**3GPP TSG-RAN WG2 Meeting #109 electronic Draft R2-2002243**

**Elbonia, 24 Feb – 6 Mar 2020**

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| *CR--Form--v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.355** | **CR** | 0250 | **rev** | **2** | **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** |

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|  | | | | | | | | | | |
| ***Title:*** | Introduction of NR 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 can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To capture agreements for NR Positioning Support into stage 3 specification. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | **RAN2-109e**  **Merged R2-2001230, R2-2001946, R2-2001949, R2-2001951and R2-2001941. And additional changes in 7.1 and 7.2.**  1 PRS resource set ID and PRS resource ID should be indicated within dl PRS QCL  2 From 615  Proposal 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-r16  Proposal 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 TS37.355  2 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:*** | | 2, 3.1, 3.2, 4.1.1, 4.1.2, 4.1., 5.1, 5.2, 5.3, 6.4.1, 6.4.2,6.5.2.1, 6.5.2.2, 6.5.2.3, 6.5.2.4, 6.5.2.10, 6.5.2.13, 6.w.1, 6.x.1, 6.y.1, 6.z,.1, 7.2, 7.4 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

# 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".

[xx] IS-QZSS-L6-001, Quasi-Zenith Satellite System Interface Specification – Centimetre Level Augmentation Service, Cabinet Office, November 5, 2018.

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 Multiple-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

STEC Slant TEC

SUPL Secure User Plane Location

SV Space Vehicle

TB Terrestrial Beacon

TBS Terrestrial Beacon System

TEC Total Electron Content

TECU TEC Units

TLM Telemetry

TOA Time Of Arrival

TOD Time Of Day

TOW Time Of Week

TP Transmission Point

TRP Transmission-Reception Point

UDRE User Differential Range Error

ULP User Plane Location Protocol

URA User Range Accuracy

USNO US Naval Observatory

UT1 Universal Time No.1

UTC Coordinated Universal Time

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-RTT positioning 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.

## 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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## 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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| Next change |

## 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

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

-- ASN1START

NR-AdditionalPath-r16 ::= SEQUENCE {

nr-relativeTimeDifference-r16 INTEGER (FFS),--FFS to be decided in RAN4

nr-path-Quality-r16 NR-TOAMeasQuality-r16 OPTIONAL,

...

}

-- ASN1STOP

| *NR-AdditionalPath* field descriptions |
| --- |
| ***nr-relativeTimeDifference***  This field specifies the additional detected path timing relative to the detected path timing of the reference resource. A positive value indicates that the particular path is later in time than the detected path of the reference; a negative value indicates that the particular path is earlier in time than the detected path of the reference. |
| ***nr-path-Quality***  This field specifies the target device′s best estimate of the quality of the detected timing of the additional path. |

#### *– NR-DL-PRS-Config*

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

-- ASN1START

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

nr-DL-PRS-ResourceSetList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTRP)) NR-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,

...

}

NR-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 NR-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),

...

}

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

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

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

dl-PRS-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 set  o 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 bits  Bit value “0” indicates a muted DL PRS transmission, and the value “1” indicates DL PRS transmission  UE can be configured with any of the following combinations of DL PRS muting options:  Option 1 only  Option 2 only  Option 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 NR-EARFCN 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-r16 SEQUENCE (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)) OF 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)) OF 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

-- ASN1STOP

#### *– NR-PositionCalculationAssistance*

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

-- ASN1START

NR-PositionCalculationAssistance-r16 ::= SEQUENCE {

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

nr-dl-prs-BeamInfo-r16 NR-DL-PRS-Beam-Info-r16 OPTIONAL, -- Need ON

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

...

}

-- ASN1STOP

| *NR-PositionCalculationAssistance* field descriptions |
| --- |
| ***nr-trp-LocationInfo***  This field provides the location coordinates of the antenna reference points of the TRPs. |
| ***nr-dl-prs-BeamInfo***  This field provides the spatial directions of DL-PRS Resources for TRPs. |
| ***nr-rtd-Info***  This field provides the time synchronization information between the reference TRP and neighbour TRPs. |

#### *NR-TRP-LocationInfo*

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

-- ASN1START

NR-TRP-LocationInfo-r16 ::= SEQUENCE (SIZE (1..4)) OF NR-TRP-LocationInfoPerFreqLayer-r16

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

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

trp-LocationInfoList-r16 SEQUENCE (SIZE (1..64)) OF TRP-LocationInfoElement-r16,

...

}

TRP-LocationInfoElement-r16 ::= SEQUENCE {

trp-id-r16 TRP-ID-r16,

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

trp-DL-PRS-ResourceSets-r16 SEQUENCE (SIZE(1..2)) OF

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

...

}

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

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

dl-PRS-Resource-ARP-List-r16 SEQUENCE (SIZE(1..64)) OF

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

...

}

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

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

...

}

-- ASN1STOP

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

| *NR-TRP-LocationInfo* field descriptions |
| --- |
| ***referencePoint***  This field specifies the reference point used to define the TRP location in the *trp-LocationInfoList*. If this field is absent, the reference point is the same as in the previous entry of the *NR-TRP-LocationInfoPerFreqLayer* list. |
| ***trp-LocationInfoList***  This field provides the antenna reference point locations of the DL-PRS Resources for the TRPs and comprises the following sub-fields:  - ***trp-id***: This field provides an identity of the TRP.  - ***trp-Location***: This field provides the location of the TRP relative to the *referencePoint* location. If this field is absent the TRP location coincides with the *referencePoint* location.  - ***trp-DL-PRS-ResourceSets***: This field provides the antenna reference point location(s) of the DL-PRS Resource Set(s) associated with this TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resource Set(s) coincides with the *trp-Location* location. This field comprises the following sub-fields:  - ***dl-PRS-ResourceSetARP***: This field provides the antenna reference point location of the DL-PRS Resource Set relative to the *trp-Location* location. If this field is absent, the antenna reference point location of this DL-PRS Resource Set coincides with the *trp-Location* location.  - ***dl-PRS-Resource-ARP-List***: This field provides the antenna reference point location(s) of the DL-PRS Resource(s) associated with this resource set of the TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resources coincides with the *dl-PRS-ResourceSetARP* location. This field comprises the following sub-fields:  - ***dl-PRS-Resource-ARP-location***: This field provides the antenna reference point location of the DL-PRS Resource associated with the DL-PRS Resource Set of the TRP relative to the *dl-PRS-ResourceSetARP* location. If this field is absent, the antenna reference point location of this DL-PRS Resource coincides with the *dl-PRS-ResourceSetARP* location. |

#### – *ReferencePoint*

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

-- ASN1START

ReferencePoint-r16 ::= SEQUENCE {

referencePointGeographicLocation-r16 CHOICE {

location3D-r16 EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,

ha-location3D-r16 HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15,

...

},

...

}

-- ASN1STOP

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

#### – *RelativeLocation*

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

-- ASN1START

RelativeLocation-r16 ::= SEQUENCE {

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

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

delta-latitude-r16 Delta-Latitude-r16,

delta-longitude-r16 Delta-Longitude-r16,

delta-height-r16 Delta-Height-r16,

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

...

}

Delta-Latitude-r16 ::= SEQUENCE {

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

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

...

}

Delta-Longitude-r16 ::= SEQUENCE {

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

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

...

}

Delta-Height-r16 ::= SEQUENCE {

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

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

...

}

LocationUncertainty-r16 ::= SEQUENCE {

horizontalUncertainty-r15 INTEGER (0..255),

horizontalConfidence-r15 INTEGER (0..100),

verticalUncertainty-r15 INTEGER (0..255),

verticalConfidence-r15 INTEGER (0..100)

}

-- ASN1STOP

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

#### – *NR-DL-PRS-BeamInfo*

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

-- ASN1START

NR-DL-PRS-BeamInfo-r16 ::= SEQUENCE (SIZE (1..4)) OF NR-DL-PRS-BeamInfoPerFreqLayer-r16

NR-DL-PRS-BeamInfoPerFreqLayer-r16 ::= SEQUENCE (SIZE (1..64)) OF NR-DL-PRS-BeamInfo-r16

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

trp-id-r16 TRP-ID-r16,

lcs-gcs-translation-parameter-r16 LCS-GCS-Translation-Parameter-r16 OPTIONAL, -- Need OP

dl-prs-BeamInfoSet-r16 DL-PRS-BeamInfoSet-r16,

...

}

DL-PRS-BeamInfoSet-r16 ::= SEQUENCE (SIZE(1..2)) OF DL-PRS-BeamInfoResourceSet-r16

DL-PRS-BeamInfoResourceSet-r16 ::= SEQUENCE (SIZE(1..64)) OF DL-PRS-BeamInfoElement-r16

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

dl-PRS-Azimuth-r16 INTEGER (0..3599),

dl-PRS-Elevation-r16 INTEGER (0..1800) OPTIONAL, -- Need ON

...

}

LCS-GCS-Translation-Parameter-r16 ::= SEQUENCE {

alpha-r16 INTEGER (0..3599),

beta-r16 INTEGER (0..3599),

gamma-r16 INTEGER (0..3599),

...

