**3GPP TSG-RAN WG2 Meeting #109 electronic Draft R2-2001941**

**Elbonia, 24 Feb – 6 Mar 2020**

|  |
| --- |
| *CR--Form--v12.0* |
| **CHANGE REQUEST** |
|  |
|  | **37.355** | **CR** |  | **rev** | **-** | **Current version:** | **15.0.0** |  |
|  |
| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network | **X** |

|  |
| --- |
|  |
| ***Title:***  | Capturing RAN1 parameters for positioning |
|  |  |
| ***Source to WG:*** | Intel Corporation  |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_pos-Core |  | ***Date:*** | 2020-02-13 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
|  |  |
| ***Reason for change:*** | To capture agreements for NR Positioning Support into stage 3 specification.   |
|  |  |
| ***Summary of change:*** | **RAN2-109e**1 PRS resource set ID and PRS resource ID should be indicated within dl PRS QCL2 From 615Proposal 1: Beam level measurement results are added in NR ECID method.Proposal 3: The ProvideAssistanceData in running CR[2] can be upgraded as below. The required physical resources are put in:  nr-DL-PRS-ProvideAssistanceData-r16 (nr-DL-PRS-AssistanceDataList-r16,nr-SSB-Config-r16) The selected physical resources index for some positioning method are put in: nr-Multi-RTT-ProvideAssistanceData-r16 nr-DL-AoD-ProvideAssistanceData-r16 nr-DL-TDOA-ProvideAssistanceData-r16Proposal 4: Non-critical extension is used in message body to capture Rel-16 NR dependent positioning methods, and prefix “nr” is used to distinguish LTE and NR. The EN is removed;Proposal 5: Common NR positioning IEs are captured in section 6 as new sub-clause. NR-PhysCellId is moved to section 6.4.1.Proposal 6: Under Common NR Positioning Information Elements clause, introduce sub-clauses: Common NR assistance data Information Elements, Common NR capability Information Elements and Common NR report Information Elements.Proposal 7: Do not group report configuration, indicate request measurement per positioning method.Proposal 9: UL/DL PRS RSRP measurements is optional for multi-RTT.Proposal 10: UL PRS RSRP measurements is optional for UL TDOA.RAN2-108 (based on R2-1914728):1 Updated the impacted spec to TS37.3552 Updated RAN1 parameters based on R1-1913674 3 Updated measurement reporting structure taking R2-1915652 into account;4 Captured following agreements:- For Multi-RTT positioning, the DL-PRS information for the candidate TRPs are provided by an LMF to the UE in an LPP Provide Assistance Data message.- The time/frequency occupancy of the DL-PRS required in the UL-PRS (SRS) information is provided as part of the DL-PRS assistance data for Multi-RTT positioning. UL-PRS (SRS) information includes an index/pointer to the relevant information in the DL-PRS assistance data (e.g., DL-PRS Resource Set ID/Resource ID).- The time/frequency occupancy of the SSBs required in both, DL-PRS and UL-PRS is grouped in a single IE, and a pointer/index is used to reference the required information.RAN2-108:NR dependent positioning:To capture RAN1 parameters (agreed in R1-1911564) into stage 3 specification.  |
|  |  |
| ***Consequences if not approved:*** | NR Positioning Support is missing in stage 3. |
|  |  |
| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | **R2-2000474** |

# 1 Scope

The present document contains the definition of the LTE Positioning Protocol (LPP) for the radio access technologies E-UTRA/LTE and NR.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.305: "Stage 2 functional specification of User Equipment (UE) positioning in E-UTRAN".

[3] 3GPP TS 23.271: "Functional stage 2 description of Location Services (LCS)".

[4] IS-GPS-200, Revision D, Navstar GPS Space Segment/Navigation User Interfaces, March 7th, 2006.

[5] IS-GPS-705, Navstar GPS Space Segment/User Segment L5 Interfaces, September 22, 2005.

[6] IS-GPS-800, Navstar GPS Space Segment/User Segment L1C Interfaces, September 4, 2008.

[7] IS-QZSS, Quasi Zenith Satellite System Navigation Service Interface Specifications for QZSS, Ver.1.1, July 31, 2009.

[8] Galileo OS Signal in Space ICD (OS SIS ICD), Issue 1.2, February 2014, European Union.

[9] Global Navigation Satellite System GLONASS Interface Control Document, Version 5.1, 2008.

[10] Specification for the Wide Area Augmentation System (WAAS), US Department of Transportation, Federal Aviation Administration, DTFA01-96-C-00025, 2001.

[11] RTCM-SC104, RTCM Recommended Standards for Differential GNSS Service (v.2.3), August 20, 2001.

[12] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); "Radio Resource Control (RRC); Protocol specification".

[13] 3GPP TS 25.331: "Radio Resource Control (RRC); Protocol Specification".

[14] 3GPP TS 44.031: "Location Services (LCS); Mobile Station (MS) - Serving Mobile Location Centre (SMLC) Radio Resource LCS Protocol (RRLP)".

[15] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".

[16] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation".

[17] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer – Measurements".

[18] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[19] 3GPP TS 23.003: "Numbering, addressing and identification".

[20] OMA-TS-LPPe-V1\_0, LPP Extensions Specification, Open Mobile Alliance.

[21] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

[22] ITU-T Recommendation X.691 (07/2002) "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)" (Same as the ISO/IEC International Standard 8825-2).

[23] BDS-SIS-ICD-2.0: "BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal (Version 2.0)", December 2013.

[24] ATIS-0500027: "Recommendations for Establishing Wide Scale Indoor Location Performance", May 2015.

[25] Bluetooth Special Interest Group: "Bluetooth Core Specification v4.2", December 2014.

[26] IEEE 802.11, Part 11: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[27] IETF RFC 6225, "Dynamic Host Configuration Protocol Options for Coordinate-Based Location Configuration Information", July 2011.

[28] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures".

[29] "Earth Gravitational Model 96 (EGM96)", National Geospatial-Intelligence Agency, NASA.

[30] RTCM Standard 10403.3: "Differential GNSS (Global Navigation Satellite Systems) Services" – Version 3, October 7, 2016.

[31] IGS ANTEX: "The Antenna Exchanged Format" – version 1.4, September 15, 2010.

[32] Federal Information Processing Standards Publication 197, "Specification for the ADVANCED ENCRYPTION STANDARD (AES)", November 26, 2001.

[33] NIST Special Publication 800-38A, "Recommendation for Block Cipher Modes of Operation Methods and Techniques", 2001.

[34] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[35] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[36] 3GPP TS 38.215: "NR; Physical layer measurements".

[37] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[x1] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[x2] 3GPP TS 38.211: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical channels and modulation".

[x3] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], TS 36.305 [2] and TS 23.271 [3] apply. Other definitions are provided below.

**Anchor carrier:** In NB-IoT, a carrier where the UE assumes that NPSS/NSSS/NPBCH/SIB-NB for FDD or NPSS/NSSS/NPBCH for TDD are transmitted.

**Location Server:** a physical or logical entity (e.g., E-SMLC or SUPL SLP) that manages positioning for a target device by obtaining measurements and other location information from one or more positioning units and providing assistance data to positioning units to help determine this. A Location Server may also compute or verify the final location estimate.

**NB-IoT:** NB-IoT allows access to network services via E-UTRA with a channel bandwidth limited to 200 kHz.

**Reference Source:** a physical entity or part of a physical entity that provides signals (e.g., RF, acoustic, infra-red) that can be measured (e.g., by a Target Device) in order to obtain the location of a Target Device.

