

tbs-ProvideLocationInformation-r13 TBS-ProvideLocationInformation-r13 OPTIONAL,

wlan-ProvideLocationInformation-r13 WLAN-ProvideLocationInformation-r13 OPTIONAL,

bt-ProvideLocationInformation-r13 BT-ProvideLocationInformation-r13 OPTIONAL

]],

[[ nr-ECID-ProvideLocationInformation-r16

NR-ECID-ProvideLocationInformation-r16 OPTIONAL,

nr-Multi-RTT-ProvideLocationInformation-r16

NR-Multi-RTT-ProvideLocationInformation-r16 OPTIONAL,

nr-DL-AoD-ProvideLocationInformation-r16

NR-DL-AoD-ProvideLocationInformation-r16 OPTIONAL,

nr-DL-TDOA-ProvideLocationInformation-r16

NR-DL-TDOA-ProvideLocationInformation-r16 OPTIONAL

]],

[[

nr-DL-AIML-ProvideLocationInformation-r19

NR-DL-AIML-ProvideLocationInformation-r19

OPTIONAL

]]

}

-- ASN1STOP

#### *– Abort*

The *Abort* message body in a LPP message carries a request to abort an ongoing LPP procedure.

-- ASN1START

Abort ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

abort-r9 Abort-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

Abort-r9-IEs ::= SEQUENCE {

commonIEsAbort CommonIEsAbort OPTIONAL, -- Need ON

...,

epdu-Abort EPDU-Sequence OPTIONAL -- Need ON

}

-- ASN1STOP

#### *– Error*

The *Error* message body in a LPP message carries information concerning a LPP message that was received with errors.

-- ASN1START

Error ::= CHOICE {

error-r9 Error-r9-IEs,

criticalExtensionsFuture SEQUENCE {}

}

Error-r9-IEs ::= SEQUENCE {

commonIEsError CommonIEsError OPTIONAL, -- Need ON

...,

epdu-Error EPDU-Sequence OPTIONAL -- Need ON

}

-- ASN1STOP

### 6.4.2 Common Positioning

[…]

#### – *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-v1800 Local2dPointWithUncertaintyEllipse-r18,

local3dPointWithUncertaintyEllipsoid-v1800 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),

dl-aiml-r19 (9)

} (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.  NOTE: If the *locationInformationType* field in a Request Location Information message was set to '*locationEstimateAndMeasurementsRequired*' and this field is absent, it means that the PRU location is not available. |
| ***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.

### 6.4.3 Common NR Positioning Information Elements

[…]

#### *– 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, ..., n1-v1800 },

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-ResourceSymbolOffset-v1800 INTEGER (13) OPTIONAL -- Need OR

]]

}

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 DL-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*. If *dl-PRS-ResourceSymbolOffset-v1800* is present, the target device shall ignore *dl-PRS-ResourceSymbolOffset-r16*. |
| ***dl-PRS-QCL-Info***  This field specifies the QCL indication for a DL-PRS Resource with another DL reference signal from serving or neighbouring cell as defined in TS 38.214 [45], clause 5.1.6.5 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 Resource. The UE obtains the SSB configuration for the SSB configured as source reference signal for the DL-PRS Resource by selecting an SSB configuration from *nr-SSB-Config* with a matching physical cell identity.  - ***ssb-Index*** indicates the index for the SSB configured as the source reference signal for the DL-PRS Resource.  - ***rs-Type*** indicates the QCL type as defined in TS 38.214 [45], clause 5.1.6.5.  - ***dl-PRS*** indicates the DL-PRS source reference signal information for QCL typeD as defined in TS 38.214 [45], clause 5.1.6.5 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, Multi-RTT, and NR DL AI/ML 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*.

Editor's Note: It is FFS whether the *NR-DL-PRS-ProcessingCapability* is needed also for DL AI/ML positioning.

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,

...,

[[

scs15-v1690 ENUMERATED {n6, n12} OPTIONAL,

scs30-v1690 ENUMERATED {n6, n12} OPTIONAL,

scs60-v1690 ENUMERATED {n6, n12} OPTIONAL,

scs120-v1690 ENUMERATED {n6, n12} OPTIONAL

]]

},

...,

[[

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

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

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

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

prs-ProcessingCapabilityOutsideMGinPPW-r17

SEQUENCE (SIZE(1..3)) OF

PRS-ProcessingCapabilityOutsideMGinPPWperType-r17

OPTIONAL,

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

durationOfPRS-Processing-RRC-Inactive-r17 SEQUENCE {

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

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

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

durationOfPRS-ProcessingSymbolsInEveryTms-r17

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

n160,n320, n640, n1280},

...

} OPTIONAL,

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

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

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

]],

[[

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

]],

[[

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

slotDot5} OPTIONAL

]],

[[

maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Inactive-r18 SEQUENCE {

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

maxNumOfOneSymbolPRS-ResProcessedPerSlot-RRC-Connected-r18 SEQUENCE {

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

ppw-maxNumOfOneSymbolPRS-ResProcessedPerSlot-r18 SEQUENCE {

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

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

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

prs-BWA-TwoContiguousIntrabandInMG-RRC-Connected-r18

PRS-BWA-TwoContiguousIntrabandInMG-r18 OPTIONAL,

prs-BWA-ThreeContiguousIntrabandInMG-RRC-Connected-r18

PRS-BWA-ThreeContiguousIntrabandInMG-r18 OPTIONAL,

prs-BWA-TwoContiguousIntraband-RRC-IdleAndInactive-r18

PRS-BWA-TwoContiguousIntrabandInMG-r18 OPTIONAL,

prs-BWA-ThreeContiguousIntraband-RRC-IdleAndInactive-r18

PRS-BWA-ThreeContiguousIntrabandInMG-r18 OPTIONAL,

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

OPTIONAL,

reducedNumOfSampleInMeasurementWithPRS-BWA-RRC-IdleAndInactive-r18

ENUMERATED { supported } OPTIONAL,

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

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

reducedNumOfSampleForMeasurementWithFH-RRC-Connected-r18 ENUMERATED { supported }

OPTIONAL,

reducedNumOfSampleForMeasurementWithFH-RRC-IdleAndInactive-r18 ENUMERATED { supported }

OPTIONAL,

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

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

]]

}

PRS-ProcessingCapabilityOutsideMGinPPWperType-r17 ::= SEQUENCE {

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

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

ppw-durationOfPRS-Processing1-r17 SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN-r17

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

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

ms40, ms45, ms50 },

ppw-durationOfPRS-ProcessingSymbolsT-r17

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

ms160, ms320, ms640, ms1280 }

} OPTIONAL,

ppw-durationOfPRS-Processing2-r17 SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN2-r17

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

ms6, ms8, ms12 },

ppw-durationOfPRS-ProcessingSymbolsT2-r17

ENUMERATED { ms4, ms5, ms6, ms8 }

} OPTIONAL,

ppw-maxNumOfDL-PRS-ResProcessedPerSlot-r17 SEQUENCE {

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

n16, n24, n32, n48, n64 }

OPTIONAL,

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

n16, n24, n32, n48, n64 }

OPTIONAL,

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

n16, n24, n32, n48, n64 }

OPTIONAL,

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

n16, n24, n32, n48, n64 }

OPTIONAL,

...