}

-- ASN1STOP

| *NR-DL-PRS-Beam-Info* field descriptions |
| --- |
| ***trp-id***  This field provides an identity of the TRP. |
| ***lcs-gcs-translation-parameter***  This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [x]. If this field is absent, the *dl-PRS-Azimuth* and *dl-PRS-Elevation* are provided in a GCS. |
| ***dl-prs-BeamInfoSet***  This field provides the DL-PRS beam information for each DL-PRS Resource of the DL-PRS Resource Set associated with this TRP. |
| ***dl-PRS-Azimuth***  This field specifies the azimuth angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the azimuth angle is measured counter-clockwise from geographical North.  For a Local Coordinate System (LCS), the azimuth angle is measured measured counter-clockwise from the x-axis of the LCS.  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |
| ***dl-PRS-Elevation***  This field specifies the elevation angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the elevation angle is measured relative to zenith and positive to the horizontal direction (elevation 0 deg. points to zenith, 90 deg to the horizon).  For a Local Coordinate System (LCS), the elevation angle is measured relative to the z-axis of the LCS (elevation 0 deg. points to the z-axis, 90 deg to the x-y plane).  Scale factor 0.1 degrees; range 0 to 180 degrees. |
| ***alpha***  This field specifies the bearing angle α for the translation of the LCS to a GCS as defined in TR 38.901 [x].  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |
| ***beta***  This field specifies the downtilts angle β for the translation of the LCS to a GCS as defined in TR 38.901 [x].  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |
| ***gamma***  This field specifies the slant angle γ for the translation of the LCS to a GCS as defined in TR 38.901 [x].  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |

#### – *NR-RTD-Info*

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

-- ASN1START

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

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

rtd-InfoList-r16 RTD-InfoList-r16,

...

}

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

ref-trp-id-r16 TRP-ID-r16,

refTime-r16 CHOICE {

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

utc-r16 UTCTime,

...

},

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

...

}

RTD-InfoList-r16 ::= SEQUENCE (SIZE (1..4)) OF RTD-InfoListPerFreqLayer-r16

RTD-InfoListPerFreqLayer-r16 ::= SEQUENCE (SIZE(1..63)) OF RTD-InfoElement-r16

RTD-InfoElement-r16 ::= SEQUENCE {

trp-id-r16 TRP-ID-r16,

subframeOffset-r16 INTEGER (0..1966079),

rtd-Quality-r16 NR-TimingMeasQuality-r16,

...

}

-- ASN1STOP

| *NR-RTD-Info* field descriptions |
| --- |
| ***referenceTRP-RTD-Info***  This field defines the reference TRP for the RTD and comprises the following sub-fields:  - ***ref-trp-id***: This field specifies the identity of the reference TRP.  - ***refTime***: This field specifies the reference time at which the *rtd-InfoList* is valid. The *systemFrameNumber* choice refers to the SFN of the reference TRP.  - ***rtd-RefQuality***: This field specifies the quality of the timing of reference TRP, used to determine the RTD values provided in *rtd-InfoList*. |
| ***trp-id-r16***  This fields provides the identity of the TRP for which the *RTD-InfoElement* is applicable. |
| ***subframeOffset***  This field specifies the subframe boundary offset at the TRP antenna location between the reference TRP and this neighbour TRP in time units  where Hz and  (TS 38.211 [x]).  The offset is counted from the beginning of a subframe #0 of the reference TRP to the beginning of the closest subsequent subframe of this neighbour TRP.  Scale factor 1 Tc. |
| ***rtd-Quality***  This field specifies the quality of the RTD. |

#### – *NR-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-TimingMeasQuality*

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

-- ASN1START

NR-TimingMeasQuality-r16 ::= SEQUENCE {

timingMeasQualityValue-r16 INTEGER (0..31),

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

...

}

-- ASN1STOP

| *NR-TimingMeasQuality* 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

#### *– 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

|  |
| --- |
| Next change |

### 6.5.2 A-GNSS Positioning

#### 6.5.2.1 GNSS Assistance Data

#### – *A-GNSS-ProvideAssistanceData*

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

-- ASN1START

A-GNSS-ProvideAssistanceData ::= SEQUENCE {

gnss-CommonAssistData GNSS-CommonAssistData OPTIONAL, -- Need ON

gnss-GenericAssistData GNSS-GenericAssistData OPTIONAL, -- Need ON

gnss-Error A-GNSS-Error OPTIONAL, -- Need ON

...,

[[

gnss-PeriodicAssistData-r15 GNSS-PeriodicAssistData-r15 OPTIONAL -- Cond CtrTrans

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *CtrTrans* | The field is mandatory present in the control transaction of a periodic assistance data delivery session as described in clauses 5.2.1a and 5.2.2a. Otherwise it is not present. |

#### – *GNSS-CommonAssistData*

The IE *GNSS-CommonAssistData* is used by the location server to provide assistance data which can be used for any GNSS (e.g., GPS, Galileo, GLONASS, BDS, etc.).

-- ASN1START

GNSS-CommonAssistData ::= SEQUENCE {

gnss-ReferenceTime GNSS-ReferenceTime OPTIONAL, -- Need ON

gnss-ReferenceLocation GNSS-ReferenceLocation OPTIONAL, -- Need ON

gnss-IonosphericModel GNSS-IonosphericModel OPTIONAL, -- Need ON

gnss-EarthOrientationParameters GNSS-EarthOrientationParameters OPTIONAL, -- Need ON

...,

[[

gnss-RTK-ReferenceStationInfo-r15

GNSS-RTK-ReferenceStationInfo-r15 OPTIONAL, -- Need ON

gnss-RTK-CommonObservationInfo-r15

GNSS-RTK-CommonObservationInfo-r15 OPTIONAL, -- Cond RTK

gnss-RTK-AuxiliaryStationData-r15

GNSS-RTK-AuxiliaryStationData-r15 OPTIONAL -- Need ON

]],

[[

gnss-SSR-CorrectionPoints-r16

GNSS-SSR-CorrectionPoints-r16 OPTIONAL -- Need ON

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *RTK* | The field is mandatory present if the IE *GNSS-RTK-Observations* is included in IE *GNSS‑GenericAssistData*; otherwise it is not present. |

#### – *GNSS-GenericAssistData*

The IE *GNSS-GenericAssistData* is used by the location server to provide assistance data for a specific GNSS (e.g., GPS, Galileo, GLONASS, BDS, etc.). The specific GNSS for which the provided assistance data are applicable is indicated by the IE *GNSS‑ID* and (if applicable) by the IE *SBAS‑ID*. Assistance for up to 16 GNSSs can be provided.

-- ASN1START

GNSS-GenericAssistData ::= SEQUENCE (SIZE (1..16)) OF GNSS-GenericAssistDataElement

GNSS-GenericAssistDataElement ::= SEQUENCE {

gnss-ID GNSS-ID,

sbas-ID SBAS-ID OPTIONAL, -- Cond GNSS-ID-SBAS

gnss-TimeModels GNSS-TimeModelList OPTIONAL, -- Need ON

gnss-DifferentialCorrections GNSS-DifferentialCorrections OPTIONAL, -- Need ON

gnss-NavigationModel GNSS-NavigationModel OPTIONAL, -- Need ON

gnss-RealTimeIntegrity GNSS-RealTimeIntegrity OPTIONAL, -- Need ON

gnss-DataBitAssistance GNSS-DataBitAssistance OPTIONAL, -- Need ON

gnss-AcquisitionAssistance GNSS-AcquisitionAssistance OPTIONAL, -- Need ON

gnss-Almanac GNSS-Almanac OPTIONAL, -- Need ON

gnss-UTC-Model GNSS-UTC-Model OPTIONAL, -- Need ON

gnss-AuxiliaryInformation GNSS-AuxiliaryInformation OPTIONAL, -- Need ON

...,

[[

bds-DifferentialCorrections-r12

BDS-DifferentialCorrections-r12 OPTIONAL, -- Cond GNSS-ID-BDS

bds-GridModel-r12 BDS-GridModelParameter-r12 OPTIONAL -- Cond GNSS-ID-BDS

]],

[[

gnss-RTK-Observations-r15 GNSS-RTK-Observations-r15 OPTIONAL, -- Need ON

glo-RTK-BiasInformation-r15 GLO-RTK-BiasInformation-r15 OPTIONAL, -- Cond GNSS-ID-GLO

gnss-RTK-MAC-CorrectionDifferences-r15

GNSS-RTK-MAC-CorrectionDifferences-r15

OPTIONAL, -- Need ON

gnss-RTK-Residuals-r15 GNSS-RTK-Residuals-r15 OPTIONAL, -- Need ON

gnss-RTK-FKP-Gradients-r15 GNSS-RTK-FKP-Gradients-r15 OPTIONAL, -- Need ON

gnss-SSR-OrbitCorrections-r15

GNSS-SSR-OrbitCorrections-r15 OPTIONAL, -- Need ON

gnss-SSR-ClockCorrections-r15

GNSS-SSR-ClockCorrections-r15 OPTIONAL, -- Need ON

gnss-SSR-CodeBias-r15 GNSS-SSR-CodeBias-r15 OPTIONAL -- Need ON

]],

[[

gnss-SSR-URA-r16 GNSS-SSR-URA-r16 OPTIONAL, -- Need ON

gnss-SSR-PhaseBias-r16 GNSS-SSR-PhaseBias-r16 OPTIONAL, -- Need ON

gnss-SSR-STEC-Correction-r16

GNSS-SSR-STEC-Correction-r16 OPTIONAL, -- Need ON

gnss-SSR-GriddedCorrection-r16

GNSS-SSR-GriddedCorrection-r16 OPTIONAL -- Need ON

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *GNSS‑ID‑BDS* | The field may be present if the *GNSS‑ID* = *bds*; otherwise it is not present. |
| *GNSS-ID-GLO* | The field may be present if the *GNSS ID* = *glonass*; otherwise it is not present. |

#### *– GNSS-PeriodicAssistData*

The IE *GNSS-PeriodicAssistData* is used by the location server to provide control parameters for a periodic assistance data delivery session (e.g., interval and duration) to the target device.

NOTE: Omission of a particular assistance data type field in IE *GNSS-PeriodicAssistData* means that the location server does not provide this assistance data type in a data transaction of a periodic assistance data delivery session, as described in clauses 5.2.1a and 5.2.2a. Inclusion of no assistance data type fields in IE *GNSS-PeriodicAssistData* means that a periodic assistance data delivery session is terminated.