**Target Device:** the device that is being positioned (e.g., UE or SUPL SET).

**Transmission Point (TP):** A set of geographically co-located transmit antennas (e.g. antenna array (with one or more antenna elements)) for one cell, part of one cell or one PRS-only TP. Transmission Points can include base station (eNodeB) antennas, remote radio heads, a remote antenna of a base station, an antenna of a PRS-only TP, etc. One cell can be formed by one or multiple transmission points. For a homogeneous deployment, each transmission point may correspond to one cell.

**Observed Time Difference Of Arrival (OTDOA):** The time interval that is observed by a target device between the reception of downlink signals from two different TPs. If a signal from TP 1 is received at the moment *t1*, and a signal from TP 2 is received at the moment *t2*, the OTDOA is *t2* – *t1*.

**PRS-only TP**: A TP which only transmits PRS signals for PRS-based TBS positioning and is not associated with a cell.

**Transmission-Reception Point (TRP)**: A set of geographically co-located antennas (e.g. antenna array (with one or more antenna elements)) supporting TP and/or RP functionality.

**Relative Time Difference (RTD):** The relative time difference between a TRP *i* and a TRP *j*, is defined as *tj – ti*, where *ti* and *tj* are defined as the time when TRP *i* and *j* transmit the start of one subframe respectively.

## 3.2 Abbreviations

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

ADR Accumulated Delta-Range

A‑GNSS Assisted‑GNSS

AP Access Point

ARFCN Absolute Radio Frequency Channel Number

ARP Antenna Reference Point

BDS BeiDou Navigation Satellite System

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-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)

ICD Interface Control Document

IGS International GNSS Service

IOD Issue of Data

IS Interface Specification

LLA Latitude Longitude Altitude

LMF Location Management Function

LPP LTE Positioning Protocol

LPPa LTE Positioning Protocol Annex

LSB Least Significant Bit

MAC Master Auxiliary Concept

MBS Metropolitan Beacon System

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 Mulitple-Round Trip Time

NAV Navigation

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

NPRS Narrowband Positioning Reference Signals

NR NR Radio Access

NRSRP Narrowband Reference Signal Received Power

NRSRQ Narrowband Reference Signal Received Quality

NTSC National Time Service Center of Chinese Academy of Sciences

OSR Observation Space Representation

OTDOA Observed Time Difference Of Arrival

PDU Protocol Data Unit

PPP Precise Point Positioning

PRB Physical Resource Block

PRC Pseudo‑Range Correction

PRS Positioning Reference Signals

posSIB Positioning System Information Block

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

QZS Quasi Zenith Satellite

QZSS Quasi-Zenith Satellite System

QZST Quasi-Zenith System Time

RF Radio Frequency

RRC Range‑Rate Correction

Radio Resource Control

RSRP Reference Signal Received 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

SSID Service Set Identifier

SSR State Space Representation

SUPL Secure User Plane Location

SV Space Vehicle

TB Terrestrial Beacon

TBS Terrestrial Beacon System

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

USNO US Naval Observatory

UT1 Universal Time No.1

UTC Coordinated Universal Time

WAAS Wide Area Augmentation System

WGS‑84 World Geodetic System 1984

WLAN Wireless Local Area Network

# 4 Functionality of Protocol

## 4.1 General

### 4.1.1 LPP Configuration

LPP is used point-to-point between a location server (E-SMLC, LMF or SLP) and a target device (UE or SET) in order to position the target device using position-related measurements obtained by one or more reference sources. Figure 4.1.1-1 shows the configuration as applied to the control- and user-plane location solutions for E-UTRAN and NG-RAN (as defined in TS 36.305 [2], TS 38.305 [x1], TS 23.273 [x3] and TS 23.271 [3]).

NB-IoT is a non-backward compatible variant of E-UTRAN supporting a reduced set of functionalities. In this specification, procedures and messages specified for the UE equally apply to the UE in NB-IoT.



Figure 4.1.1-1: LPP Configuration for Control- and User-Plane Positioning in E-UTRAN or NG-RAN

### 4.1.2 LPP Sessions and Transactions

An LPP session is used between a Location Server and the target device in order to obtain location related measurements or a location estimate or to transfer assistance data. A single LPP session is used to support a single location request (e.g., for a single MT-LR, MO-LR or NI-LR). Multiple LPP sessions can be used between the same endpoints to support multiple different location requests (as required by TS 23.271 [3]). Each LPP session comprises one or more LPP transactions, with each LPP transaction performing a single operation (capability exchange, assistance data transfer, or location information transfer). In E-UTRAN and NG-RAN, the LPP transactions are realized as LPP procedures. The instigator of an LPP session will always instigate the first LPP transaction, but subsequent transactions may be instigated by either end. LPP transactions within a session may occur serially or in parallel. LPP transactions are indicated at the LPP protocol level with a transaction ID in order to associate messages with one another (e.g., request and response).

Messages within a transaction are linked by a common transaction identifier.

### 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 and NR Multi-RTTpositioning methods.

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| Next change |

5 LPP Procedures

5.1 Procedures related to capability transfer

The purpose of the procedures that are grouped together in this clause is to enable the transfer of capabilities from the target device to the server. Capabilities in this context refer to positioning and protocol capabilities related to LPP and the positioning methods supported by LPP.

These procedures instantiate the Capability Transfer transaction from TS 36.305 [2] and TS 38.305 [x1].

5.1.1 Capability Transfer procedure

The Capability Transfer procedure is shown in Figure 5.1.1-1.

****

**Figure 5.1.1-1: LPP Capability Transfer procedure**

1. The server sends a *RequestCapabilities* message to the target. The server may indicate the types of capability needed.

2. The target responds with a *ProvideCapabilities* message to the server. The capabilities shall correspond to any capability types specified in step 1. This message shall include the *endTransaction* IE set to TRUE.

5.1.2 Capability Indication procedure

The Capability Indication procedure allows the target to provide unsolicited capabilities to the server and is shown in Figure 5.1.2-1.

****

**Figure 5.1.2-1: LPP Capability Indication procedure**

1. The target sends a *ProvideCapabilities* message to the server. This message shall include the *endTransaction* IE set to TRUE.

5.1.3 Reception of LPP Request Capabilities

Upon receiving a *RequestCapabilities* message, the target device shall generate a *ProvideCapabilities* message as a response.

The target device shall:

1> for each positioning method for which a request for capabilities is included in the message:

2> if the target device supports this positioning method:

3> include the capabilities of the device for that supported positioning method in the response message;

1> set the IE *LPP-TransactionID* in the response message to the same value as the IE *LPP-TransactionID* in the received message;

1> deliver the response message to lower layers for transmission.

### 5.1.4 Transmission of LPP Provide Capabilities

When triggered to transmit a *ProvideCapabilities* message, the target device shall:

1> for each positioning method whose capabilities are to be indicated:

2> set the corresponding IE to include the device's capabilities;

2> if OTDOA capabilities are to be indicated:

3> include the IE *supportedBandListEUTRA*;

1> deliver the response to lower layers for transmission.

Editor’s Note: FFS on whether supportedBandListNR is needed.

## 5.2 Procedures related to Assistance Data Transfer

The purpose of the procedures in this clause is to enable the target to request assistance data from the server to assist in positioning, and to enable the server to transfer assistance data to the target in the absence of a request.

These procedures instantiate the Assistance Data Transfer transaction from TS 36.305 [2] and TS 38.305 [x1].

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| Next change |

## 5.3 Procedures related to Location Information Transfer

The purpose of the procedures in this clause is to enable the server to request location measurement data and/or a location estimate from the target, and to enable the target to transfer location measurement data and/or a location estimate to a server in the absence of a request.