},

...,

[[

ppw-maxNumOfDL-Bandwidth-r17 CHOICE {

fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

mhz50, mhz80, mhz100},

fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

} OPTIONAL

]]

}

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

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

mhz80, mhz100, mhz160, mhz200}

OPTIONAL,

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

OPTIONAL,

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

mhz50, mhz80, mhz100} OPTIONAL,

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

OPTIONAL,

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

prs-durationOfTwoPRS-BWA-Processing-r18 SEQUENCE {

prs-durationOfTwoPRS-BWA-ProcessingSymbolsN-r18

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

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

prs-durationOfTwoPRS-BWA-ProcessingSymbolsT-r18

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

} OPTIONAL,

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18 SEQUENCE {

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

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

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

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

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

n16, n24, n32, n48, n64 } OPTIONAL

},

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18 SEQUENCE {

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

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

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

n16, n24, n32, n48, n64 } OPTIONAL

}

}

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

maximumOfThreeAggregatedDL-PRS-Bandwidth-FR1-r18

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

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

maximumOfThreeAggregatedDL-PRS-Bandwidth-FR2-r18

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

mhz1200} OPTIONAL,

maximumOfDL-PRS-BandwidthPerPFL-FR1-r18

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

maximumOfDL-PRS-BandwidthPerPFL-FR2-r18

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

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

prs-durationOfThreePRS-BWA-Processing-r18 SEQUENCE {

prs-durationOfThreePRS-BWA-ProcessingSymbolsN-r18

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

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

prs-durationOfThreePRS-BWA-ProcessingSymbolsT-r18

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

ms320, ms640, ms1280}

} OPTIONAL,

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR1-r18 SEQUENCE {

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

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

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

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

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

n16, n24, n32, n48, n64 } OPTIONAL

},

maxNumOfAggregatedDL-PRS-ResourcePerSlot-FR2-r18 SEQUENCE {

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

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

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

n16, n24, n32, n48, n64 } OPTIONAL

}

}

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

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

OPTIONAL,

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

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

processingDuration-r18 SEQUENCE {

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

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

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

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

ms160, ms320, ms640, ms1280}

} OPTIONAL,

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

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

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

...

}

-- ASN1STOP

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

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

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

-- ASN1START

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

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

DL-PRS-QCL-ProcessingCapabilityPerBand-r16,

...

}

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

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

ssb-FromNeighCellAsQCL-r16 ENUMERATED { supported} OPTIONAL,

prs-FromServNeighCellAsQCL-r16 ENUMERATED { supported} OPTIONAL,

...

}

-- ASN1STOP

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

[…]

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

The IE *NR-DL-PRS-ResourcesCapability* defines the DL-PRS Resources capability for each 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, ..., n24-v1690},

maxNrOfPosLayer-r16 INTEGER (1..4),

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

DL-PRS-ResourcesCapabilityPerBand-r16,

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

...

}

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

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

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

maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer-r16

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

n256, n512, n1024, ...},

...

}

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

DL-PRS-ResourcesBandCombination-r16

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

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

FreqBandIndicatorNR-r16,

maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet-r16

CHOICE {

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

n256, n512, n1024, n2048},

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

n256, n512, n1024, n2048},

fr1-FR2Mix-r16 SEQUENCE {

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

n192, n256, n512, n1024, n2048},

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

n256, n512, n1024, n2048},

...

},

...

},

...

}

-- ASN1STOP

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

[…]

#### – *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-AggregationID-PrefList-r18 SEQUENCE (SIZE (1.. maxOD-DL-PRS-Configs-r17)) OF

INTEGER (1.. maxOD-DL-PRS-Configs-r17)

OPTIONAL,

nr-OnDemandDL-PRS-AggregationReqList-r18 SEQUENCE (SIZE (1.. maxOD-DL-PRS-Configs-r17)) OF

NR-OnDemandDL-PRS-AggregationReqElement-r18

OPTIONAL

]],

[[

nr-TRP-RequestList-r19 NR-TRP-RequestList-r19 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,

...

}

NR-OnDemandDL-PRS-AggregationReqElement-r18 ::= SEQUENCE (SIZE (2..3)) OF

INTEGER (1..nrMaxFreqLayers-r16)

NR-TRP-RequestList-r19 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-TRP-RequestListPerFreqLayer-r19

NR-TRP-RequestListPerFreqLayer-r19 ::= SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

TRP-RequestInfoElement-r19

TRP-RequestInfoElement-r19 ::= SEQUENCE {

dl-PRS-ID-r19 INTEGER (0..255) OPTIONAL,

nr-PhysCellID-r19 NR-PhysCellID-r16 OPTIONAL,

nr-CellGlobalID-r19 NCGI-r15 OPTIONAL,

nr-ARFCN-r19 ARFCN-ValueNR-r15 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. |
| ***dl-PRS-AggregationID-PrefList***  This field specifies a list of identities i.e., *DL-PRS-Configuration-ID*, for On-demand DL-PRS Configuration information i.e., *On-Demand-DL-PRS-Configuration*, thatthe target device wishes to obtain, for DL-PRS aggregation, in the order of preference. The first integer value in the list is the most preferred On-demand DL-PRS Configuration information; the second integer value in the list is the second most preferred, etc. |
| ***nr-OnDemandDL-PRS-AggregationReqList***  This field specifies a list of DL-PRS for specific PFL combinations for which the DL-PRS information i.e., *NR-On-Demand-DL-PRS-Information*, is requested by the target device for DL-PRS aggregation, listed in the order of preference. The first *NR-OnDemandDL-PRS-AggregationReqElement* in the list is the most preferred PFL combination for DL-PRS aggregation; the second element in the list is the second most preferred, etc. |
| ***nr-TRP-RequestList***  This field specifies a list of TRPs for which the *NR-On-Demand-DL-PRS-Request* is desired and comprises the following subfields:  - ***dl-PRS-ID*** specifies the DL-PRS ID of the TRP for which the on-demand DL-PRS is requested.  - ***nr-PhysCellID*** specifies the physical Cell-ID of the TRP for which the on-demand DL-PRS is requested.  - ***nr-CellGlobalID*** specifies the NCGI, the globally unique identity of a cell in NR, of the TRP for which the on-demand DL-PRS is requested, as defined in TS 38.331 [35].  - ***nr-ARFCN*** specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |

#### – *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*, *NR-DL-TDOA-ProvideAssistanceData*, or *NR-DL-AIML-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-PositionCalculationAssistance*

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

-- ASN1START

NR-PositionCalculationAssistance-r16 ::= SEQUENCE {

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

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

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

...,

[[

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

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

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

OPTIONAL, -- Need ON

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

]],

[[

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

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

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

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

OPTIONAL, -- Cond Integrity1

nr-IntegrityParametersDL-PRS-BeamInfo-r18

NR-IntegrityParametersDL-PRS-BeamInfo-r18

OPTIONAL, -- Cond Integrity2

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

OPTIONAL, -- Cond Integrity3

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

OPTIONAL, -- Cond Integrity4

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

]],

[[

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

]]

}

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

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

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

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

...

}

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

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

...

}

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

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

...

}

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

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

...

}

-- ASN1STOP

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

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

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

#### – *NR-PRU-DL-Info*

The IE *NR-PRU-DL-Info* is used by the location server to provide the carrier phase measurements with associated measurements and additional information reported by a PRU for UE-based DL-TDOA to a target UE.

The IE *NR-PRU-DL-Info* is also used by the location server to provide PRU measurements and additional information reported by a PRU for UE-based DL AI/ML positioning to a target UE.

-- ASN1START

NR-PRU-DL-Info-r18 ::= SEQUENCE {

nr-PRU-LocationInfo-r18 LocationCoordinates OPTIONAL, -- Need ON

nr-PRU-DL-TDOA-MeasInfo-r18 NR-DL-TDOA-SignalMeasurementInformation-r16

OPTIONAL, -- Need ON

nr-PRU-DL-AoD-MeasInfo-r18 NR-DL-AoD-SignalMeasurementInformation-r16

OPTIONAL, -- Need ON

nr-PRU-RSCP-MeasInfo-r18 NR-PRU-RSCP-MeasurementInformation-r18

OPTIONAL, -- Need ON

...

}

NR-PRU-RSCP-MeasurementInformation-r18 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF

NR-PRU-RSCP-MeasElement-r18

NR-PRU-RSCP-MeasElement-r18 ::= SEQUENCE {

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

nr-PhysCellID-r18 NR-PhysCellID-r16 OPTIONAL, -- Need ON

nr-CellGlobalID-r18 NCGI-r15 OPTIONAL, -- Need ON

nr-ARFCN-r18 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON

nr-DL-PRS-ResourceID-r18 NR-DL-PRS-ResourceID-r16 OPTIONAL, -- Need ON

nr-DL-PRS-ResourceSetID-r18 NR-DL-PRS-ResourceSetID-r16 OPTIONAL, -- Need ON

nr-TimeStamp-r18 NR-TimeStamp-r16,

nr-los-nlos-Indicator-r18 CHOICE {

perTRP LOS-NLOS-Indicator-r17,

perResource LOS-NLOS-Indicator-r17

} OPTIONAL, -- Need ON

nr-RSCP-r18 INTEGER (0..3599) OPTIONAL, -- Need ON

nr-DL-PRS-RSRP-Result-r18 INTEGER (0..126) OPTIONAL, -- Need ON

nr-DL-PRS-FirstPathRSRP-Result-r18 INTEGER (0..126) OPTIONAL, -- Need ON

nr-PhaseQuality-r18 NR-PhaseQuality-r18 OPTIONAL, -- Need ON

nr-PRU-RSCP-AddSampleMeasurements-r18 SEQUENCE (SIZE (1..nrNumOfSamples-1-r18 )) OF

NR-RSCP-AdditionalMeasurements-r18 OPTIONAL, -- Need ON

nr-PRU-RSRP-AddSampleMeasurements-r18 SEQUENCE (SIZE (1..nrNumOfSamples-1-r18)) OF

INTEGER (0..61) OPTIONAL, -- Need ON

nr-PRU-FirstPathRSRP-ResultDiff-AddSampleMeasurements-r18

SEQUENCE (SIZE (1..nrNumOfSamples-1-r18 )) OF INTEGER (0..61) OPTIONAL, -- Need ON

nr-PRU-RSCP-AdditionalMeasurements-r18

NR-PRU-RSCP-AdditionalMeasurements-r18 OPTIONAL, -- Need ON

...

}

NR-PRU-RSCP-AdditionalMeasurements-r18 ::= SEQUENCE (SIZE (1..3)) OF

NR-PRU-RSCP-AdditionalMeasurementElement-r18

NR-PRU-RSCP-AdditionalMeasurementElement-r18 ::= SEQUENCE {

nr-DL-PRS-ResourceID-r18 NR-DL-PRS-ResourceID-r16 OPTIONAL, -- Need ON

nr-DL-PRS-ResourceSetID-r18 NR-DL-PRS-ResourceSetID-r16 OPTIONAL, -- Need ON

nr-DL-PRS-RSRP-ResultDiff-r18 INTEGER (0..61) OPTIONAL, -- Need ON

nr-DL-PRS-FirstPathRSRP-ResultDiff-r18 INTEGER (0..61) OPTIONAL, -- Need ON

nr-PRU-RSCP-AdditionalMeasurementsList-r18 SEQUENCE (SIZE (1..nrNumOfSamples-r18 )) OF

NR-RSCP-AdditionalMeasurements-r18 OPTIONAL, -- Need ON

nr-PRU-RSRPDiff-AdditionalMeasurementsList-r18 SEQUENCE (SIZE (1..nrNumOfSamples-r18 )) OF INTEGER (0..61) OPTIONAL, -- Need ON

nr-PRU-FirstPathRSRP-ResultDiff-AdditionalMeasurementsList-r18

SEQUENCE (SIZE (1..nrNumOfSamples-r18 )) OF INTEGER (0..61) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *NR-PRU-DL-Info* field descriptions |
| --- |
| ***nr-PRU-LocationInfo***  This field provides the location coordinates of the PRU. |
| ***nr-PRU-DL-TDOA-MeasInfo***  This field specifies the list of carrier phase measurement RSCPD together with the other measurement information in DL-TDOA by the PRU. |
| ***nr-PRU-DL-AoD-MeasInfo***  This field specifies the list of other measurement information in DL-AoD by the PRU. |
| ***nr-PRU-RSCP-MeasInfo***  This field specifies the list of carrier phase measurement RSCP measured by the PRU, together with DL-PRS RSRP, and/or DL-PRS RSRPP measurement(s) associated with the RSCP measurements. |