-- ASN1START

GNSS-PeriodicAssistData-r15 ::= SEQUENCE {

gnss-RTK-PeriodicObservations-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

glo-RTK-PeriodicBiasInformation-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

gnss-RTK-MAC-PeriodicCorrectionDifferences-r15

GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

gnss-RTK-PeriodicResiduals-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

gnss-RTK-FKP-PeriodicGradients-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

gnss-SSR-PeriodicOrbitCorrections-r15

GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

gnss-SSR-PeriodicClockCorrections-r15

GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

gnss-SSR-PeriodicCodeBias-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

...,

[[

gnss-SSR-PeriodicURA-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

gnss-SSR-PeriodicPhaseBias-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

gnss-SSR-PeriodicSTEC-Correction-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Need ON

gnss-SSR-PeriodicGriddedCorrection-r16 GNSS-PeriodicControlParam-r15 OPTIONAL -- Need ON

]]

}

-- ASN1STOP

#### 6.5.2.2 GNSS Assistance Data Elements

#### – *GNSS-ReferenceTime*

The IE *GNSS-ReferenceTime* is used by the location server to provide the GNSS specific system time with uncertainty and the relationship between GNSS system time and network air-interface timing of the eNodeB/NodeB/BTS transmission in the reference cell.

If the IE *networkTime* is present, the IEs *gnss-SystemTime* and *networkTime* provide a valid relationship between GNSS system time and air-interface network time, as seen at the approximate location of the target device, i.e. the propagation delay from the the eNodeB/NodeB/BTS to the target device shall be compensated for by the location server. Depending on implementation, the relation between GNSS system time and air-interface network time may have varying accuracy. The uncertainty of this timing relation is provided in the IE *referenceTimeUnc*. If the propagation delay from the eNodeB/NodeB/BTS to the target device is not accurately known, the location server shall use the best available approximation of the propagation delay and take the corresponding delay uncertainty into account in the calculation of the IE *referenceTimeUnc*.

If the IE *networkTime* is not present, the IE *gnssSystemTime* is an estimate of current GNSS system time at time of reception of the IE *GNSS-ReferenceTime* by the target device. The location server should achieve an accuracy of +/- 3 seconds for this estimate including allowing for the transmission delay between the location server and the target device. Note that the target device should further compensate *gnss-SystemTime* for the time between the reception of *GNSS-ReferenceTime* and the time when the *gnss-SystemTime* is used.

The location server shall provide a value for the *gnss-TimeID* only for GNSSs supported by the target device.

The IE *GNSS-ReferenceTimeForOneCell* can be provided multiple times (up to 16) to provide fine time assistance for several (neighbour) cells.

-- ASN1START

GNSS-ReferenceTime ::= SEQUENCE {

gnss-SystemTime GNSS-SystemTime,

referenceTimeUnc INTEGER (0..127) OPTIONAL, -- Cond noFTA

gnss-ReferenceTimeForCells SEQUENCE (SIZE (1..16)) OF

GNSS-ReferenceTimeForOneCell OPTIONAL, -- Need ON

...

}

GNSS-ReferenceTimeForOneCell ::= SEQUENCE {

networkTime NetworkTime,

referenceTimeUnc INTEGER (0..127),

bsAlign ENUMERATED {true} OPTIONAL,

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *noFTA* | The field may be present if *gnss-ReferenceTimeForCells* is absent; otherwise it is not present. |

| *GNSS-ReferenceTime* field descriptions |
| --- |
| ***gnss-SystemTime***  This field provides the specific GNSS system time. |
| ***networkTime***  This field specifies the cellular network time at the epoch corresponding to *gnss-SystemTime.* |
| ***referenceTimeUnc***  This field provides the accuracy of the relation between *gnssSystemTime* and *networkTime* time if IE *networkTime* is provided. When IE *networkTime* is not provided, this field can be included to provide the accuracy of the provided *gnssSystemTime*.  If GNSS TOD is the given GNSS time, then the true GNSS time, corresponding to the provided network time as observed at the target device location, lies in the interval [GNSS TOD - *referenceTimeUnc*, GNSS TOD + *referenceTimeUnc*].  The uncertainty *r*, expressed in microseconds, is mapped to a number *K*, with the following formula:  *r* = C\*(((1+x)K)-1)  with C = 0.5 and x = 0.14. To encode any higher value of uncertainty than that corresponding in the above formula to K=127, the same value, K=127, shall also be used. The uncertainty is then coded on 7 bits, as the binary encoding of K. Example values for the *referenceTimeUnc* Format: see table K to uncertainty relation below. |
| ***bsAlign***  This flag, if present, indicates that the transmission timings of all cells sharing, depending on the RAT, the same carrier frequency and Tracking Area/Location Area/Routing Area as the cell indicated, are frame aligned. This information allows the target device to derive the GNSS - cellular time relation for any of these cells based on the timing relation information provided in *GNSS-ReferenceTime*. The flag should be set consistently in all these cells. This flag does not guarantee SFN alignment. |

K to uncertainty relation

|  |  |
| --- | --- |
| Value of K | Value of uncertainty |
| 0 | 0 nanoseconds |
| 1 | 70 nanoseconds |
| 2 | 149.8 nanoseconds |
| - | - |
| 50 | 349.62 microseconds |
| - | - |
| 127 | ≥ 8.43 seconds |

#### – *GNSS-SystemTime*

-- ASN1START

GNSS-SystemTime ::= SEQUENCE {

gnss-TimeID GNSS-ID,

gnss-DayNumber INTEGER (0..32767),

gnss-TimeOfDay INTEGER (0..86399),

gnss-TimeOfDayFrac-msec INTEGER (0..999) OPTIONAL, -- Need ON

notificationOfLeapSecond BIT STRING (SIZE(2)) OPTIONAL, -- Cond gnss-TimeID-glonass

gps-TOW-Assist GPS-TOW-Assist OPTIONAL, -- Cond gnss-TimeID-gps

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *gnss-TimeID-glonass* | The field may be present if *gnss-TimeID*=`glonass′; otherwise it is not present. |
| *gnss-TimeID-gps* | The field may be present if *gnss-TimeID*=`gps′; otherwise it is not present. |

| *GNSS-SystemTime* field descriptions |
| --- |
| ***gnss-TimeID***  This field specifies the GNSS for which the *GNSS-SystemTime* is provided. |
| ***gnss-DayNumber***  This field specifies the sequential number of days (with day count starting at 0) from the origin of the GNSS System Time as follows:  GPS, QZSS, SBAS – Days from January 6th 1980 00:00:00 UTC (USNO);  Galileo – Days from Galileo System Time (GST) start epoch, defined as 13 seconds before midnight between 21st August and 22nd August 1999; i.e., GST was equal to 13 seconds at August 22nd 1999 00:00:00 UTC;  GLONASS – Days from December 31st 1995 21:00:00 UTC (SU), which is local UTC Moscow  January 1st 1996 00:00:00, defined as UTC(SU) + 3 hours in [9];  BDS – Days from January 1st 2006 00:00:00 UTC (NTSC). |
| ***gnss-TimeOfDay***  This field specifies the integer number of seconds from the GNSS day change. |
| ***gnss-TimeOfDayFrac-msec***  This field specifies the fractional part of the *gnssTimeOfDay* field in 1‑milli‑seconds resolution. The total GNSS TOD is *gnss-TimeOfDay + gnssTimeOfDayFrac-msec.* |
| ***notificationOfLeapSecond***  This field specifies the notification of forthcoming leap second correction, as defined by parameter KP in [9, Table 4.7]. |
| ***gps-TOW-Assist***  This field contains several fields in the Telemetry (TLM) Word and Handover Word (HOW) that are currently being broadcast by the respective GPS satellites. Combining this information with GPS TOW enables the target device to know the entire 1.2-second (60-bit) pattern of TLM and HOW that is transmitted at the start of each six-second NAV subframe by the particular GPS satellite. |

#### – *GPS-TOW-Assist*

-- ASN1START

GPS-TOW-Assist ::= SEQUENCE (SIZE(1..64)) OF GPS-TOW-AssistElement

GPS-TOW-AssistElement ::= SEQUENCE {

satelliteID INTEGER (1..64),

tlmWord INTEGER (0..16383),

antiSpoof INTEGER (0..1),

alert INTEGER (0..1),

tlmRsvdBits INTEGER (0..3),

...

}

-- ASN1STOP

| *GPS-TOW-Assist* field descriptions |
| --- |
| ***satelliteID***  This field identifies the satellite for which the *GPS-TOW-Assist* is applicable. This field is identical to the GPS PRN Signal No. defined in [4]. |
| ***tlmWord***  This field contains a 14-bit value representing the Telemetry Message (TLM) being broadcast by the GPS satellite identified by the particular *satelliteID*, with the MSB occurring first in the satellite transmission, as defined in [4]. |
| ***antiSpoof***  This field contains the Anti-Spoof flag that is being broadcast by the GPS satellite identified by *satelliteID*, as defined in [4]. |
| ***alert***  This field contains the Alert flag that is being broadcast by the GPS satellite identified by *satelliteID*, as defined in [4]. |
| ***tlmRsvdBits***  This field contains the two reserved bits in the TLM Word being broadcast by the GPS satellite identified by *satelliteID*, with the MSB occurring first in the satellite transmission, as defined in [4]. |

#### – *NetworkTime*

-- ASN1START

NetworkTime ::= SEQUENCE {

secondsFromFrameStructureStart INTEGER(0..12533),

fractionalSecondsFromFrameStructureStart INTEGER(0..3999999),

frameDrift INTEGER (-64..63) OPTIONAL, -- Cond GNSSsynch

cellID CHOICE {

eUTRA SEQUENCE {

physCellId INTEGER (0..503),

cellGlobalIdEUTRA CellGlobalIdEUTRA-AndUTRA OPTIONAL, -- Need ON

earfcn ARFCN-ValueEUTRA,

...,

[[ earfcn-v9a0 ARFCN-ValueEUTRA-v9a0 OPTIONAL -- Cond EARFCN-max

]]

},

uTRA SEQUENCE {

mode CHOICE {

fdd SEQUENCE {

primary-CPICH-Info INTEGER (0..511),

...