These procedures instantiate the Location Information Transfer transaction in TS 36.305 [2] and TS 38.305 [x1].

NOTE: The service layer (e.g. NAS or OMA SUPL ULP) would be used to transfer information associated with a location request from a target to a server (MO-LR).

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## 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

 ]]

}

-- 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

 ]]

}

-- 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

 ]]

}

-- 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

 ]]

}

-- ASN1STOP

| ***ProvideAssistanceData* field descriptions** |
| --- |
| ***commonIEsProvideAssistanceData***This IE is provided for future extensibility and should not be included in this version of the protocol. |

#### – *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

 ]]

}

-- 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

 ]]

}

-- ASN1STOP

Editor’s Note: FFS on how to capture NR E-CID, Multi-RTT, DL-AoD, DL-TDOA for NR, introduce highlevel IE NR-Positioning and common subsection NR positioning measurements or define them as separate IEs and separate subsections.

|  |
| --- |
| Next change |

## 6.4 Common IEs

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

### 6.4.1 Common Lower-Level IEs

#### – *AccessTypes*

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

-- ASN1START

AccessTypes ::= SEQUENCE {

 accessTypes BIT STRING { eutra (0),

 utra (1),

 gsm (2),

 nb-iot (3),

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

 ...

}

-- ASN1STOP

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

#### *–* *ARFCN-ValueEUTRA*

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

-- ASN1START

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

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

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

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

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

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

-- ASN1STOP

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

#### – *ARFCN-ValueNR*

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

-- ASN1START

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

-- ASN1STOP

#### *– ARFCN-ValueUTRA*

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

-- ASN1START

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

-- ASN1STOP

#### – *CarrierFreq-NB*

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

-- ASN1START

CarrierFreq-NB-r14 ::= SEQUENCE {

 carrierFreq-r14 ARFCN-ValueEUTRA-r14,

 carrierFreqOffset-r14 CarrierFreqOffsetNB-r14 OPTIONAL,

 ...

}

-- ASN1STOP

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

– *CarrierFreqOffsetNB*

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

-- ASN1START

CarrierFreqOffsetNB-r14 ::= ENUMERATED {

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

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

 }

-- ASN1STOP

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

#### *– CellGlobalIdEUTRA-AndUTRA*

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

-- ASN1START

CellGlobalIdEUTRA-AndUTRA ::= SEQUENCE {

 plmn-Identity SEQUENCE {

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

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

 },

 cellIdentity CHOICE {

 eutra BIT STRING (SIZE (28)),

 utra BIT STRING (SIZE (32))

 },

 ...

}

-- ASN1STOP

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

#### *– CellGlobalIdGERAN*

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

-- ASN1START

CellGlobalIdGERAN ::= SEQUENCE {

 plmn-Identity SEQUENCE {

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

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

 },

 locationAreaCode BIT STRING (SIZE (16)),

 cellIdentity BIT STRING (SIZE (16)),

 ...

}

-- ASN1STOP

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

#### *– ECGI*

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

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

-- ASN1START

ECGI ::= SEQUENCE {

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

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

 cellidentity BIT STRING (SIZE (28))

}

-- ASN1STOP

#### *– Ellipsoid-Point*

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

-- ASN1START

Ellipsoid-Point ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

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

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

}

-- ASN1STOP

#### *– Ellipsoid-PointWithUncertaintyCircle*

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

-- ASN1START

Ellipsoid-PointWithUncertaintyCircle ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

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

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

 uncertainty INTEGER (0..127)

}

-- ASN1STOP

#### *– EllipsoidPointWithUncertaintyEllipse*

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

-- ASN1START

EllipsoidPointWithUncertaintyEllipse ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

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

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

 uncertaintySemiMajor INTEGER (0..127),

 uncertaintySemiMinor INTEGER (0..127),

 orientationMajorAxis INTEGER (0..179),

 confidence INTEGER (0..100)

}

-- ASN1STOP

#### *– EllipsoidPointWithAltitude*

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

-- ASN1START

EllipsoidPointWithAltitude ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

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

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

 altitudeDirection ENUMERATED {height, depth},

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

}

-- ASN1STOP

#### *– EllipsoidPointWithAltitudeAndUncertaintyEllipsoid*

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

-- ASN1START

EllipsoidPointWithAltitudeAndUncertaintyEllipsoid ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

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

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

 altitudeDirection ENUMERATED {height, depth},

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

 uncertaintySemiMajor INTEGER (0..127),

 uncertaintySemiMinor INTEGER (0..127),

 orientationMajorAxis INTEGER (0..179),

 uncertaintyAltitude INTEGER (0..127),

 confidence INTEGER (0..100)

}

-- ASN1STOP

#### *– EllipsoidArc*

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

-- ASN1START

EllipsoidArc ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

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

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

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

 uncertaintyRadius INTEGER (0..127),

 offsetAngle INTEGER (0..179),

 includedAngle INTEGER (0..179),

 confidence INTEGER (0..100)

}

-- ASN1STOP

#### *– EPDU-Sequence*

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

-- ASN1START

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

maxEPDU INTEGER ::= 16

EPDU ::= SEQUENCE {

 ePDU-Identifier EPDU-Identifier,

 ePDU-Body EPDU-Body

}

EPDU-Identifier ::= SEQUENCE {

 ePDU-ID EPDU-ID,

 ePDU-Name EPDU-Name OPTIONAL,

 ...

}

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

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

EPDU-Body ::= OCTET STRING

-- ASN1STOP

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

External PDU Identifier Definition

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

#### *– HighAccuracyEllipsoidPointWithUncertaintyEllipse*

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

-- ASN1START

HighAccuracyEllipsoidPointWithUncertaintyEllipse-r15 ::= SEQUENCE {

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

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

 uncertaintySemiMajor-r15 INTEGER (0..255),

 uncertaintySemiMinor-r15 INTEGER (0..255),

 orientationMajorAxis-r15 INTEGER (0..179),

 confidence-r15 INTEGER (0..100)

}

-- ASN1STOP

#### *– HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid*

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

-- ASN1START

HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15 ::= SEQUENCE {

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

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

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

 uncertaintySemiMajor-r15 INTEGER (0..255),

 uncertaintySemiMinor-r15 INTEGER (0..255),

 orientationMajorAxis-r15 INTEGER (0..179),

 horizontalConfidence-r15 INTEGER (0..100),

 uncertaintyAltitude-r15 INTEGER (0..255),

 verticalConfidence-r15 INTEGER (0..100)

}

-- ASN1STOP

#### *– HorizontalVelocity*

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

-- ASN1START

HorizontalVelocity ::= SEQUENCE {

 bearing INTEGER(0..359),

 horizontalSpeed INTEGER(0..2047)

}

-- ASN1STOP

#### *– HorizontalWithVerticalVelocity*

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

-- ASN1START

HorizontalWithVerticalVelocity ::= SEQUENCE {

 bearing INTEGER(0..359),

 horizontalSpeed INTEGER(0..2047),

 verticalDirection ENUMERATED{upward, downward},

 verticalSpeed INTEGER(0..255)

}

-- ASN1STOP

#### *– HorizontalVelocityWithUncertainty*

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

-- ASN1START

HorizontalVelocityWithUncertainty ::= SEQUENCE {

 bearing INTEGER(0..359),

 horizontalSpeed INTEGER(0..2047),

 uncertaintySpeed INTEGER(0..255)