[…]

#### – *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*, *NR-DL-TDOA-ProvideAssistanceData*, or *NR-DL-AIML-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-TRP-LocationInfo*

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

nr-IntegrityTRP-LocationBounds-r18

NR-IntegrityLocationBounds-r18 OPTIONAL -- Need OR

]]

}

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

nr-IntegrityDL-PRS-ResourceSetARP-LocationBounds-r18

NR-IntegrityLocationBounds-r18 OPTIONAL -- Need OR

]]

}

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

nr-IntegrityDL-PRS-ResourceARP-LocationBounds-r18

NR-IntegrityLocationBounds-r18 OPTIONAL -- Need OR

]]

}

NR-IntegrityLocationBounds-r18 ::= SEQUENCE {

units-r18 ENUMERATED {mm, cm, m, ...},

meanLocationErrorBound-r18 SEQUENCE {

horizontal-r18 INTEGER (0..255),

vertical-r18 INTEGER (0..255)

},

stdDevLocationErrorBound-r18 SEQUENCE {

horizontal-r18 INTEGER (0..255),

vertical-r18 INTEGER (0..255)

},

...

}

-- ASN1STOP

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

| *NR-TRP-LocationInfo* field descriptions |
| --- |
| ***referencePoint***  This field specifies the reference point used to define the location of TRPs provided 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* in the *NR-TRP-LocationInfo* list. |
| ***trp-LocationInfoList***  This field provides the antenna reference point locations of the DL-PRS Resources for the TRPs together with integrity information 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 Resource 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 none of *trp-Location*, *trp-LocationCartesian* is present, 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*.  - ***nr-IntegrityTRP-LocationBounds***: This field provides the mean and standard deviation TRP location error bound which is the mean value and the standard deviation of an overbounding model that bounds the TRP location error. This field comprises the following sub-fields:  - ***units***: This field specifies the units (scale factor) for the *meanLocationErrorBound* and s*tdDevLocationErrorBound*. Enumerated values mm, cm, and m correspond to 10-3 metre, 10-2 metre, and 1 metre, respectively.  - ***meanLocationErrorBound***: This field specifies the mean TRP Location Error bound in horizontal and vertical direction, which are the mean values for a set of two overbounding models that bound the TRP location error in horizontal and vertical directions.  Scale factor is 1 with units provided in *units* field.  - ***stdDevLocationErrorBound***: This field specifies the standard deviation TRP Location Error bound in horizontal and vertical direction, which are the standard deviation values for a set of two overbounding models that bound the TRP location error in horizontal and vertical directions.  Scale factor is 1 with units provided in *units* field.  - ***trp-DL-PRS-ResourceSets***: This field provides the antenna reference point location(s) of the DL-PRS Resource Set(s) associated with this TRP together with integrity information. 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 none of *dl-PRS-ResourceSetARP*, *dl-PRS-ResourceSetARP-Cartesian* is present, the antenna reference point location of this DL-PRS Resource Set coincides with the *trp-Location* or *trp-LocationCartesian* location.  - ***nr-IntegrityDL-PRS-ResourceSetARP-LocationBounds***: This field provides the mean and the standard deviation ARP of the location error bound of the DL-PRS Resource Set of an overbounding model that bounds the antenna reference point location error of the DL-PRS Resource Set. This field comprises the sub-fields *units***,** *meanLocationErrorBound,* and *stdDevLocationErrorBound****,*** as described under *nr-IntegrityTRP-LocationBounds*.  - ***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 together with integrity information. If this field is absent, the antenna reference point location(s) of the DL-PRS Resources coincides with the *dl-PRS-ResourceSetARP* location or *dl-PRS-ResourceSetARP-Cartesian*. 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 none of *dl-PRS-Resource-ARP-location*, *dl-PRS-Resource-ARP-locationCartesian* is present, the antenna reference point location of this DL-PRS Resource coincides with the *dl-PRS-ResourceSetARP* location or *dl-PRS-Resource-ARP-locationCartesian*.  - ***nr-IntegrityDL-PRS-ResourceARP-LocationBounds***: This field provides the mean and the standard deviation ARP of the location error bound of the DL-PRS Resources of an overbounding model that bounds the antenna reference point location error of the DL-PRS Resource. This field comprises the sub-fields *units***,** *meanLocationErrorBound,* and *stdDevLocationErrorBound****,*** as described under *nr-IntegrityTRP-LocationBounds*. |

NOTE 5: The locations may be provided in either geodetic coordinates (*RelativeLocation*) or local Cartesian coordinates (*RelativeCartesianLocation*), but not both. Local Cartesian coordinates are provided with respect to the *horizAxesOrientation* of the local origin defined by the *referencePoint* field.

#### *–* *NR-TRP-LocationInfo-Implicit*

The IE *NR-TRP-LocationInfo-Implicit* provides information to enable a target device to determine whether the coordinates of TRPs are consistent between training and inference phases for NR DL AI/ML positioning.

-- ASN1START

NR-TRP-LocationInfo-Implicit-r19 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-TRP-LocationInfo-Implicit-PerFreqLayer-r19

NR-TRP-LocationInfo-Implicit-PerFreqLayer-r19 ::= SEQUENCE {

trp-LocationInfo-Implicit-List-r19 SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

TRP-LocationInfo-Implicit-Element-r19,

...

}

TRP-LocationInfo-Implicit-Element-r19 ::= SEQUENCE {

nr-PhysCellID-r19 NR-PhysCellID-r16 OPTIONAL, -- Need ON

nr-CellGlobalID-r19 NCGI-r15 OPTIONAL, -- Need ON

nr-ARFCN-r19 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON

nr-AIML-AssociatedID-r19 INTEGER (0..255),

...