},

tdd SEQUENCE {

cellParameters INTEGER (0..127),

...

}

},

cellGlobalIdUTRA CellGlobalIdEUTRA-AndUTRA OPTIONAL, -- Need ON

uarfcn ARFCN-ValueUTRA,

...

},

gSM SEQUENCE {

bcchCarrier INTEGER (0..1023),

bsic INTEGER (0..63),

cellGlobalIdGERAN CellGlobalIdGERAN OPTIONAL, -- Need ON

...

},

...,

nBIoT-r14 SEQUENCE {

nbPhysCellId-r14 INTEGER (0..503),

nbCellGlobalId-r14 ECGI OPTIONAL, -- Need ON

nbCarrierFreq-r14 CarrierFreq-NB-r14,

...

},

nr-r15 SEQUENCE {

nrPhysCellId-r15 INTEGER (0..1007),

nrCellGlobalID-r15 NCGI-r15 OPTIONAL, -- Need ON

nrARFCN-r15 ARFCN-ValueNR-r15,

...

}

},

...

}

-- ASN1STOP

|  |  |
| --- | --- |
| Conditional presence | Explanation |
| *EARFCN-max* | The field is mandatory present if the corresponding *earfcn* (i.e. without suffix) is set to *maxEARFCN*. Otherwise the field is not present. |
| *GNSSsynch* | The field is present and set to 0 if *NetworkTime* is synchronized to *gnss-SystemTime*; otherwise the field is optionally present, need OR. |

| *NetworkTime* field descriptions |
| --- |
| ***secondsFromFrameStructureStart***  This field specifies the number of seconds from the beginning of the longest frame structure in the corresponding air interface.  In case of E-UTRA, the SFN cycle length is 10.24 seconds.  In case of UTRA, the SFN cycle length is 40.96 seconds.  In case of GSM, the hyperfame length is 12533.76 seconds.  In case of NB-IoT, the Hyper-SFN cycle lengths is 10485.76 seconds.  In case of NR, the SFN cycle length is 10.24 seconds. |
| ***fractionalSecondsFromFrameStructureStart***  This field specifies the fractional part of the *secondsFromFrameStructureStart* in 250 ns resolution.  The total time since the particular frame structure start is *secondsFromFrameStructureStart + fractionalSecondsFromFrameStructureStart* |
| ***frameDrift***  This field specifies the drift rate of the GNSS‑network time relation with scale factor 2-30 seconds/second, in the range from ‑5.9605e-8 to +5.8673e-8 sec/sec. |
| ***cellID***  This field specifies the cell for which the GNSS–network time relation is provided. |
| ***physCellId***  This field specifies the physical cell identity of the reference cell (E-UTRA), as defined in TS 36.331 [12], for which the GNSS network time relation is provided. |
| ***cellGlobalIdEUTRA***  This field specifies the Evolved Cell Global Identifier (ECGI), the globally unique identity of a cell in E-UTRA, of the reference cell for the GNSS‑network time relation, as defined in TS 36.331 [12]. |
| ***earfcn***  This field specifies E-ARFCN of the reference cell for the GNSS‑network time relation (E-UTRA). In case the server includes *earfcn-v9a0*, the server shall set the corresponding *earfcn* (i.e. without suffix) to *maxEARFCN*. |
| ***primary-CPICH-Info***  This field specifies the physical cell identity of the reference cell (UTRA) for the GNSS‑network time relation, as defined in TS 25.331 [13]. |
| ***cellParameters***  This field specifies the physical cell identity of the reference cell (UTRA) for the GNSS‑network time relation, as defined in TS 25.331 [13]. |
| ***cellGlobalIdUTRA***  The filed specifies the global UTRAN Cell Identifier, the globally unique identity of a cell in UTRA, of the reference cell for the GNSS‑network time relation, as defined in TS 25.331 [13]. |
| ***uarfcn***  This field specifies ARFCN of the reference cell for the GNSS‑network time relation (UTRA). |
| ***bcchCarrier***  This field specifies the absolute GSM RF channel number of the BCCH of the reference base station (GERAN) for the GNSS‑network time relation, as defined in TS 44.031 [14]. |
| ***bsic***  This field specifies the Base Station Identity Code of the reference base station (GERAN) for the GNSS‑network time relation, as defined in TS 44.031 [14]. |
| ***cellGlobalIdGERAN***  This field specifies the Cell Global Identification (CGI), the globally unique identity of a cell in GERAN, of the reference base station for the GNSS‑network time relation. |
| ***nbPhysCellId***  This field specifies the narrowband physical layer cell identity of the NB-IoT reference cell, as defined in TS 36.331 [12], for which the GNSS network time relation is provided. |
| ***nbCellGlobalId***  This field specifies the global cell identifier of the NB-IoT reference cell for which the GNSS‑network time relation is provided, as defined in TS 36.331 [12]. |
| ***nbCarrierFreq***  This field specifies the carrier frequency of the NB-IoT reference cell for which the GNSS‑network time relation is provided. |
| ***nrPhysCellId***  This field specifies the physical cell identity of the reference cell (NR), as defined in TS 38.331 [35], for which the GNSS network time relation is provided. |
| ***nrCellGlobalID***  This field specifies the NR Cell Global Identifier (NCGI) of the reference cell (NR) for the GNSS‑network time relation, as defined in TS 38.331 [35]. |
| ***nrARFCN***  This field specifies NR-ARFCN of the reference cell (NR) for the GNSS‑network time relation. |

#### – *GNSS-ReferenceLocation*

The IE *GNSS-ReferenceLocation* is used by the location server to provide the target device with a‑priori knowledge of its location in order to improve GNSS receiver performance. The IE *GNSS-ReferenceLocation* is provided in WGS‑84 reference system.

-- ASN1START

GNSS-ReferenceLocation ::= SEQUENCE {

threeDlocation EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,

...

}

-- ASN1STOP

#### – *GNSS-IonosphericModel*

The IE *GNSS-IonosphericModel* is used by the location server to provide parameters to model the propagation delay of the GNSS signals through the ionosphere. Proper use of these fields allows a single‑frequency GNSS receiver to remove parts of the ionospheric delay from the pseudorange measurements. Two Ionospheric Models are supported: The Klobuchar model as defined in [4], and the NeQuick model as defined in [8].

-- ASN1START

GNSS-IonosphericModel ::= SEQUENCE {

klobucharModel KlobucharModelParameter OPTIONAL, -- Need ON

neQuickModel NeQuickModelParameter OPTIONAL, -- Need ON

...

}

-- ASN1STOP

#### – *KlobucharModelParameter*

-- ASN1START

KlobucharModelParameter ::= SEQUENCE {

dataID BIT STRING (SIZE (2)),

alfa0 INTEGER (-128..127),

alfa1 INTEGER (-128..127),

alfa2 INTEGER (-128..127),

alfa3 INTEGER (-128..127),

beta0 INTEGER (-128..127),

beta1 INTEGER (-128..127),

beta2 INTEGER (-128..127),

beta3 INTEGER (-128..127),

...

}

-- ASN1STOP

| *KlobucharModelParamater* field descriptions |
| --- |
| ***dataID***  When *dataID* has the value ′11′ it indicates that the parameters have been generated by QZSS, and the parameters have been specialized and are applicable within the area defined in [7]. When *dataID* has the value ′01′ it indicates that the parameters have been generated by BDS, and UE shall use these parameters according to the description given in 5.2.4.7 in [23]. When *dataID* has the value ′00′ it indicates the parameters are applicable worldwide [4], [7]. All other values for *dataID* are reserved. |
| ***alpha0***  This field specifies the 0 parameter of the Klobuchar model, as specified in [4], [23].  Scale factor 2-30 seconds. |
| ***alpha1***  This field specifies the 1 parameter of the Klobuchar model, as specified in [4], [23].  Scale factor 2-27 seconds/semi-circle. |
| ***alpha2***  This field specifies the 2 parameter of the Klobuchar model, as specified in [4], [23].  Scale factor 2-24 seconds/semi-circle2. |
| ***alpha3***  This field specifies the 3 parameter of the Klobuchar model, as specified in [4], [23].  Scale factor 2-24 seconds/semi-circle3. |
| ***beta0***  This field specifies the 0 parameter of the Klobuchar model, as specified in [4], [23].  Scale factor 211 seconds. |
| ***beta1***  This field specifies the 1 parameter of the Klobuchar model, as specified in [4], [23].  Scale factor 214 seconds/semi-circle. |
| ***beta2***  This field specifies the 2 parameter of the Klobuchar model, as specified in [4], [23].  Scale factor 216 seconds/semi-circle2. |
| ***beta3***  This field specifies the 3 parameter of the Klobuchar model, as specified in [4], [23].  Scale factor 216 seconds/semi-circle3. |

#### – *NeQuickModelParameter*

-- ASN1START

NeQuickModelParameter ::= SEQUENCE {

ai0 INTEGER (0..2047),

ai1 INTEGER (-1024..1023),

ai2 INTEGER (-8192..8191),

ionoStormFlag1 INTEGER (0..1) OPTIONAL, -- Need OP

ionoStormFlag2 INTEGER (0..1) OPTIONAL, -- Need OP

ionoStormFlag3 INTEGER (0..1) OPTIONAL, -- Need OP

ionoStormFlag4 INTEGER (0..1) OPTIONAL, -- Need OP

ionoStormFlag5 INTEGER (0..1) OPTIONAL, -- Need OP

...