}

-- ASN1STOP

#### *– HorizontalWithVerticalVelocityAndUncertainty*

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

-- ASN1START

HorizontalWithVerticalVelocityAndUncertainty ::= SEQUENCE {

 bearing INTEGER(0..359),

 horizontalSpeed INTEGER(0..2047),

 verticalDirection ENUMERATED{upward, downward},

 verticalSpeed INTEGER(0..255),

 horizontalUncertaintySpeed INTEGER(0..255),

 verticalUncertaintySpeed INTEGER(0..255)

}

-- ASN1STOP

#### *– LocationCoordinateTypes*

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

-- ASN1START

LocationCoordinateTypes ::= SEQUENCE {

 ellipsoidPoint BOOLEAN,

 ellipsoidPointWithUncertaintyCircle BOOLEAN,

 ellipsoidPointWithUncertaintyEllipse BOOLEAN,

 polygon BOOLEAN,

 ellipsoidPointWithAltitude BOOLEAN,

 ellipsoidPointWithAltitudeAndUncertaintyEllipsoid BOOLEAN,

 ellipsoidArc BOOLEAN,

 ...,

 [[

 highAccuracyEllipsoidPointWithUncertaintyEllipse-r15 BOOLEAN OPTIONAL,

 highAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15 BOOLEAN OPTIONAL

 ]]

}

-- ASN1STOP

#### *– NCGI*

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

-- ASN1START

NCGI-r15 ::= SEQUENCE {

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

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

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

}

-- ASN1STOP

#### *– NR-PhysCellId*

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

-- ASN1START

NR-PhysCellId-r16 ::= SEQUENCE {

 PhysCellId-r16 INTEGER (0..1007)}

-- ASN1STOP

#### *– PeriodicAssistanceDataControlParameters*

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

-- ASN1START

PeriodicAssistanceDataControlParameters-r15 ::= SEQUENCE {

 periodicSessionID-r15 PeriodicSessionID-r15,

 ...,

 [[

 updateCapabilities-r15 UpdateCapabilities-r15 OPTIONAL

 ]]

}

PeriodicSessionID-r15 ::= SEQUENCE {

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

 periodicSessionNumber-r15 INTEGER (0..255),

 ...

}

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

-- ASN1STOP

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

#### *– Polygon*

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

-- ASN1START

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

PolygonPoints ::= SEQUENCE {

 latitudeSign ENUMERATED {north, south},

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

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

}

-- ASN1STOP

#### *– PositioningModes*

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

-- ASN1START

PositioningModes ::= SEQUENCE {

 posModes BIT STRING { standalone (0),

 ue-based (1),

 ue-assisted (2)

 } (SIZE (1..8)),

 ...

}

-- ASN1STOP

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

#### – *SegmentationInfo*

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

-- ASN1START

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

-- ASN1STOP

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

#### *– VelocityTypes*

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

-- ASN1START

VelocityTypes ::= SEQUENCE {

 horizontalVelocity BOOLEAN,

 horizontalWithVerticalVelocity BOOLEAN,

 horizontalVelocityWithUncertainty BOOLEAN,

 horizontalWithVerticalVelocityAndUncertainty BOOLEAN,

 ...

}

-- ASN1STOP

### 6.4.2 Common NR Positioning Information Elements

#### 6.4.2.1 Common NR assistance data Information Elements

#### *– NR-DL-PRS-Config*

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

-- ASN1START

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

 dl-PRS-ResourceSetList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTRP)) DL-PRS-ResourceSet-r16,

 nr-DL-PRS-SFN0-Offset-r16 SEQUENCE {

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

 integerSubframeOffset-r16 INTEGER (0..9) OPTIONAL -- Need OP

 } OPTIONAL,

 ...

}

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

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

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

 dl-PRS-ResourceRepetitionFactor-r16 ENUMERATED {n1, n2, n4, n6, n8, n16, n32, ...},

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

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

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

 dl-PRS-MutingPatternList-r16 SEQUENCE {

 mutingOption1-r16 SEQUENCE {

 mutingPattern-r16 MutingPattern-r16,

 dl-PRS-MutingBitRepetitionFactor-r16 ENUMERATED {n1, n2, n4, n8, ...} OPTIONAL --Need OR

 },

 mutingOption2-r16 SEQUENCE {

 mutingPattern-r16 MutingPattern-r16

 }

 },

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

 ...

}

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

 dl-PRS-ResourceId-r16 NR-DL-PRS-ResourceID-r16,

 dl-PRS-SequenceId-r16 INTEGER {0.. 4095},

 dl-PRS-ReOffset-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),

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

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

 ...

}

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)),

 ...

}

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,

 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),

 ...},

 ...

}

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

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

nrMaxNumDL-PRS-ResourcesPerSet-1 INTEGER ::= 63

nrMaxNumDL-PRS-ResourceSetsPerTRP-1 INTEGER ::= 7

nrMaxResourceOffsetValue-1 INTEGER ::= 511

nrMaxResourcesPerSet INTEGER ::= 64 -- Maximum resources can be configured for one set

nrMaxSetsPerTrp INTEGER ::= 2 -- Maximum resources set can be configured for one TRP