}

-- ASN1STOP

| *NR-TRP-LocationInfo-Implicit* field descriptions |
| --- |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the cell. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR. |
| ***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-AIML-AssociatedID***  This field provides an identity associated with the coordinates of the TRP(s) belonging to the indicated cell. The value of the *nr-AIML-AssociatedID* is changed if/when the coordinates of the TRP(s) is changed.  NOTE: The target device is not expected to receive different values of *nr-AIML-AssociatedID* for TRPs belonging to the same cell. |

[…]

### 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 NR-SelectedDL-PRS-IndexList-r16 OPTIONAL, -- Need ON

nr-PositionCalculationAssistance-r16

NR-PositionCalculationAssistance-r16

OPTIONAL, -- Cond UEB

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

...,

[[

nr-On-Demand-DL-PRS-Configurations-r17

NR-On-Demand-DL-PRS-Configurations-r17

OPTIONAL, -- Need ON

nr-On-Demand-DL-PRS-Configurations-Selected-IndexList-r17

NR-On-Demand-DL-PRS-Configurations-Selected-IndexList-r17 OPTIONAL, -- Need ON

assistanceDataValidityArea-r17 AreaID-CellList-r17 OPTIONAL -- Need ON

]],

[[

nr-PeriodicAssistData-r18 NR-PeriodicAssistData-r18 OPTIONAL -- Cond CtrTrans

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *UEB* | The field is optionally present, need ON, for UE based NR DL-TDOA; otherwise it is not present. |
| *CtrTrans* | The field is mandatory present in the control transaction of a periodic assistance data delivery session as described in clauses 5.2.1a and 5.2.2a, for UE based NR DL-TDOA. Otherwise it is not present. |

|  |
| --- |
| *NR-DL-TDOA-ProvideAssistanceData* field descriptions |
| ***nr-DL-PRS-AssistanceData***  This field specifies the assistance data reference and neighbour TRPs and provides the DL-PRS configuration for the TRPs.  Note, if this field is absent but the *nr-SelectedDL-PRS-IndexList* field is present, the *nr-DL-PRS-AssistanceData* may be provided in IE *NR-Multi-RTT-ProvideAssistanceData*, *NR-DL-AoD-ProvideAssistanceData*, or *NR-DL-AIML-ProvideAssistanceData*. |
| ***nr-SelectedDL-PRS-IndexList***  This field specifies the DL-PRS Resources which are applicable for this *NR-DL-TDOA-ProvideAssistanceData* message. |
| ***nr-PositionCalculationAssistance***  This field provides position calculation assistance data for UE-based mode. |
| ***nr-DL-TDOA-Error***  This field provides DL-TDOA error reasons. |
| ***nr-On-Demand-DL-PRS-Configurations***  This field provides a set of available DL-PRS configurations which can be requested by the target device on-demand.  NOTE 1: Void  NOTE 2: If this field is absent but the *nr-On-Demand-DL-PRS-Configurations-Selected-IndexList* is present, the *nr-On-Demand-DL-PRS-Configurations* may be provided in IE *NR-Multi-RTT-ProvideAssistanceData,* *NR-DL-AoD-ProvideAssistanceData*, or *NR-DL-AIML-ProvideAssistanceData*. |
| ***nr-On-Demand-DL-PRS-Configurations-Selected-IndexList***  This field specifies the selected available on-demand DL-PRS configurations which are applicable for this *NR-DL-TDOA-ProvideAssistanceData message*. |
| ***assistanceDataValidityArea***  This field specifies the network area for which this *NR-DL-TDOA-ProvideAssistanceData* is valid. |
| ***nr-PeriodicAssistData***  This field specifies the control parameters for a periodic assistance data delivery session (e.g., interval and duration) for UE‑based carrier phase positioning. |

[…]

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

[…]

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

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

-- ASN1START

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

measurementReferenceTime-r16 CHOICE {

systemFrameNumber-r16 NR-TimeStamp-r16,

utc-time-r16 UTCTime,

...

} OPTIONAL,

...,

[[

locationCoordinates-r17 LocationCoordinates OPTIONAL, -- Cond batch1

locationSource-r17 LocationSource-r13 OPTIONAL -- Cond batch2

]]

}

-- ASN1STOP

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

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

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

### 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 and UE-based 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 NR-SelectedDL-PRS-IndexList-r16 OPTIONAL, -- Need ON

nr-PositionCalculationAssistance-r16

NR-PositionCalculationAssistance-r16

OPTIONAL, -- Cond UEB

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

...,

[[

nr-DL-PRS-BeamInfo-r17 NR-DL-PRS-BeamInfo-r16 OPTIONAL, -- Cond UEA

nr-On-Demand-DL-PRS-Configurations-r17

NR-On-Demand-DL-PRS-Configurations-r17

OPTIONAL, -- Need ON

nr-On-Demand-DL-PRS-Configurations-Selected-IndexList-r17

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

OPTIONAL, -- Need ON

assistanceDataValidityArea-r17 AreaID-CellList-r17 OPTIONAL -- Need ON

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *UEB* | The field is optionally present, need ON, for UE based NR DL-AoD; otherwise it is not present. |
| *UEA* | The field is optionally present, need ON, for UE-assisted NR DL-AoD; otherwise it is not present. |

|  |
| --- |
| *NR-DL-AoD-ProvideAssistanceData* field descriptions |
| ***nr-DL-PRS-AssistanceData***  This field specifies the assistance data reference and neighbour TRPs and provides the DL-PRS configuration for the TRPs.  Note, if this field is absent but the *nr-SelectedDL-PRS-IndexList* field is present, the *nr-DL-PRS-AssistanceData* may be provided in IE *NR-Multi-RTT-ProvideAssistanceData*, *NR-DL-TDOA-ProvideAssistanceData*, or *NR-DL-AIML-ProvideAssistanceData*. |
| ***nr-SelectedDL-PRS-IndexList***  This field specifies the DL-PRS Resources which are applicable for this *NR-DL-AoD-ProvideAssistanceData* message. |
| ***nr-PositionCalculationAssistance***  This field provides position calculation assistance data for UE-based mode. |
| ***nr-DL-AoD-Error***  This field provides DL-AoD error reasons. |
| ***nr-DL-PRS-BeamInfo***  This field provides spatial direction information of the DL-PRS Resources included in *nr-DL-PRS-AssistanceData* or indicated by *nr-SelectedDL-PRS-IndexList.* |
| ***nr-On-Demand-DL-PRS-Configurations***  This field provides a set of available DL-PRS configurations which can be requested by the target device on-demand.  NOTE 1: Void.  NOTE 2: If this field is absent but the *nr-On-Demand-DL-PRS-Configurations-Selected-IndexList* is present, the *nr-On-Demand-DL-PRS-Configurations* may be provided in IE *NR-Multi-RTT-ProvideAssistanceData,* *NR-DL-TDOA-ProvideAssistanceData*, or *NR-DL-AIML-ProvideAssistanceData*. |
| ***nr-On-Demand-DL-PRS-Configurations-Selected-IndexList***  This field specifies the selected available on-demand DL-PRS configurations which are applicable for this *NR-DL-AoD-ProvideAssistanceData message*. |
| ***assistanceDataValidityArea***  This field specifies the network area for which this *NR-DL-AoD-ProvideAssistanceData* is valid. |

[…]

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

[…]

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

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

-- ASN1START

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

measurementReferenceTime-r16 CHOICE {

sfn-time-r16 NR-TimeStamp-r16,

utc-time-r16 UTCTime,

...