}

-- ASN1STOP

| *NeQuickModelParameter* field descriptions |
| --- |
| ***ai0***  Effective Ionisation Level 1st order parameter.  Scale factor 2-2 Solar Flux Units (SFUs), [8] clause 5.1.6. |
| ***ai1***  Effective Ionisation Level 2nd order parameter.  Scale factor 2-8 Solar Flux Units/degree, [8] clause 5.1.6. |
| ***ai2***  Effective Ionisation Level 3rd order parameter.  Scale factor 2-15 Solar Flux Units/degree2, [8] clause 5.1.6. |
| ***ionoStormFlag1, ionoStormFlag2, ionoStormFlag3, ionoStormFlag4, ionoStormFlag5***  These fields specify the ionosphere disturbance flags (1,…,5) for five different regions as described in [8], clause 5.1.6. If the ionosphere disturbance flag for a region is not present the target device shall treat the ionosphere disturbance condition as unknown. |

#### – *GNSS-EarthOrientationParameters*

The IE *GNSS-EarthOrientationParameters* is used by the location server to provide parameters to construct the ECEF and ECI coordinate transformation as defined in [4]. The IE *GNSS-EarthOrientationParameters* indicates the relationship between the Earth′s rotational axis and WGS-84 reference system.

-- ASN1START

GNSS-EarthOrientationParameters ::= SEQUENCE {

teop INTEGER (0..65535),

pmX INTEGER (-1048576..1048575),

pmXdot INTEGER (-16384..16383),

pmY INTEGER (-1048576..1048575),

pmYdot INTEGER (-16384..16383),

deltaUT1 INTEGER (-1073741824..1073741823),

deltaUT1dot INTEGER (-262144..262143),

...

}

-- ASN1STOP

| *GNSS-EarthOrientationParameters* field descriptions |
| --- |
| ***teop***  This field specifies the EOP data reference time in seconds, as specified in [4].  Scale factor 24 seconds. |
| ***pmX***  This field specifies the X-axis polar motion value at reference time in arc-seconds, as specified in [4].  Scale factor 2-20 arc-seconds. |
| ***pmXdot***  This field specifies the X-axis polar motion drift at reference time in arc-seconds/day, as specified in [4].  Scale factor 2-21 arc-seconds/day. |
| ***pmY***  This field specifies the Y-axis polar motion value at reference time in arc-seconds, as specified in [4].  Scale factor 2-20 arc-seconds. |
| ***pmYdot***  This field specifies the Y-axis polar motion drift at reference time in arc-seconds/day, as specified in [4].  Scale factor 2-21 arc-seconds/day. |
| ***deltaUT1***  This field specifies the UT1-UTC difference at reference time in seconds, as specified in [4].  Scale factor 2-24 seconds. |
| ***deltaUT1dot***  This field specifies the Rate of UT1-UTC difference at reference time in seconds/day, as specified in [4].  Scale factor 2-25 seconds/day. |

#### *– GNSS-RTK-ReferenceStationInfo*

The IE *GNSS-RTK-ReferenceStationInfo* is used by the location server to provide the Earth-centered, Earth-fixed (ECEF) coordinates of the antenna reference point (ARP) of the stationary reference station for which the *GNSS‑RTK‑Observations* assistance data are provided together with reference station antenna description.

The parameters provided in IE *GNSS-RTK-ReferenceStationInfo* are used as specified for message type 1006, 1033 and 1032 in [30].

-- ASN1START

GNSS-RTK-ReferenceStationInfo-r15 ::= SEQUENCE {

referenceStationID-r15 GNSS-ReferenceStationID-r15,

referenceStationIndicator-r15 ENUMERATED {physical, non-physical},

antenna-reference-point-ECEF-X-r15 INTEGER (-137438953472..137438953471),

antenna-reference-point-ECEF-Y-r15 INTEGER (-137438953472..137438953471),

antenna-reference-point-ECEF-Z-r15 INTEGER (-137438953472..137438953471),

antennaHeight-r15 INTEGER (0..65535) OPTIONAL, -- Need ON

antennaDescription-r15 AntennaDescription-r15 OPTIONAL, -- Need ON

antenna-reference-point-unc-r15 AntennaReferencePointUnc-r15 OPTIONAL, -- Need ON

physical-reference-station-info-r15 PhysicalReferenceStationInfo-r15 OPTIONAL, -- Cond NP

...

}

AntennaDescription-r15 ::= SEQUENCE {

antennaDescriptor-r15 VisibleString (SIZE (1..256)),

antennaSetUpID-r15 ENUMERATED { non-zero } OPTIONAL, -- Need OP

...

}

AntennaReferencePointUnc-r15 ::= SEQUENCE {

uncertainty-X-r15 INTEGER (0..255),

confidence-X-r15 INTEGER (0..100),

uncertainty-Y-r15 INTEGER (0..255),

confidence-Y-r15 INTEGER (0..100),

uncertainty-Z-r15 INTEGER (0..255),

confidence-Z-r15 INTEGER (0..100),

...

}

PhysicalReferenceStationInfo-r15 ::= SEQUENCE {

physicalReferenceStationID-r15 GNSS-ReferenceStationID-r15,

physical-ARP-ECEF-X-r15 INTEGER (-137438953472..137438953471),

physical-ARP-ECEF-Y-r15 INTEGER (-137438953472..137438953471),

physical-ARP-ECEF-Z-r15 INTEGER (-137438953472..137438953471),

physical-ARP-unc-r15 AntennaReferencePointUnc-r15 OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *NP* | The field is optionally present, need ON, if the *referenceStationIndicator* has the value ′*non-physical*′; otherwise it is not present. |

| *GNSS-RTK-ReferenceStationInfo* field descriptions |
| --- |
| ***referenceStationID***  The Reference Station ID is determined by the RTK service provider. |
| ***referenceStationIndicator***  This fields specifies type of reference station. Enumerated value *physical* indicates a real, physical reference station; value *non-physical* indicates a non-physical or computed reference station. |
| ***antenna-reference-point-ECEF-X***  This field specifies the antenna reference point X-coordinate in the World Geodetic System 1984 (WGS 84) datum.  Scale factor 0.0001 m; range ±13,743,895.3471 m. |
| ***antenna-reference-point-ECEF-Y***  This field specifies the antenna reference point Y-coordinate in the World Geodetic System 1984 (WGS 84) datum.  Scale factor 0.0001 m; range ±13,743,895.3471 m. |
| ***antenna-reference-point-ECEF-Z***  This field specifies the antenna reference point Z-coordinate in the World Geodetic System 1984 (WGS 84) datum.  Scale factor 0.0001 m; range ±13,743,895.3471 m. |
| ***antennaHeight***  This field specifies the height of the Antenna Reference Point above the marker used in the survey campaign.  Scale factor 0.0001 m; range 0–6.5535 m. |
| ***antennaDescriptor***  This field provides an ASCII descriptor of the reference station antenna using IGS naming convention [31]. The descriptor can be used to look up model specific phase center corrections of that antenna. |
| ***antennaSetUpID***  This field, if present, indicates that the standard IGS Model is not valid (≠ 0 [30]). If this field is absent the standard IGS Model is valid (′0 = Use standard IGS Model′ [30]). |
| ***antenna-reference-point-unc***  This field specifies the uncertainty of the ARP coordinates. *uncertainty-X*, *uncertainty-Y*, and *uncertainty-Z* correspond to the encoded high accuracy uncertainty of the X, Y, and Z-coordinate, respectively, as defined in TS 23.032 [15]. *confidence-X*, *confidence-Y*, and *confidence-Z* corresponds to confidence as defined in TS 23.032 [15]. |
| ***physical-reference-station-info***  This field provides the earth-centered, earth-fixed (ECEF) coordinates of the antenna reference point (ARP) for the real (or "physical") reference station used. This field may be used in case of the non-physical reference station approach to allow the target device to refer baseline vectors to a physical reference rather than to a non-physical reference without any connection to a physical point. |
| ***physicalReferenceStationID***  This field specifies the station ID of a real reference station, when the *referenceStationIndicator* has the value ′*non-physical*′. |
| ***physical-ARP-ECEF-X***  This field specifies the antenna reference point X-coordinate in the World Geodetic System 1984 (WGS 84) datum.  Scale factor 0.0001 m; range ±13,743,895.3471 m. |
| ***physical-ARP-ECEF-Y***  This field specifies the antenna reference point Y-coordinate in the World Geodetic System 1984 (WGS 84) datum.  Scale factor 0.0001 m; range ±13,743,895.3471 m. |
| ***physical-ARP-ECEF-Z***  This field specifies the antenna reference point Z-coordinate in the World Geodetic System 1984 (WGS 84) datum.  Scale factor 0.0001 m; range ±13,743,895.3471 m. |
| ***physical-ARP-unc***  This field specifies the uncertainty of the ARP coordinates. |

#### *– GNSS-RTK-CommonObservationInfo*

The IE *GNSS-RTK-CommonObservationInfo* is used by the location server to provide common information applicable to the IE *GNSS-RTK-Observations.*

The parameters provided in IE *GNSS-RTK-CommonObservationInfo* are used as specified for message type 1071-1127 in [30].

-- ASN1START

GNSS-RTK-CommonObservationInfo-r15 ::= SEQUENCE {

referenceStationID-r15 GNSS-ReferenceStationID-r15,

clockSteeringIndicator-r15 INTEGER (0..3),

externalClockIndicator-r15 INTEGER (0..3),

smoothingIndicator-r15 BIT STRING (SIZE(1)),

smoothingInterval-r15 BIT STRING (SIZE(3)),

...