-- ASN1STOP

| *NR-DL-PRS-Config* field descriptions |
| --- |
| ***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 slot 0 for a TRP where 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 parameter controls 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 DL PRS Resource Set. |
| ***dl-PRS-ResourceTimeGap***This parameter indicates 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. DL-PRS-ResourceTimeGap is provided only if DL-PRS-ResourceRepetitionFactor is configured and is greater than 1. The time duration spanned by one DL PRS Resource set containing repeated DL PRS Resources should not exceed DL-PRS-Periodicity. |
| ***dl-PRS-MutingPatternList***List of dl-PRS-MutingPattern, first entry is for Option 1 and second entry is for Option 2. The following options are supported for the applicability of the bitmap.• Option 1: Each bit in the bitmap corresponds to a configurable number of consecutive instances (in a periodic transmission of DL-PRS resource sets) of a DL-PRS Resource seto All DL-PRS Resources within a DL-PRS Resource Set instance are muted for a DL-PRS Resource Set instance that is indicated to be muted by the bitmap• Option 2: Each bit in the bitmap corresponds to a single repetition index for each of the DL-PRS Resources within an instance of a DL-PRS Resource Set (The length of the bitmap is equal to DL-PRS-ResourceRepetitionFactor)o The above applies to all instances of the DL-PRS Resource Set that the above DL-PRS Resources are part of.• Bitmap size values: 2, 4, 6, 8, 16, 32 bitsBit value “0” indicates a muted DL PRS transmission, and the value “1” indicates DL PRS transmissionUE can be configured with any of the following combinations of DL PRS muting options:Option 1 onlyOption 2 onlyOption 1 and Option 2 |
| ***dl-PRS-MutingBitRepetitionFactor***This parameter indicates the configurable number of consecutive instances (in a periodic transmission of DL-PRS resource sets) of a DL-PRS Resource Set applicable to single bit of Option 1 Muting bitmap. |
| ***dl-PRS-CombSizeN***This parameter indicates Resource element (RE) spacing in each symbol of DL PRS Resource. All DL PRS Resource Sets belonging to the same Positioning Frequency Layer have the same value of combSize. |
| ***dl-PRS-ReOffset***This parameter indicates Resource element offset in frequency domain for the first symbol in a DL PRS Resource. The relative RE offsets of following symbols are defined relative to the RE Offset in frequency domain of the first symbol in the DL PRS resource. |
| ***dl-PRS-ResourceSlotOffset***This parameters indicates points to starting slot of DL PRS Resource with respect to corresponding DL-PRS-ResourceSetSlotOffset***.*** |
| ***dl-PRS-QCL-Info***This parameter indicates QCL indication with other DL reference signals for serving and neighboring cells. |
| ***dl-PRS-SubcarrierSpacing***This parameter indicates Subcarrier Spacing for DL PRS Resource. 15, 30, 60 kHz for FR1; 60, 120 kHz for FR2. |
| ***dl-PRS-ResourceBandwidth***This parameter indicates the number of PRBs allocated for DL PRS Resource (allocated DL PRS bandwidth). All DL PRS Resources of the DL PRS Resource Set have the same bandwidth. All DL PRS Resource Sets belonging to the same Positioning Frequency Layer have the same value of DL PRS Bandwidth and Start PRB.Value 1 equals 24, value 2 equals to 28, value 3 equals to 32 and so on. |
| ***dl-PRS-StartPRB***This parameter indicates start PRB index defined as offset with respect to reference DL PRS Point A configured for positioning frequency layer.  |
| ***dl-PRS-PointA***This parameter indicates absolute frequency of the reference resource block for DL PRS. Its lowest subcarrier is also known as DL PRS Point A. A single Point A for DL PRS resource allocation is provided per positioning frequency layer. All DL PRS Resources belonging to the same DL PRS Resource Set have common Point A. |
| ***dl-PRS-CyclicPrefix***This parameter indicates Cyclic Prefix Type for DL PRS Resource. |
| ***dl-PRS-NumSymbol***This parameter indicates the number of symbols per DL PRS Resource within a slot. |
| ***dl-PRS-SequenceId***This parameter indicates the sequence Id used to initialize cinit value used in pseudo random generator TS38.211 [x2, 5.2.1] for generation of DL PRS sequence for transmission on a given DL PRS Resource. |
| ***nr-DL-PRS-SFN0-Offset***Defines time offset of the SFN0 slot 0 for given TRP with respect to SFN0 slot 0 of reference TRP. |
| ***sfn-Offset***This field specifies the SFN offset at the TRP antenna location between the reference TRP and this neighbour TRP. The offset corresponds to the number of full radio frames counted from the beginning of a radio frame #0 of the reference TRP to the beginning of the closest subsequent radio frame #0 of this neighbour TRP. |
| ***integerSubframeOffset***This field specifies the frame boundary offset at the TRP antenna location between the reference TRP and this neighbour TRP counted in full subframes. The offset is counted from the beginning of a subframe #0 of the reference TRP to the beginning of the closest subsequent subframe #0 of this neighbour TRP, rounded down to multiples of subframes.  |

#### *– TRP-ID*

The IE *TRP-ID* provides the IDs to identify the TRP.

-- ASN1START

TRP-ID-r16 ::= SEQUENCE {

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

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

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

 nrARFCNRef-r16 ARFCN-ValueNR-r15 OPTIONAL -- Cond NotSameAsRefServ0

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *NotSameAsRefServ0* | The field is mandatory present if the NREARFCN is not the same as for the assistance data reference TRP; otherwise it is not present. |

| *TRP-ID* field descriptions |
| --- |
| ***nr-PhysCellId***This field specifies the physical cell identity of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalId***This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP, as defined in TS 38.331 [35]. The server should include this field if it considers that it is needed to resolve ambiguity in the TRP indicated by *nr-PhysCellId*. |
| ***nrARFCNRef***This field specifies the NRARFCN of the TRP. |
| ***dl-PRS-ID***This field is used along with a DL PRS Resource Set ID and a DL PRS Resources ID to uniquely identify a DL PRS Resource. This ID can be associated with multiple DL PRS Resource Sets associated with a single TRP.Each TRP should only be associated with one such ID. |

#### *– NR-SSB-Config*

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

-- ASN1START

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

 trp-ID-r16 TRP-ID-r16,

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

 halfFrameIndex-r16 INTEGER (0..1),

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

 ssb-PositionsInBurst-r16 CHOICE {

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

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

 longBitmap-r16 BIT STRING (SIZE (64))

 } OPTIONAL, --Need OR

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

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

 smtc-r16 SEQUENCE {

 periodicityAndOffset-r16 CHOICE {

 sf5 INTEGER (0..4),

 sf10 INTEGER (0..9),

 sf20 INTEGER (0..19),

 sf40 INTEGER (0..39),

 sf80 INTEGER (0..79),

 sf160 INTEGER (0..159)

 },

 duration-r16 ENUMERATED { sf1, sf2, sf3, sf4, sf5, ... }

 }

}

-- ASN1STOP

| *NR-SSB-Config* field descriptions |
| --- |
| ***ssb-PositionsInBurst***Indicates the time domain positions of the transmitted SS-blocks in a half frame with SS/PBCH blocks as defined in TS 38.213 [39], clause 4.1. The first/ leftmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not transmitted while value 1 indicates that the corresponding SS/PBCH block is transmitted.  |
| ***ss-PBCH-BlockPower***Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [13], clause 7. |
| ***ssb-periodicityServingCell***The SSB periodicity in ms for the rate matching purpose. If the field is absent, the UE applies the value ms5. (see TS 38.213 [39], clause 4.1). |
| ***ssbSubcarrierSpacing***Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable. |
| ***smtc***The SSB periodicity/offset/duration configuration.  |
| ***ssb-Index*** For a DL PRS resource, SSB index indicated for QCL Type D and QCL Type C is same. |

|  |
| --- |
|  |
|  |

#### – *NR-SelectedDL-PRS-PerFreq-r16*

The IE *NR-SelectedDL-PRS-PerFreq-r16* is used by the location server to provide the selected FrequencyLayer index of *nr-DL-PRS-AssistanceDataList-r16* to device. In case of multiple methods, the *NR-DL-PRS-ProvideAssistanceData-r16* may only be present in one of the method.

-- ASN1START

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

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

 nr-SelectedDL-PRS-IndexListPerFreq (SIZE (1..nrMaxTRPsPerFreq)) OF NR-SelectedDL-PRS-IndexPerTRP-r16 OPTIONAL, --Need ON

 ...

}

NR-Selected-DL-PRS-IndexPerTRP-r16 ::= SEQUENCE {

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

 dl-SelectedPRS-ResourceSetIndexList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTrp)) DL-SelectedPRS-ResourceSetIndex-r16 OPTIONAL, --Need ON

 ...

}

DL-Selected-PRS-ResourceSetIndex-r16 ::= SEQUENCE {

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

 dl-SelectedPRS-ResourceIndexList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet)) dl-SelectedPRS-ResourceIndex-r16 OPTIONAL, --Need ON

}

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

 nr-dl-SelectedPRS-ResourceIdIndex-r16 INTEGER (0.. maxNumDL-PRS-ResourcesPerSet-1),

...

}

nrMaxFreqLayers INTEGER ::= 4 -- Max freq layers

nrMaxFreqLayers-1 INTEGER ::= 3

nrMaxTRPsPerFreq INTEGER ::= 64 -- Max TRPs per freq layers

nrMaxTRPsPerFreq-1 INTEGER ::= 63

nrMaxSetsPerTrp INTEGER ::= 2 -- Maximum resources set can be configured for one TRP

nrMaxSetsPerTrp-1 INTEGER ::= 1

nrMaxResourcesPerSet INTEGER ::= 64 -- Maximum resources can be configured for one set

|  |  |
| --- | --- |
|  |  |

#### – *NR-DL-PRS-AssistanceData*

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

-- ASN1START

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

 nr-DL-PRS-ReferenceInfo-r16 DL-PRS-IdInfo-r16 OPTIONAL, -- Need ON

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

 nr-SSB-Config-r16 SEQUENCE (SIZE (0..255)) OF NR-SSB-Config-r16, ...