} OPTIONAL,

...,

[[

locationCoordinates-r17 LocationCoordinates OPTIONAL, -- Cond batch1

locationSource-r17 LocationSource-r13 OPTIONAL -- Cond batch2

]]

}

-- ASN1STOP

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

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

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

### 6.5.13 NR DL AI/ML Positioning

This clause defines the information elements for NR DL AI/ML positioning (TS 38.305 [40]).

#### 6.5.13.1 NR DL AI/ML Positioning Assistance Data

#### – *NR-DL-AIML-ProvideAssistanceData*

The IE *NR-DL-AIML-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE-based DL AI/ML positioning. It may also be used to provide NR DL AI/ML positioning specific error reason.

-- ASN1START

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

nr-DL-PRS-AssistanceData-r19 NR-DL-PRS-AssistanceData-r16 OPTIONAL, -- Need ON

nr-SelectedDL-PRS-IndexList-r19 NR-SelectedDL-PRS-IndexList-r16 OPTIONAL, -- Need ON

nr-On-Demand-DL-PRS-Configurations-r19

NR-On-Demand-DL-PRS-Configurations-r17

OPTIONAL, -- Need ON

nr-On-Demand-DL-PRS-Configurations-Selected-IndexList-r19

NR-On-Demand-DL-PRS-Configurations-Selected-IndexList-r17 OPTIONAL, -- Need ON

assistanceDataValidityArea-r19 AreaID-CellList-r17 OPTIONAL, -- Need ON

nr-PositionCalculationAssistance-r19

NR-PositionCalculationAssistance-r16

OPTIONAL, -- Need ON

nr-DL-AIML-Positioning-Error-r19 NR-DL-AIML-Positioning-Error-r19 OPTIONAL, -- Need ON

...

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-AIML-ProvideAssistanceData* field descriptions |
| ***nr-DL-PRS-AssistanceData***  This field specifies the assistance data reference and neighbour TRPs and provides the DL-PRS configuration for the TRPs.  NOTE: If this field is absent but the *nr-SelectedDL-PRS-IndexList* field is present, the *nr-DL-PRS-AssistanceData* may be provided in IE *NR-DL-TDOA-ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData*. |
| ***nr-SelectedDL-PRS-IndexList***  This field specifies the DL-PRS Resources which are applicable for this *NR-DL-AIML-ProvideAssistanceData* message. |
| ***nr-On-Demand-DL-PRS-Configurations***  This field provides a set of available DL-PRS configurations which can be requested by the target device on-demand.  NOTE: If this field is absent but the *nr-On-Demand-DL-PRS-Configurations-Selected-IndexList* is present, the *nr-On-Demand-DL-PRS-Configurations* may be provided in IE *NR-DL-TDOA-ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData*. |
| ***nr-On-Demand-DL-PRS-Configurations-Selected-IndexList***  This field specifies the selected available on-demand DL-PRS configurations which are applicable for this *NR-DL-AIML-ProvideAssistanceData message*. |
| ***assistanceDataValidityArea***  This field specifies the network area for which this *NR-DL-AIML-ProvideAssistanceData* is valid. |
| ***nr-PositionCalculationAssistance***  This field provides the position calculation assistance data. |
| ***nr-DL-AIML-Positioning-Error***  This field provides DL AI/ML positioning error reasons. |

#### 6.5.13.2 NR DL AI/ML Positioning Assistance Data Request

#### – *NR-DL-AIML-RequestAssistanceData*

The IE *NR-DL-AIML-RequestAssistanceData* is used by the target device to request assistance data from a location server for NR DL AI/ML positioning.

-- ASN1START

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

nr-PhysCellID-r19 NR-PhysCellID-r16 OPTIONAL,

nr-DL-PRS-AssistanceDataReq-r19 ENUMERATED { requested } OPTIONAL,

nr-DL-PRS-ExpectedAoD-or-AoA-Req-r19 ENUMERATED { eAoD, eAoA } OPTIONAL,

nr-on-demand-DL-PRS-Req-r19 NR-On-Demand-DL-PRS-Request-r17 OPTIONAL,

pre-configured-AssistanceDataReq-r19 ENUMERATED { true } OPTIONAL,

nr-PositionCalculationAssistanceReq-r19 BIT STRING {

trpLoc (0),

beamInfo (1),

rtdInfo (2),

losNlosInfo (3),

trpTEG-Info (4),

nr-IntegrityBounds (5),

pruInfo (6),

trpLoc-Implicit (7)

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

nr-IntegrityAssistanceReq-r19 BIT STRING {

serviceParameters (0),

serviceAlert (1),

riskParameters (2),

integrityParaTRP-Loc (3),

integrityParaBeamInfo (4),

integrityParaRTD-Info (5)

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

...

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-AIML-RequestAssistanceData* field descriptions |
| ***nr-PhysCellID***  This field specifies the NR physical cell identity of the current primary cell of the target device. |
| ***nr-DL-PRS-AssistanceDataReq***  This field, if present, indicates that the *nr-DL-PRS-AssistanceData* are requested. |
| ***nr-DL-PRS-ExpectedAoD-or-AoA-Req***  This field, if present, indicates that the IE *NR-DL-PRS-ExpectedAoD-or-AoA* in *NR-DL-PRS-AssistanceData* is requested. Enumerated value '*eAoD*' indicates that expected AoD information is requested; value '*eAoA*' indicates that expected AoA information is requested.  This field may only be present if the *nr-DL-PRS-AssistanceDataReq* is also present. |
| ***nr-on-demand-DL-PRS-Req***  This field indicates the on-demand DL-PRS requested for DL AI/ML positioning. |
| ***pre-configured-AssistanceDataReq***  This field, if present, indicates that the target device requests pre-configured assistance data with area validity. |
| ***nr-PositionCalculationAssistanceReq***  This field indicates the Position Calculation Assistance Data requested. This is represented by a bit string, with a one‑value at the bit position means the particular assistance data is requested; a zero‑value means not requested.  - bit 0 indicates whether the field *nr-TRP-LocationInfo* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 1 indicates whether the field *nr-DL-PRS-BeamInfo* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 2 indicates whether the field *nr-RTD-Info* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 3 indicates whether the field *nr-DL-PRS-Expected-LOS-NLOS-Assistance* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 4 indicates whether the field *nr-DL-PRS-TRP-TEG-Info* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 5 together with bit 0 indicates whether the fields *nr-IntegrityTRP-LocationBounds*, *nr-IntegrityDL-PRS-ResourceSetARP-LocationBounds*, *nr-IntegrityDL-PRS-ResourceARP-LocationBounds* in IE *NR-TRP-LocationInfo* are requested or not; bit 5 together with bit 1 indicates whether the field *nr-IntegrityBeamInfoBounds* in IE *NR-DL-PRS-BeamInfo* is requested or not; bit 5 together with the bit 2 indicates whether the field *nr-IntegrityRTD-InfoBounds* in IE *NR-RTD-Info* is requested or not;  - bit 6 indicates whether the field *nr-PRU-DL-Info* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 7 indicates whether the field *nr-TRP-LocationInfo-Implicit* in IE *NR-PositionCalculationAssistance* is requested or not. |
| ***nr-IntegrityAssistanceReq***  This field indicates the Integrity Assistance Data requested. This is represented by a bit string, with a one‑value at the bit position means the particular assistance data is requested; a zero‑value means not requested.  - bit 0 indicates whether the field *nr-IntegrityServiceParameters* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 1 indicates whether the field *nr-IntegrityServiceAlert* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 2 indicates whether the field *nr-IntegrityRiskParameters* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 3 indicates whether the field *nr-IntegrityParametersTRP-LocationInfo* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 4 indicates whether the field *nr-IntegrityParametersDL-PRS-BeamInfo* in IE *NR-PositionCalculationAssistance* is requested or not;  - bit 5 indicates whether the field *nr-IntegrityParametersRTD-Info* in IE *NR-PositionCalculationAssistance* is requested or not. |