}

-- ASN1STOP

| *GNSS-RTK-CommonObservationInfo* field descriptions |
| --- |
| ***referenceStationID***  This field specifies the Station ID for which the *GNSS-RTK-Observations* are provided. |
| ***clockSteeringIndicator***  This field provides the clock steering indicator. The interpretation of the value is as follows:  0 clock steering is not applied  In this case receiver clock must be kept in the range of ±1 ms (approximately ±300 km)  1 clock steering has been applied  In this case receiver clock must be kept in the range of ±1 microsecond (approximately ±300 meters).  2 unknown clock steering status  3 reserved |
| ***externalClockIndicator***  This field provides the external clock indicator. The interpretation of the value is as follows:  0 internal clock is used  1 external clock is used, clock status is "locked"  2 external clock is used, clock status is "not locked", which may indicate external clock failure and that the transmitted data may not be reliable.  3 unknown clock is used |
| ***smoothingIndicator***  This field provides the GNSS Divergence-free Smoothing Indicator. The interpretation of the value is as follows:  1 Divergence-free smoothing is used  0 Other type of smoothing is used |
| ***smoothingInterval***  The GNSS Smoothing Interval is the integration period over which the pseudorange code phase measurements are averaged using carrier phase information. Divergence-free smoothing may be continuous over the entire period for which the satellite is visible. A value of zero indicates no smoothing is used.  See table "smoothingInterval value to interpretation of Smoothing Interval relation" below. |

*smoothingInterval* value to interpretation of Smoothing Interval relation

|  |  |
| --- | --- |
| Indicator | Smoothing Interval |
| 000 (0) | No smoothing |
| 001 (1) | < 30 s |
| 010 (2) | 30-60 s |
| 011 (3) | 1-2 min |
| 100 (4) | 2-4 min |
| 101 (5) | 4-8 min |
| 110 (6) | >8 min |
| 111 (7) | Unlimited smoothing interval |

#### *– GNSS-RTK-AuxiliaryStationData*

The IE *GNSS-RTK-AuxiliaryStationData* is used by the location server to provide the coordinates of the antenna reference point (ARP) of Auxiliary Reference Stations, relative to the coordinates provided in IE *GNSS‑RTK‑ReferenceStationInfo*. The reference station provided in IE *GNSS-RTK-ReferenceStationInfo* is the Master Reference Station. Therefore, one Master Reference Station with its associated Auxiliary Stations is used in a single Provide Assistance Data message.

The parameters provided in IE *GNSS-RTK-AuxiliaryStationData* are used as specified for message type 1014 in [30].

-- ASN1START

GNSS-RTK-AuxiliaryStationData-r15 ::= SEQUENCE {

networkID-r15 GNSS-NetworkID-r15,

subNetworkID-r15 GNSS-SubNetworkID-r15 OPTIONAL, -- Need ON

master-referenceStationID-r15 GNSS-ReferenceStationID-r15,

auxiliaryStationList-r15 AuxiliaryStationList-r15,

...

}

AuxiliaryStationList-r15 ::= SEQUENCE (SIZE (1..32)) OF AuxiliaryStationElement-r15

AuxiliaryStationElement-r15 ::= SEQUENCE {

aux-referenceStationID-r15 GNSS-ReferenceStationID-r15,

aux-master-delta-latitude-r15 INTEGER (-524288..524287),

aux-master-delta-longitude-r15 INTEGER (-1048576..1048575),

aux-master-delta-height-r15 INTEGER (-4194304..4194303),

aux-ARP-unc-r15 Aux-ARP-Unc-r15 OPTIONAL, -- Need ON

...

}

Aux-ARP-Unc-r15 ::= SEQUENCE {

horizontalUncertainty-r15 INTEGER (0..255),

horizontalConfidence-r15 INTEGER (0..100),

verticalUncertainty-r15 INTEGER (0..255) OPTIONAL, -- Need ON

verticalConfidence-r15 INTEGER (0..100) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *GNSS-RTK-AuxiliaryStationData* field descriptions |
| --- |
| ***networkID***  This field defines the network and the source of the particular set of reference stations and their observation information. The RTK service provider should ensure that the *networkID* is unique in the region serviced. The *networkID* indicates an area and its reference stations where the service providers will provide a homogenous solution with levelled integer ambiguities between its reference stations. In general, the area indicated by *networkID* will comprise one subnetwork with a unique *subNetworkID*. |
| ***subNetworkID***  This field identifies the subnetwork of a network identified by *networkID*. In general the area indicated by *networkID* will consist of one subnetwork. The *subNetworkID* indicates the actual solution number of integer ambiguity level. If one network has only one subnetwork, this indicates that an ambiguity level throughout the whole network is established. |
| ***master-referenceStationID***  This field identifies the Master Reference Station. |
| ***aux-referenceStationID***  This field identifies the Auxiliary Reference Station. |
| ***aux-master-delta-latitude***  This field provides the delta value in latitude of Antenna Reference Point of "Auxiliary Reference Station minus Master Reference Station" in geographical coordinates based on GRS80 ellipsoid parameters for the same ECEF system as used in IE *GNSS‑RTK‑ReferenceStationInfo*.  Scale factor 25×10-6 degrees; range ±13.1071 degrees. |
| ***aux-master-delta-longitude***  This field provides the delta value in longitude of Antenna Reference Point of "Auxiliary Reference Station minus Master Reference Station" in geographical coordinates based on GRS80 ellipsoid parameters for the same ECEF system as used in IE *GNSS‑RTK‑ReferenceStationInfo*.  Scale factor 25×10-6 degrees; range ±26.2142 degrees. |
| ***aux-master-delta-height***  This field provides the delta value in ellipsoidal height of Antenna Reference Point of "Auxiliary Reference Station minus Master Reference Station" in geographical coordinates based on GRS80 ellipsoid parameters for the same ECEF system as used in IE *GNSS‑RTK‑ReferenceStationInfo*.  Scale factor 1 milli-meter; range ±4194.303 m. |
| ***aux-ARP-unc***  This field specifies the uncertainty of the auxiliary station ARP coordinates and comprise the following fields:  - ***horizontalUncertainty*** indicates the horizontal uncertainty of the ARP latitude/longitude. The ′*horizontalUncertainty*′ corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and ′*horizontalConfidence*′ corresponds to confidence as defined in TS 23.032 [15].  - ***verticalUncertainty*** indicates the vertical uncertainty of the ARP altitude. The '*verticalUncertainty*' corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and '*verticalConfidence*' corresponds to confidence as defined in TS 23.032 [15]. |

#### *– GNSS-SSR-CorrectionPoints*

The IE *GNSS-SSR-CorrectionPoints* is used by the location server to provide a list of correction point coordinates or an array of correction points ("grid") for which the *GNSS‑SSR‑GriddedCorrection* are valid.

-- ASN1START

GNSS-SSR-CorrectionPoints-r16 ::= SEQUENCE {

correctionPointSetID-r16 INTEGER (0..16383),

correctionPoints-r16 CHOICE {

listOfCorrectionPoints-r16 GNSS-SSR-ListOfCorrectionPoints-r16,

arrayOfCorrectionPoints-r16 GNSS-SSR-ArrayOfCorrectionPoints-r16

},

...

}

GNSS-SSR-ListOfCorrectionPoints-r16 ::= SEQUENCE {

referencePointLatitude-r16 INTEGER (-16384..16383),

referencePointLongitude-r16 INTEGER (-32768..32767),

relativeLocationsList-r16 SEQUENCE (SIZE (0..63)) OF RelativeLocation,

...

}

RelativeLocation ::= SEQUENCE {

deltaLatitude-r16 INTEGER (-512..511),

deltaLongitude-r16 INTEGER (-1024..1023),

...

}

GNSS-SSR-ArrayOfCorrectionPoints-r16 ::=SEQUENCE {

referencePointLatitude-r16 INTEGER (-16384..16383),

referencePointLongitude-r16 INTEGER (-32768..32767),

numberOfStepsLatitude-r16 INTEGER (0..63),

numberOfStepsLongitude-r16 INTEGER (0..63),

stepOfLatitude-r16 INTEGER (1..511),

stepOfLongitude-r16 INTEGER (1..1023),

bitmaskOfGrids-r16 BIT STRING (SIZE(64)) OPTIONAL, -- Need OP

...

}

-- ASN1STOP

| *GNSS-SSR-CorrectionPoints* field descriptions |
| --- |
| ***correctionPointSetID***  This field provides the ID of the Atmospheric Correction Point set. It is a regionally unique arbitrary number that is used by the UE to ensure that the atmospheric corrections are being applied to the correct set of points. |
| ***referencePointLatitude***  This field specifies the latitude for the reference point, expressed in the range of -90° , +90°, coded as a number between -214 and 214-1, coded in 2's complement binary on 15 bits. The relation between the latitude X in the range [‑90°, 90°] and the coded number N is:    where  denotes the greatest integer less than or equal to x (floor operator).  For the *listOfCorrectionPoints*, the reference point defines the 1st correction point location.  For the *arrayOfCorrectionPoints*, the reference point defines the northwest corner of the correction point array. |
| ***referencePointLongitude***  This field specifies the longitude for the reference point, expressed in the range -180°, +180°, coded as a number between -215 and 215-1, coded in 2's complement binary on 16 bits. The relation between the longitude X in the range [-180°, 180°) and the coded number N is:    For the *listOfCorrectionPoints*, the reference point defines the 1st correction point location.  For the *arrayOfCorrectionPoints*, the reference point defines the northwest corner of the correction point array. |
| ***relativeLocationsList***  This field specifies the 2nd, 3rd, …, 64th correction point location. |
| ***deltaLatitude***  This field specifies the delta value in latitude of this correction point location relative to the previous point on the list or the reference point in the case of the first additional point, defined as "correction point location" minus "previous correction point location" in units of 0.01 degrees. |
| ***deltaLongitude***  This field specifies the delta value in longitude of this correction point location relative to the previous point on the list or the reference point in the case of the first additional point, defined as "correction point location" minus "previous correction point location" in units of 0.01 degrees. |
| ***numberOfStepsLatitude*, *numberOfStepsLongitude***  These fields specify the number of steps for latitude and longitude direction respectively. |
| ***stepOfLatitude, stepOfLongitude***  These fields specify the spacing of the correction points for latitude and longitude respectively. The unit and scale factor is 0.01 degrees. |
| ***bitmaskOfGrids***  This field specifies the availability of correction data at the correction points in the array. If a specific bit is enabled (set to '1'), the correction is available. Only the first *numberOfStepsLatitude*×*numberOfStepsLongitude* bits are used, the remainder are set to '0'. Starting with the northwest corner of the array (top left on a north oriented map) the correction points are enumerated with row precedence – first row west to east, second row west to east, until last row west to east – ending with the southeast corner of the array. If the field is omitted all correction points are used and none omitted. |