}

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

 nr-DL-PRS-AssistanceDataPerFreq (SIZE (1..nrMaxTRPsPerFreq)) OF NR-DL-PRS-AssistanceDataPerTRP-r16,

 nr-DL–PRS-PositioningFrequencyLayer-r16 NR-DL–PRS-PositioningFrequencyLayer-r16 OPTIONAL, --Need ON

 ...

}

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

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

 nr-DL-PRS-expectedRSTD-uncerainty-r16 INTEGER (-246..246),

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

 nr-DL-PRS-Config-r16 NR-DL-PRS-Config-r16,

 ...

}

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

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

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

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

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

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

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

 ...

}

nrMaxFreqLayers INTEGER ::= 4 -- Max freq layers

nrMaxTRPsPerFreq INTEGER ::= 64 -- Max TRPs per freq layers

nrMaxResourceIDs INTEGER ::= 64 -- Max ResourceIDs

-- ASN1STOP

| *NR-DL-PRS-AssistanceData* field descriptions |
| --- |
| ***nr-DL-PRS-Config*** This field specifies the PRS configuration of the TRP. |
| ***nr-DL-PRS-ReferenceInfo***This field indicates the IDs of the reference TRP. |
| ***nr-DL-PRS-ResourceID-List***The list of nr DL PRS resource ID. Only a single NR-DL-PRS-ResourceId is included if the field is used in measurement reporting. |

#### – *DL-PRS-IdInfo*

The IE *DL-PRS-IdInfo* provides IDs provides the IDs of the reference and neighbour TRPs DL-PRS Resources.

-- ASN1START

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

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

 nr-DL-PRS-ResourceID-List-r16 (SIZE (1..nrMaxResourceIDs)) OF NR-DL-PRS-ResourceId-r16 OPTIONAL,

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

}

-- ASN1STOP

#### 6.4.2.2 Common NR report Information Elements

|  |
| --- |
|  |
|  |
|  |
|  |

#### *– NR-MeasQuality*

The IE *NR-MeasQuality* defines the target device′s best estimate of the quality of measurements.

-- ASN1START

NR-MeasQuality-r16 ::= SEQUENCE {

 timingMeasQualityValue-r16 INTEGER (0..31),

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

 ...

}

-- ASN1STOP

| *NR-MeasQuality* field descriptions |
| --- |
| ***timingMeasQualityValue***This parameter provides the best estimate of the uncertainty of the measurement. |
| ***timingMeasQualityResolution***This parameter provides the resolution levels used in the Value field. |

#### *– NR-TimeStamp*

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

-- ASN1START

NR-TimeStamp-r16 ::= SEQUENCE {

 trp-ID-r16 TRP-ID-r16 OPTIONAL,-- Cond NotSameAsRefServ0

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

 nr-Slot-r16 CHOICE {

 scs15 INTEGER (0..9),

 scs30 INTEGER (0..19),

 scs60 INTEGER (0..39),

 scs120 INTEGER (0..79)

 },

 ...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *NotSameAsRefServ0* | The field is mandatory present if the SFN is not from the reference TRP; otherwise it is not present. |

#### 6.4.2.3 Common NR capability Information Elements

#### *– NR-DL-PRS-MeasCapability*

The IE *NR-DL-PRS-MeasCapability* defines the UE downlink PRS measurement capability.

-- ASN1START

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

 supportedBandListNR-r16 SEQUENCE (SIZE (1..nrMaxBands)) OF SupportedBandNR OPTIONAL, --- not in RAN1 list

 maxNumOfDL-PRS-Resources-r16 MaxNumOfDL-PRS-Resources-r16, -- FFS on the definition

 numDL-PRS-RSRPMeasurementsPerTRP-r16 INTEGER (1..FFS), -- FFS 3?

 numPositioningFrequencyLayers-r16 INTEGER (1..FFS), -- FFS

 numTrpPerPositioningFrequencyLayer-r16 INTEGER (1..FFS), -- FFS

 numDL-PRS-ResourceSetsPerTRP-r16 INTEGER (1..FFS), -- FFS

 numDL-PRS-ResourcesPerSet-r16 INTEGER (1..FFS), -- FFS

 totalNum-DL-PRS-Resources-r16 INTEGER (1..FFS), -- FFS

 ...

}

SupportedBandNR-r16 ::= SEQUENCE {

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

}

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

-- ASN1STOP

Editor’s Note: all capabilities in NR-DL-PRS-MeasCapability will be discussed in RAN1, this part will be updated once RAN1 has conclusion on capability..

#### *– NR-UL-SRS-MeasCapability*

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

-- ASN1START

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

 --FFS

}

-- ASN1STOP

Editor’s Note: all capabilities in NR-UL-SRS-Meas-Capability will be discussed in RAN1. This part will be updated once RAN1 has conclusion.

|  |
| --- |
| Next change |

### 6.w.1 NR-ECID Positioning

This clause defines the information elements for NR ECID positioning (TS 38.305 [x1]).

#### 6.w.1.1 NR-ECID Location Information

#### – *NR-ECID-ProvideLocationInformation*

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

-- ASN1START

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

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

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

 ...

}

-- ASN1STOP

#### 6.w.1.2 NR-ECID Location Information Elements

#### – *NR-ECID-SignalMeasurementInformation*

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

-- ASN1START

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

 nr-PrimaryCellMeasuredResults-r16 NR-MeasuredResultsElement-r16,

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

 ...

}

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

NR-MeasuredResultsElement-r16 ::= SEQUENCE {

 systemFrameNumber BIT STRING (SIZE (10)),

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

 measResultNR-r16 SEQUENCE {

 cellResults-r16 SEQUENCE{

 resultsSSB-Cell-r16 MeasQuantityResults-r16 OPTIONAL,

 resultsCSI-RS-Cell-r16 MeasQuantityResults-r16 OPTIONAL

 },

 rsIndexResults-r16 SEQUENCE{

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

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

 } OPTIONAL

 },

 ...

}

MeasQuantityResults-r16 ::= SEQUENCE {

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

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

}

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

ResultsPerSSB-Index-r16 ::= SEQUENCE {

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

 ssb-Results-r16 MeasQuantityResults-r16 OPTIONAL

}

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

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

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

 csi-RS-Results-r16 MeasQuantityResults-r16 OPTIONAL

}

-- ASN1STOP

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

#### 6.w.1.3 NR-ECID Location Information Request

#### – *NR-ECID-RequestLocationInformation*

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

-- ASN1START

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

 requestedMeasurements-r16 BIT STRING { ssrsrpReq (0),

 ssrsrqReq (1),

 csirsrpReq (2),

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

 ...

}

-- ASN1STOP

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

#### 6.w.1.4 NR-ECID Capability Information

#### – *NR-ECID-ProvideCapabilities*

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

-- ASN1START

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

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

 ssrsrqSup (1),

 csirsrpSup (2),

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

 periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

 triggeredReporting-r16 ENUMERATED { supported } OPTIONAL,

 ...

}

-- ASN1STOP

#### 6.w.1.5 NR-ECID Capability Information Request

#### – *NR-ECID-RequestCapabilities*

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

-- ASN1START

NR-ECID-RequestCapabilities ::= SEQUENCE {

 ...