#### 6.5.13.3 NR DL AI/ML Positioning Location Information

#### – *NR-DL-AIML-ProvideLocationInformation*

The IE *NR-DL-AIML-ProvideLocationInformation* is used by the target device to provide NR DL AI/ML location information to the location server. It may also be used to provide NR DL AI/ML positioning specific error reason.

-- ASN1START

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

nr-DL-AIML-LocationInformation-r19 NR-DL-AIML-LocationInformation-r19 OPTIONAL,

nr-DL-AIML-LocationInformationInstances-r19 SEQUENCE (SIZE (1..maxMeasInstances-r17)) OF

NR-DL-AIML-LocationInformation-r19

OPTIONAL, -- Cond batch

nr-DL-AIML-Positioning-Error-r19 NR-DL-AIML-Positioning-Error-r19 OPTIONAL,

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *batch* | The field is optionally present if the field *nr-DL-AIML-LocationInformation* is absent; otherwise it is not present. |

#### 6.5.13.4 NR DL AI/ML Positioning Location Information Elements

#### *– NR-DL-AIML-LocationInformation*

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

-- ASN1START

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

measurementReferenceTime-r19 CHOICE {

systemFrameNumber-r19 NR-TimeStamp-r16,

utc-time-r19 UTCTime,

...

} OPTIONAL,

locationCoordinates-r19 LocationCoordinates OPTIONAL, -- Cond batch1

locationSource-r19 LocationSource-r13 OPTIONAL, -- Cond batch2

...

}

-- ASN1STOP

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

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

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

#### 6.5.13.5 NR DL AI/ML Positioning Location Information Request

#### – *NR-DL-AIML-RequestLocationInformation*

The IE *NR-DL-AIML-RequestLocationInformation* is used by the location server to request NR DL AI/ML location information from a target device using DL AI/ML positioning.

-- ASN1START

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

nr-AssistanceAvailability-r19 BOOLEAN,

multiLocationEstimateInSameReport-r19 ENUMERATED { requested } OPTIONAL, -- Need ON

...

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-AIML-RequestLocationInformation* field descriptions |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***multiLocationEstimateInSameReport***  This field, if present, indicates that the target device is requested to provide multiple location estimate instances in a single measurement report; i.e., include *nr-DL-AIML-LocationInformationInstances* in IE *NR-DL-AIML-ProvideLocationInformation.* |

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

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

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

-- ASN1START

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

locationCoordinateTypes-r19 LocationCoordinateTypes OPTIONAL,

periodicalReporting-r19 ENUMERATED { supported } OPTIONAL,

periodicReportingIntervalMsSupport-r19 PeriodicReportingIntervalMsSupport-r18 OPTIONAL,

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

scheduledLocationRequestSupported-r19 ScheduledLocationTimeSupport-r17 OPTIONAL,

nr-PosCalcAssistanceSupport-r19 BIT STRING {

trpLocSup (0),

beamInfoSup (1),

rtdInfoSup (2),

trpTEG-InfoSup (3),

nr-IntegritySup (4),

pruInfoSup (5),

trpLoc-ImplicitSup (6)

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

nr-los-nlos-AssistanceDataSupport-r19 SEQUENCE {

type LOS-NLOS-IndicatorType2-r17,

granularity LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

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

eAoD (0),

eAoA (1)

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

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

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

ENUMERATED { supported } OPTIONAL,

nr-dl-prs-AssistanceDataValidity-r19 SEQUENCE {

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

...

} OPTIONAL,

multiLocationEstimateInSameMeasReport-r19 ENUMERATED { supported } OPTIONAL,

nr-IntegrityAssistanceSupport-r19 BIT STRING {

serviceParametersSup (0),

serviceAlertSup (1),

riskParametersSup (2),

integrityParaTRP-LocSup (3),

integrityParaBeamInfoSup (4),

integrityParaRTD-InfoSup (5)

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

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

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

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

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

...

}

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

freqBandIndicatorNR-r19 FreqBandIndicatorNR-r16,

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

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

...

}

-- ASN1STOP

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

#### 6.5.13.7 NR DL AI/ML Positioning Capability Information Request

#### – *NR-DL-AIML-RequestCapabilities*

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

-- ASN1START

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

...

}

-- ASN1STOP

#### 6.5.13.8 NR DL AI/ML Positioning Error Elements

#### – *NR-DL-AIML-Positioning-Error*

The IE *NR-DL-AIML-Positioning-Error* is used by the location server or target device to provide NR DL AI/ML positioning error reasons to the target device or location server, respectively.

-- ASN1START

NR-DL-AIML-Positioning-Error-r19 ::= CHOICE {

locationServerErrorCauses-r19 NR-DL-AIML-LocationServerErrorCauses-r19,

targetDeviceErrorCauses-r19 NR-DL-AIML-TargetDeviceErrorCauses-r19,

...

}

-- ASN1STOP

#### – *NR-DL-AIML-LocationServerErrorCauses*

The IE *NR-DL-AIML-LocationServerErrorCauses* is used by the location server to provide NR DL AI/ML positioning error reasons to the target device.

-- ASN1START

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

cause-r19 ENUMERATED { undefined,

assistanceDataNotSupportedByServer,

assistanceDataSupportedButCurrentlyNotAvailableByServer,

notProvidedAssistanceDataNotSupportedByServer,

on-demand-dl-prs-NotSupportedByServer,

on-demand-dl-prs-SupportedButCurrentlyNotAvailableByServer,

...