#### – *GNSS-TimeModelList*

The IE *GNSS-TimeModelList* is used by the location server to provide the GNSS‑GNSS system time offset between the GNSS system time indicated by IE *GNSS‑ID* in IE *GNSS-GenericAssistDataElement* to the GNSS system time indicated by IE *gnss-TO-ID*. Several *GNSS-TimeModelElement* IEs can be included with different *gnss-TO-ID* fields. The location server should provide a *GNSS-TimeModelList* for the same *GNSS-ID* as the *gnss-TimeID* in IE *GNSS-SystemTime* in *GNSS-ReferenceTime* assistance. If the location server does not provide a *GNSS-TimeModelList* for the same *GNSS-ID* as the *gnss-TimeID* in IE *GNSS-SystemTime* in *GNSS-ReferenceTime* assistance the target device assumes *tA1* and *tA2* are equal to zero.

-- ASN1START

GNSS-TimeModelList ::= SEQUENCE (SIZE (1..15)) OF GNSS-TimeModelElement

GNSS-TimeModelElement ::= SEQUENCE {

gnss-TimeModelRefTime INTEGER (0..65535),

tA0 INTEGER (-67108864..67108863),

tA1 INTEGER (-4096..4095) OPTIONAL, -- Need ON

tA2 INTEGER (-64..63) OPTIONAL, -- Need ON

gnss-TO-ID INTEGER (1..15),

weekNumber INTEGER (0..8191) OPTIONAL, -- Need ON

deltaT INTEGER (-128..127) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *GNSS-TimeModelElement* field descriptions |
| --- |
| ***gnss-TimeModelRefTime***  This field specifies the reference time of week for *GNSS-TimeModelElement* and it is given in GNSS specific system time.  Scale factor 24 seconds. |
| ***tA0***  This field specifies the bias coefficient of the *GNSS-TimeModelElement*.  Scale factor 2-35 seconds. |
| ***tA1***  This field specifies the drift coefficient of the *GNSS-TimeModelElement.*  Scale factor of 2-51 seconds/second. |
| ***tA2***  This field specifies the drift rate correction coefficient of the *GNSS-TimeModelElement.*  Scale factor of 2-68 seconds/second2. |
| ***gnss-TO-ID***  This field specifies the GNSS system time of the GNSS for which the *GNSS-TimeModelElement* is applicable. *GNSS-TimeModelElement* contains parameters to convert GNSS system time from the system indicated by *GNSS‑ID* to GNSS system time indicated by *gnss-TO-ID*. The conversion is defined in [4,5,6]. See table of gnss-TO-ID to Indication relation below. NOTE. |
| ***weekNumber***  This field specifies the reference week of the *GNSS-TimeModelElement* given in GNSS specific system time. The location server should include this field, if *tA1* or *tA2* is included.  Scale factor 1 week. |
| ***deltaT***  This field specifies the integer number of seconds of the GNSS-GNSS time offset provided in the *GNSS-TimeModelElement.*  Scale factor 1 second. |

gnss-TO-ID to Indication relation

|  |  |
| --- | --- |
| Value of *gnss-TO-ID* | Indication |
| 1 | GPS |
| 2 | Galileo |
| 3 | QZSS |
| 4 | GLONASS |
| 5 | BDS |
| 6-15 | reserved |

NOTE: The time relationship between the system time indicated by *GNSS-ID* and system time indicated by *gnss‑TO-ID* is given by the following equation:  
  
tGNSS = tE - ( A0GGTO + A1GGTO (tE - tGGTO + 604800 (WN - WNGGTO)) + A2GGTO (tE - tGGTO +   
 604800 (WN - WNGGTO))2 )  
  
where  
  
tGNSS  is the system time of week for the GNSS indicated by *gnss-TO-ID*.  
tE is the system time of week for the GNSS indicated by *GNSS-ID*.  
WN is the week number of the GNSS system time indicated by *GNSS-ID* corresponding to the tE.   
tGGTO is the system time of week for the time model data in the GNSS time indicated by *GNSS-ID* and given by the *gnss‑TimeModelRefTime* field.  
WNGGTO is the week number for the time model data in the GNSS time indicated by *GNSS-ID* corresponding to the tGGTO and given by the *weekNumber* field.  
A0GGTO is given by the *tA0* field.  
A1GGTO is given by the *tA1* field.  
A2GGTO is given by the *tA2* field.  
  
If the *tA1*and *tA2*are not included in the *GNSS-TimeModelElement*, the target device assumes A1GGTO and A2GGTO are equal to zero.

The GNSS system times in the IE *GNSS-TimeModelList* and used in the equation above are all given in Time of Week (TOW) and Week Number (WN) in the indicted GNSS specific system time. For conversion between TOW/WN and Day Number/Time of Day (*gnss-DayNumber*/*gnss-TimeOfDay*) a GNSS week consists of 7 days since the origin of the particular GNSS System time (with the week number count starting at 0), and a day consists of 86400 seconds.

#### – *GNSS-DifferentialCorrections*

The IE *GNSS-DifferentialCorrections* is used by the location server to provide differential GNSS corrections to the target device for a specific GNSS. Differential corrections can be provided for up to 3 signals per GNSS.

-- ASN1START

GNSS-DifferentialCorrections ::= SEQUENCE {

dgnss-RefTime INTEGER (0..3599),

dgnss-SgnTypeList DGNSS-SgnTypeList,

...

}

DGNSS-SgnTypeList ::= SEQUENCE (SIZE (1..3)) OF DGNSS-SgnTypeElement

DGNSS-SgnTypeElement ::= SEQUENCE {

gnss-SignalID GNSS-SignalID,

gnss-StatusHealth INTEGER (0..7),

dgnss-SatList DGNSS-SatList,

...

}

DGNSS-SatList ::= SEQUENCE (SIZE (1..64)) OF DGNSS-CorrectionsElement

DGNSS-CorrectionsElement ::= SEQUENCE {

svID SV-ID,

iod BIT STRING (SIZE(11)),

udre INTEGER (0..3),

pseudoRangeCor INTEGER (-2047..2047),

rangeRateCor INTEGER (-127..127),

udreGrowthRate INTEGER (0..7) OPTIONAL, -- Need ON

udreValidityTime INTEGER (0..7) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *GNSS-DifferentialCorrections* field descriptions |
| --- |
| ***dgnss-RefTime***  This field specifies the time for which the DGNSS corrections are valid, modulo 1 hour. *dgnss-RefTime* is given in GNSS specific system time.  Scale factor 1‑second. |
| ***dgnss-SgnTypeList***  This list includes differential correction data for different GNSS signal types, identified by *GNSS-SignalID*. |
| ***gnss-StatusHealth***  This field specifies the status of the differential corrections. The values of this field and their respective meanings are defined as in table *gnss-StatusHealth* Value to Indication relation below.  The first six values in this field indicate valid differential corrections. When using the values described below, the "UDRE Scale Factor" value is applied to the UDRE values contained in the element. The purpose is to indicate an estimate in the amount of error in the corrections.  The value "110" indicates that the source of the differential corrections (e.g., reference station or external DGNSS network) is currently not being monitored. The value "111" indicates that the corrections provided by the source are invalid, as judged by the source. |
| ***dgnss-SatList***  This list includes differential correction data for different GNSS satellites, identified by *SV-ID*. |
| ***iod***  This field specifies the Issue of Data field which contains the identity for the *GNSS-NavigationModel.* |
| ***udre***  This field provides an estimate of the uncertainty (1-σ) in the corrections for the particular satellite. The value in this field shall be multiplied by the UDRE Scale Factor in the *gnss-StatusHealth* field to determine the final UDRE estimate for the particular satellite. The meanings of the values for this field are shown in the table *udre Value* to Indication relation below. |
| ***pseudoRangeCor***  This field specifies the correction to the pseudorange for the particular satellite at *dgnss-RefTime*, t0. The value of this field is given in meters and the scale factor is 0.32 meters in the range of ±655.04 meters. The method of calculating this field is described in [11].  If the location server has received a request for GNSS assistance data from a target device which included a request for the GNSS Navigation Model and DGNSS, the location server shall determine, for each satellite, if the navigation model stored by the target device is still suitable for use with DGNSS corrections and if so and if DGNSS corrections are supported the location server should send DGNSS corrections without including the GNSS Navigation Model.  The *iod* value sent for a satellite shall always be the IOD value that corresponds to the navigation model for which the pseudo-range corrections are applicable.  The target device shall only use the *pseudoRangeCor*value when the IOD value received matches its available navigation model.  Pseudo-range corrections are provided with respect to GNSS specific geodetic datum (e.g., PZ-90.02 if *GNSS‑ID* indicates GLONASS).  Scale factor 0.32 meters. |
| ***rangeRateCor***  This field specifies the rate-of-change of the pseudorange correction for the particular satellite, using the satellite ephemeris and clock corrections identified by the *iod* field. The value of this field is given in meters per second and the resolution is 0.032 meters/sec in the range of ±4.064 meters/sec. For some time t1 > t0, the corrections for *iod* are estimated by  PRC(t1,IOD) = PRC(t0, IOD) + RRC(t0,IOD)⋅(t1 - t0),  and the target device uses this to correct the pseudorange it measures at t1, PRm(t1,IOD), by  PR(t1, IOD) = PRm(t1, IOD) + PRC(t1, IOD) .  The location server shall always send the RRC value that corresponds to the PRC value that it sends. The target device shall only use the RRC value when the *iod* value received matches its available navigation model.  Scale factor 0.032 meters/second. |
| ***udreGrowthRate***  This field provides an estimate of the growth rate of uncertainty (1-σ) in the corrections for the particular satellite identified by *SV-ID*. The estimated UDRE at time value specified in the *udreValidityTime**t1* is calculated as follows:  UDRE(*t0*+*t1*) = UDRE(*t0*) × *udreGrowthRate ,*  where *t0* is the DGNSS Reference Time *dgnss-RefTime*for which the corrections are valid, *t1* is the *udreValidityTime*  field, UDRE(*t0*) is the value of the *udre* field, and *udreGrowthRate* field is the factor as shown in the table Value of *udreGrowthRate* to Indication relation below. |
| ***udreValidityTime***  This field specifies the time when the *udreGrowthRate* field applies and is included if *udreGrowthRate* is included. The meaning of the values for this field is as shown in the table Value of *udreValidityTime* to Indication relation below. |