}

-- ASN1STOP

#### 6.w.1.6 NR-ECID Error Elements

#### – *NR-ECID-Error*

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

-- ASN1START

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

 locationServerErrorCauses-r16 NR-ECID-LocationServerErrorCauses-r16,

 targetDeviceErrorCauses-r16 NR-ECID-TargetDeviceErrorCauses-r16,

 ...

}

-- ASN1STOP

#### – *NR-ECID-LocationServerErrorCauses*

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

-- ASN1START

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

 Cause-r16 ENUMERATED { undefined,

 ...

 },

 ...

}

-- ASN1STOP

#### – *NR-ECID-TargetDeviceErrorCauses*

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

-- ASN1START

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

 Cause-r16 ENUMERATED { undefined,

 requestedMeasurementNotAvailable,

 notAllrequestedMeasurementsPossible,

 ...

 },

 ss-RSRPMeasurementNotPossible NULL OPTIONAL,

 ss-RSRQMeasurementNotPossible NULL OPTIONAL,

 csi-RSRPMeasurementNotPossible NULL OPTIONAL,

 csi-RSRQMeasurementNotPossible NULL OPTIONAL,

 ...

}

-- ASN1STOP

### 6.x.1 NR-DL-TDOA Positioning

This clause defines the information elements for NR downlink TDOA positioning (TS 38.305 [x1]).

#### 6.x.1.1 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 downlink TDOA. It may also be used to provide NR DL TDOA positioning specific error reason.

-- ASN1START

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

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

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

 nr-PositionCalculationAssistanceData-r16

 NR-PositionCalculationAssistanceData-r16

 OPTIONAL, -- Cond UEB

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

 ...

}

-- ASN1STOP

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

#### 6.x.1.2 NR-DL-TDOA Assistance Data Request

#### – *NR-DL-TDOA-RequestAssistanceData*

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

-- ASN1START

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

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

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

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

 ...

}

-- ASN1STOP

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

#### 6.x.1.3 NR-DL-TDOA Location Information

#### – *NR-DL-TDOA-ProvideLocationInformation*

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

-- ASN1START

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

 nr-DL-TDOA-SignalMeasurementInformation-r16

 DL-TDOA-SignalMeasurementInformation-r16 OPTIONAL,

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

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

 ...

}

-- ASN1STOP

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

#### 6.x.1.4 NR-DL-TDOA Location Information Elements

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

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

-- ASN1START

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

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

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

 ...

}

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

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

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

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

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

 nr-TimeStamp-r16 NR-TimeStamp-r16,

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

 nr-MeasQuality-r16 NR-MeasQuality-r16,

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

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

 ...

}

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

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

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

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

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

 dl-PRS-RSRP-ResultDiff-r16 INTEGER (FFS) OPTIONAL, -- FFS on the value range

...

}

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

-- ASN1STOP

| *NR-DL-TDOA-SignalMeasurementInformation* field descriptions |
| --- |
|  |
| ***nr-PRS-RSRP-Result***This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
| ***nr-RSTD***This field specifies the relative timing difference between this neighbour TRP and the PRS reference TRP, as defined in FFS. Mapping of the measured quantity is defined as in FSS. |
| ***nr-MeasQuality*** This field specifies the target device′s best estimate of the quality of the measurement. |

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

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

-- ASN1START

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

 measurementReferenceTime-r16 CHOICE {

 systemFrameNumber-r16 NR-TimeStamp-r16,

 utc-time-r16 UTCTime,

 ...

 } OPTIONAL,

 ...

}

-- ASN1STOP

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

#### 6.x.1.5 NR-DL-TDOA Location Information Request

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

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

-- ASN1START

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

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

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

 } (SIZE(1..8)),

 nr-AssistanceAvailability-r16 BOOLEAN,

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

 ...

}

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

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

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

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

}

-- ASN1STOP

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

#### 6.x.1.6 NR-DL-TDOA Capability Information

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

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

-- ASN1START

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

 nr-DL-TDOA-Mode-r16 PositioningModes,

 nr-DL-TDOA-MeasCapability-r16 NR-DL-PRS-MeasCapability-r16 OPTIONAL,

 nr-DL-TDOA-MeasSupported-r16 BIT STRING { prsrsrpSup (0)} (SIZE(1..8)),

 periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-TDOA-ProvideCapabilities* field descriptions |
| --- |
| ***nr-DL-TDOA-Mode***This field specifies the DL-TDOA mode(s) supported by the target device.  |

#### 6.x.1.7 NR-DL TDOA Capability Information Request

#### – *NR-DL-TDOA-RequestCapabilities*

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

-- ASN1START

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

 ...

}

-- ASN1STOP

#### 6.x.1.8 NR-DL-TDOA Error Elements

#### – *NR-DL-TDOA-Error*

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

-- ASN1START

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

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

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

 ...

}

-- ASN1STOP

#### – *NR-DL-TDOA-LocationServerErrorCauses*

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

-- ASN1START

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

 cause-r16 ENUMERATED { undefined,

 assistanceDataNotSupportedByServer,

 assistanceDataSupportedButCurrentlyNotAvailableByServer,

 notProvidedAssistanceDataNotSupportedByServer, ...

 },

 ...

}

-- ASN1STOP

#### – *NR-DL-TDOA-TargetDeviceErrorCauses*

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

-- ASN1START

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

 cause-r16 ENUMERATED { undefined,

 assistance-data-missing,

 unableToMeasureAnyTRP,

 attemptedButUnableToMeasureSomeNeighbourTRPs,

 thereWereNotEnoughSignalsReceivedForUeBasedDL-TDOA,

 locationCalculationAssistanceDataMissing, ...

 },

 nr-PRS-RSRPMeasurementNotPossible-r16 NULL OPTIONAL,

 nr-RSTDMeasurementNotPossible-r16 NULL OPTIONAL,

 ...

}

-- ASN1STOP

### 6.y.1 NR-DL-AoD Positioning

This clause defines the information elements for NR downlink AoD positioning (TS 38.305 [x1]).

#### 6.y.1.1 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 Aod. It may also be used to provide NR DL AoD positioning specific error reason.

-- ASN1START

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

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

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

 nr-PositionCalculationAssistanceData-r16

 NR-PositionCalculationAssistanceData-r16

 OPTIONAL, -- Cond UEB

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

 ...

}

-- ASN1STOP

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

#### 6.y.1.2 NR-DL-AoD Assistance Data Request

#### – *NR-DL-AoD-RequestAssistanceData*

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

-- ASN1START

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

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

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

 ...

}

-- ASN1STOP

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

#### 6.y.1.3 NR-DL-AoD Location Information

#### – *NR-DL-AoD-ProvideLocationInformation*

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

-- ASN1START

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

 nr-DL-AoD-SignalMeasurementInformation-r16

 NR-DL-AoD-SignalMeasurementInformation-r16 OPTIONAL,

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

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

 ...

}

-- ASN1STOP

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

#### 6.y.1.4 NR-DL-AoD Location Information Elements

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

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

-- ASN1START

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

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

 ...

}

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

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

 trp-ID-r16 TRP-ID-r16 OPTIONAL, nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,

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

 nr-TimeStamp-r16 NR-TimeStamp-r16,

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

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

 nr-MeasQuality-r16 NR-MeasQuality-r16,

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

 ...

}

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

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

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

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

 nr-TimeStamp-r16 NR-TimeStamp-r16,

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

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

 ...

}

nrMaxTRPs INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

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

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

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

-- ASN1START

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

 measurementReferenceTime-r16 CHOICE {

 sfn-time-r16 NR-TimeStamp-r16,

 utc-time-r16 UTCTime,

 ...

 } OPTIONAL,

 ...