},

...

}

-- ASN1STOP

#### – *NR-DL-AIML-TargetDeviceErrorCauses*

The IE *NR-DL-AIML-TargetDeviceErrorCauses* is used by the target device to provide NR DL AI/ML positioning error reasons to the location server.

-- ASN1START

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

cause-r19 ENUMERATED { undefined,

assistance-data-missing,

unableToMeasureAnyTRP,

attemptedButUnableToMeasureSomeNeighbourTRPs,

thereWereNotEnoughSignalsReceived,

locationCalculationAssistanceDataMissing,

dl-aiml-positioning-not-available,

...

},

remoteUE-Indication-r19 ENUMERATED {true} OPTIONAL, -- Cond NR

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *NR* | This field is optionally present, need OR, for NR access. Otherwise it is not present. |

| *NR-DL-AIML-TargetDeviceErrorCauses* field descriptions |
| --- |
| ***remoteUE-Indication***  This field indicates whether the target device in NR access is configured as a L2 U2N Remote UE. |

[…]

## 7.2 Mapping of *posSibType* to assistance data element

The supported *posSibType*'s are specified in Table 7.2-1. The GNSS Common and Generic Assistance Data IEs are defined in clause 6.5.2.2. The OTDOA Assistance Data IEs and NR DL-TDOA/DL-AoD Assistance Data IEs are defined in clause 7.4.2. The Barometric Assistance Data IEs are defined in clause 6.5.5.8. The TBS (based on MBS signals) Assistance Data IEs are defined in clause 6.5.4.8.

Table 7.2-1: Mapping of posSibType to assistanceDataElement

|  |  |  |
| --- | --- | --- |
|  | *posSibType* | *assistanceDataElement* |
| GNSS Common Assistance Data (clause 6.5.2.2) | *posSibType1-1* | *GNSS-ReferenceTime* |
| *posSibType1-2* | *GNSS-ReferenceLocation* |
| *posSibType1-3* | *GNSS-IonosphericModel* |
| *posSibType1-4* | *GNSS-EarthOrientationParameters* |
| *posSibType1-5* | *GNSS-RTK-ReferenceStationInfo* |
| *posSibType1-6* | *GNSS-RTK-CommonObservationInfo* |
| *posSibType1-7* | *GNSS-RTK-AuxiliaryStationData* |
| *posSibType1-8* | *GNSS-SSR-CorrectionPoints* |
| *posSibType1-9* | *GNSS-Integrity-ServiceParameters* |
| *posSibType1-10* | *GNSS-Integrity-ServiceAlert* |
| *posSibType1-11* | *GNSS-LOS-NLOS-GridPoints* |
| *posSibType1-12* | *GNSS-SSR-IOD-Update* |
| GNSS Generic Assistance Data (clause 6.5.2.2) | *posSibType2-1* | *GNSS-TimeModelList* |
| *posSibType2-2* | *GNSS-DifferentialCorrections* |
| *posSibType2-3* | *GNSS-NavigationModel* |
| *posSibType2-4* | *GNSS-RealTimeIntegrity* |
| *posSibType2-5* | *GNSS-DataBitAssistance* |
| *posSibType2-6* | *GNSS-AcquisitionAssistance* |
| *posSibType2-7* | *GNSS-Almanac* |
| *posSibType2-8* | *GNSS-UTC-Model* |
| *posSibType2-9* | *GNSS-AuxiliaryInformation* |
| *posSibType2-10* | *BDS-DifferentialCorrections* |
| *posSibType2-11* | *BDS-GridModelParameter* |
| *posSibType2-12* | *GNSS-RTK-Observations* |
| *posSibType2-13* | *GLO-RTK-BiasInformation* |
| *posSibType2-14* | *GNSS-RTK-MAC-CorrectionDifferences* |
| *posSibType2-15* | *GNSS-RTK-Residuals* |
| *posSibType2-16* | *GNSS-RTK-FKP-Gradients* |
| *posSibType2-17* | *GNSS-SSR-OrbitCorrections* |
| *posSibType2-17a* | *GNSS-SSR-OrbitCorrectionsSet2* |
| *posSibType2-18* | *GNSS-SSR-ClockCorrections* |
| *posSibType2-18a* | *GNSS-SSR-ClockCorrectionsSet2* |
| *posSibType2-19* | *GNSS-SSR-CodeBias* |
| *posSibType2-20* | *GNSS-SSR-URA* |
| *posSibType2-20a* | *GNSS-SSR-URA-Set2* |
| *posSibType2-21* | *GNSS-SSR-PhaseBias* |
| *posSibType2-22* | *GNSS-SSR-STEC-Correction* |
| *posSibType2-23* | *GNSS-SSR-GriddedCorrection* |
| *posSibType2-24* | *NavIC-DifferentialCorrections* |
| *posSibType2-25* | *NavIC-GridModelParameter* |
| *posSibType2-26* | *GNSS-LOS-NLOS-GriddedIndications* |
| *posSibType2-27* | *GNSS-SSR-SatellitePCVResiduals* |
| OTDOA Assistance Data (clause 7.4.2) | *posSibType3-1* | *OTDOA-UE-Assisted* |
| Barometric Assistance Data  (clause 6.5.5.8) | *posSibType4-1* | *Sensor-AssistanceDataList* |
| TBS Assistance Data  (clause 6.5.4.8) | *posSibType5-1* | *TBS-AssistanceDataList* |
| NR DL-TDOA/DL-AoD/DL AI/ML Assistance Data (clauses 6.4.3, 7.4.2) | *posSibType6-1* | *NR-DL-PRS-AssistanceData* |
| *posSibType6-2* | *NR-UEB-TRP-LocationData* |
| *posSibType6-3* | *NR-UEB-TRP-RTD-Info* |
| *posSibType6-4* | *NR-TRP-BeamAntennaInfo* |
| *posSibType6-5* | *NR-DL-PRS-TRP-TEG-Info* |
| *posSibType6-7* | *NR-PRU-DL-Info* |
| On-demand DL-PRS Configurations (clause 6.4.3) | *posSibType6-6* | *NR-On-Demand-DL-PRS-Configurations* |
| Integrity Assistance Data for NR Positioning Methods (clause 6.4.3) | *posSibType7-1* | *NR-IntegrityRiskParameters* |
| *posSibType7-2* | *NR-IntegrityServiceParameters* |
| *posSibType7-3* | *NR-IntegrityServiceAlert* |
| *posSibType7-4* | *NR-IntegrityParameters* |