}

-- ASN1STOP

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

#### 6.y.1.5 NR-DL-AoD Location Information Request

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

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

-- ASN1START

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

 nr-AssistanceAvailability-r16 BOOLEAN,

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

 ...

}

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

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

}

-- ASN1STOP

| *NR-DL-AoD-RequestLocationInformation* field descriptions |
| --- |
| ***nr-AssistanceAvailability***This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***nr-RequestedMeasurements***This field specifies the DL-AoD measurements requested. This is represented by a bit string, with a one‑value at the bit position means the particular measurement is requested; a zero‑value means not requested. |
| ***maxDL-PRS-RSRP-MeasurementsPerTRP***This field specifies the maximum number of DL PRS RSRP measurements on different DL PRS resources from the same TRP.  |

#### 6.y.1.6 NR-DL-AoD Capability Information

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

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

-- ASN1START

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

 nr-DL-TDOA-Mode-r16 PositioningModes,

 periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

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

 ...

}

-- ASN1STOP

#### 6.y.1.7 NR-DL AoD Capability Information Request

#### – *NR-DL-AoD-RequestCapabilities*

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

-- ASN1START

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

 ...

}

-- ASN1STOP

#### 6.y.1.8 NR-DL-AoD Error Elements

#### – *NR-DL-AoD-Error*

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

-- ASN1START

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

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

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

 ...

}

-- ASN1STOP

#### – *NR-DL-AoD-LocationServerErrorCauses*

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

-- ASN1START

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

 cause-r16 ENUMERATED { undefined,

 assistanceDataNotSupportedByServer,

 assistanceDataSupportedButCurrentlyNotAvailableByServer,

 notProvidedAssistanceDataNotSupportedByServer,

 ...

 },

 ...

}

-- ASN1STOP

#### – *NR-DL-AoD-TargetDeviceErrorCauses*

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

-- ASN1START

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

 cause-r16 ENUMERATED { undefined,

 assistance-data-missing,

 unableToMeasureAnyTRP,

 attemptedButUnableToMeasureSomeNeighbourTRPs,

 thereWereNotEnoughSignalsReceivedForUeBasedDL-AoD,

 locationCalculationAssistanceDataMissing,

 ...

 },

 nr-PRS-RSRPMeasurementNotPossible-r16 NULL OPTIONAL,

 ...

}

-- ASN1STOP

### 6.z.1 NR-Multi-RTT Positioning

This clause defines the information elements for downlink NR-Multi-RTT positioning (TS 38.305 [x1]).

#### 6.z.1.1 NR-Multi-RTT Assistance Data

#### – *NR-Multi-RTT-ProvideAssistanceData*

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

-- ASN1START

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

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

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

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

 ...

}

-- ASN1STOP

#### 6.z.1.2 NR-Multi-RTT Assistance Data Request

#### – *NR-Multi-RTT-RequestAssistanceData*

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

-- ASN1START

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

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

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

 ...

}

-- ASN1STOP

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

#### 6.z.1.3 NR-Multi-RTT Location Information

#### – *NR-Multi-RTT-ProvideLocationInformation*

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

-- ASN1START

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

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

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

 ...

}

-- ASN1STOP

#### 6.z.1.4 NR-Multi-RTT Location Information Elements

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

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

-- ASN1START

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

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

 ...

}

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

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

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

 nr-MeasQuality-r16 NR-MeasQuality-r16,

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

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

 ...

}

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

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

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

 ...

}

nrMaxTRPs INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

| *NR-Multi-RTT-SignalMeasurementInformation* field descriptions |
| --- |
| ***nr-PRS-RSRP-Result***This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |
| ***nr-UE-RxTxTimeDiff***This field specifies the UE Rx–Tx time difference measurement, as defined in FFS.  |

#### 6.z.1.5 NR-Multi-RTT Location Information Request

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

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

-- ASN1START

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

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

 nr-AssistanceAvailability-r16 BOOLEAN,

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

 ...

}

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

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

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

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

}

-- ASN1STOP

| *NR-Multi-RTT-RequestLocationInformation* field descriptions |
| --- |
| ***nr-AssistanceAvailability***This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***nr-RequestedMeasurements***This field specifies the Multi-RTT measurements requested. This is represented by a bit string, with a one‑value at the bit position means the particular measurement is requested; a zero‑value means not requested. |
| ***maxDL-PRS-RSRP-MeasurementsPerTRP***This field specifies the maximum number of DL PRS RSRP measurements on different DL PRS resources from the same TRP.  |
| ***maxDL-PRS-RxTxTimeDiffMeasPerTRP***This field specifies the maximum number of UE-Rx-Tx time difference measurements for different DL PRS resources or DL PRS resource sets per TRP.  |
| ***timingReportingGranularityFactor***This field specifies the reporting granularity for the UE timing measurements (DL RSTD, the UE Rx-Tx time difference).  |

#### 6.z.1.6 NR-Multi-RTT Capability Information

#### – *NR-Multi-RTT-ProvideCapabilities*

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

-- ASN1START

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

 nr-DL-PRS-MeasCapability-r16 NR-DL-PRS-MeasCapability-r16,

 nr-UL-SRS-MeasCapability-r16 NR-UL-SRS-MeasCapability-r16,

 nr-Multi-RTT-MeasSupported-r16 BIT STRING { prsrsrpSup (0)} (SIZE(1..8)),

 periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

 ...

}

-- ASN1STOP

| *NR-Multi-RTT-ProvideCapabilities* field descriptions |
| --- |
|  |
|  |
|  |

Editor’s Note: FFS on whether nr-UL-SRS-MeasCapability is needed.

#### 6.z.1.7 NR-Multi-RTT Capability Information Request

#### – *NR-Multi-RTT-RequestCapabilities*

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

-- ASN1START

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

 ...

}

-- ASN1STOP

#### 6.z.1.8 NR-Multi-RTT Error Elements

#### – *NR-Multi-RTT-Error*

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

-- ASN1START

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

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

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

 ...

}

-- ASN1STOP

#### – *NR-Multi-RTT-LocationServerErrorCauses*

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

-- ASN1START

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

 cause-r16 ENUMERATED { undefined,

 assistanceDataNotSupportedByServer,

 assistanceDataSupportedButCurrentlyNotAvailableByServer,

 ...

 },

 ...

}

-- ASN1STOP

#### – *NR-Multi-RTT-TargetDeviceErrorCauses*

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

-- ASN1START

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

 cause-r16 ENUMERATED { undefined,

 dl-assistance-data-missing,

 unableToMeasureAnyTRP,

 attemptedButUnableToMeasureSomeNeighbourTRPs,

 ul-srs-configuration-missing,

 unableToTransmit-ul-prs,

 ...

 },

 nr-PRS-RSRPMeasurementNotPossible-r16 NULL OPTIONAL,

 nr-UERxTxMeasurementNotPossible-r16 NULL OPTIONAL,

 ...

}

-- ASN1STOP

6.5.x NR UL Positioning

#### 6.5.x.1 NR UL Capability Information

#### *– NR-UL-ProvideCapabilities*

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

-- ASN1START

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

 nr-UL-SRS-MeasCapability-r16 NR-UL-SRS-MeasCapability-r16,

 ...,

}

-- ASN1STOP

| *NR-UL-ProvideCapabilities* field descriptions |
| --- |
|  |
|  |
|  |

#### 6.5.x.2 NR UL Capability Information Request

#### *– NR-UL-RequestCapabilities*

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

-- ASN1START

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

 ...

}

-- ASN1STOP

|  |
| --- |
| **End Text Proposal Change** |