*gnss-StatusHealth* Value to Indication relation

|  |  |
| --- | --- |
| *gnss-StatusHealth Value* | Indication |
| 000 | UDRE Scale Factor = 1.0 |
| 001 | UDRE Scale Factor = 0.75 |
| 010 | UDRE Scale Factor = 0.5 |
| 011 | UDRE Scale Factor = 0.3 |
| 100 | UDRE Scale Factor = 0.2 |
| 101 | UDRE Scale Factor = 0.1 |
| 110 | Reference Station Transmission Not Monitored |
| 111 | Data is invalid - disregard |

*udre Value* to Indication relation

|  |  |
| --- | --- |
| *udre* Value | Indication |
| 00 | UDRE ≤ 1.0 m |
| 01 | 1.0 m < UDRE ≤ 4.0 m |
| 10 | 4.0 m < UDRE ≤ 8.0 m |
| 11 | 8.0 m < UDRE |

Value of *udreGrowthRate* to Indication relation

|  |  |
| --- | --- |
| **Value of *udreGrowthRate*** | **Indication** |
| 000 | 1.5 |
| 001 | 2 |
| 010 | 4 |
| 011 | 6 |
| 100 | 8 |
| 101 | 10 |
| 110 | 12 |
| 111 | 16 |

Value of *udreValidityTime* to Indication relation

|  |  |
| --- | --- |
| **Value of *udreValidityTime*** | **Indication**  **[seconds]** |
| 000 | 20 |
| 001 | 40 |
| 010 | 80 |
| 011 | 160 |
| 100 | 320 |
| 101 | 640 |
| 110 | 1280 |
| 111 | 2560 |

#### – *GNSS-NavigationModel*

The IE *GNSS-NavigationModel* is used by the location server to provide precise navigation data to the GNSS capable target device. In response to a request from a target device for GNSS Assistance Data, the location server shall determine whether to send the navigation model for a particular satellite to a target device based upon factors like the T-Toe limit specified by the target device and any request from the target device for DGNSS (see also *GNSS-DifferentialCorrections*). GNSS Orbit Model can be given in Keplerian parameters or as state vector in Earth-Centered Earth-Fixed coordinates, dependent on the *GNSS-ID* and the target device capabilities. The meaning of these parameters is defined in relevant ICDs of the particular GNSS and GNSS specific interpretations apply. For example, GPS and QZSS use the same model parameters but some parameters have a different interpretation [7].

-- ASN1START

GNSS-NavigationModel ::= SEQUENCE {

nonBroadcastIndFlag INTEGER (0..1),

gnss-SatelliteList GNSS-NavModelSatelliteList,

...

}

GNSS-NavModelSatelliteList ::= SEQUENCE (SIZE(1..64)) OF GNSS-NavModelSatelliteElement

GNSS-NavModelSatelliteElement ::= SEQUENCE {

svID SV-ID,

svHealth BIT STRING (SIZE(8)),

iod BIT STRING (SIZE(11)),

gnss-ClockModel GNSS-ClockModel,

gnss-OrbitModel GNSS-OrbitModel,

...,

[[ svHealthExt-v1240 BIT STRING (SIZE(4)) OPTIONAL -- Need ON

]]

}

GNSS-ClockModel ::= CHOICE {

standardClockModelList StandardClockModelList, -- Model-1

nav-ClockModel NAV-ClockModel, -- Model-2

cnav-ClockModel CNAV-ClockModel, -- Model-3

glonass-ClockModel GLONASS-ClockModel, -- Model-4

sbas-ClockModel SBAS-ClockModel, -- Model-5

...,

bds-ClockModel-r12 BDS-ClockModel-r12 -- Model-6

}

GNSS-OrbitModel ::= CHOICE {

keplerianSet NavModelKeplerianSet, -- Model-1

nav-KeplerianSet NavModelNAV-KeplerianSet, -- Model-2

cnav-KeplerianSet NavModelCNAV-KeplerianSet, -- Model-3

glonass-ECEF NavModel-GLONASS-ECEF, -- Model-4

sbas-ECEF NavModel-SBAS-ECEF, -- Model-5

...,

bds-KeplerianSet-r12 NavModel-BDS-KeplerianSet-r12 -- Model-6

}

-- ASN1STOP

| *GNSS-NavigationModel* field descriptions |
| --- |
| ***nonBroadcastIndFlag***  This field indicates if the *GNSS-NavigationModel* elements are not derived from satellite broadcast data or are given in a format not native to the GNSS. A value of 0 means the *GNSS-NavigationModel* data elements correspond to GNSS satellite broadcasted data; a value of 1 means the *GNSS-NavigationModel* data elements are not derived from satellite broadcast. |
| ***gnss-SatelliteList***  This list provides ephemeris and clock corrections for GNSS satellites indicated by *SV‑ID*. |
| ***svHealth***  This field specifies the satellite's current health. The health values are GNSS system specific. The interpretation of *svHealth* depends on the *GNSS‑ID* and is as shown in table GNSS to svHealth Bit String(8) relation below. |
| ***iod***  This field specifies the Issue of Data and contains the identity for GNSS Navigation Model.  In case of broadcasted GPS NAV ephemeris, the *iod* contains the IODC as described in [4].  In case of broadcasted Modernized GPS ephemeris, the *iod* contains the 11-bit parameter toe as defined in [4, Table 30-I] [6, Table 3.5-1].  In case of broadcasted SBAS ephemeris, the *iod* contains the 8 bits Issue of Data as defined in [10] Message Type 9.  In case of broadcasted QZSS QZS-L1 ephemeris, the *iod* contains the IODC as described in [7].  In case of broadcasted QZSS QZS-L1C/L2C/L5 ephemeris, the *iod* contains the 11-bit parameter toe as defined in [7].  In case of broadcasted GLONASS ephemeris, the *iod* contains the parameter tb as defined in [9].  In the case of broadcasted Galileo ephemeris, the *iod* contains the IOD index as described in [8].  In the case of broadcasted BDS ephemeris, the *iod* contains 11 MSB bits of the toe as defined in [23].  The interpretation of *iod* depends on the *GNSS‑ID* and is as shown in table GNSS to iod Bit String(11) relation below. |
| ***svHealthExt***  This field specifies the satellite's additional current health. The health values are GNSS system specific. The interpretation of *svHealthExt* depends on the *GNSS‑ID* and is as shown in table GNSS to svHealthExt Bit String(4) relation below. |

GNSS to svHealth Bit String(8) relation

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| GNSS | *svHealth* Bit String(8) | | | | | | | |
| Bit 1  (MSB) | Bit 2 | Bit 3 | Bit 4 | Bit 5 | Bit 6 | Bit 7 | Bit 8 (LSB) |
| GPS L1/CA(1) | SV Health [4] | | | | | | '0'  (reserved) | '0'  (reserved) |
| Modernized GPS(2) | L1C Health  [6] | L1 Health [4,5] | L2 Health  [4,5] | L5 Health [4,5] | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| SBAS(3) | Ranging  On (0),Off(1) [10] | Corrections On(0),Off(1) [10] | Integrity  On(0),Off(1)[10] | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| QZSS(4)  QZS-L1 | SV Health [7] | | | | | | '0'  (reserved) | '0'  (reserved) |
| QZSS(5)  QZS‑  L1C/L2C/L5 | L1C Health  [7] | L1 Health  [7] | L2 Health  [7] | L5 Health  [7] | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| GLONASS | Bn (MSB)  [9, page 30] | FT [9, Table 4.4] | | | | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| Galileo  [8, clause 5.1.9.3] | E5a Data Validity Status | E5b Data Validity Status | E1-B Data Validity Status | E5a Signal Health Status | | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| BDS  [23] | B1I Health (SatH1) [23] | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) | '0'  (reserved) |
| Note 1: If *GNSS‑ID* indicates 'gps', and GNSS Orbit Model-2 is included, this interpretation of *svHealth* applies.  Note 2: If *GNSS‑ID* indicates 'gps', and GNSS Orbit Model-3 is included, this interpretation of *svHealth* applies. If a certain signal is not supported on the satellite indicated by *SV‑ID*, the corresponding health bit shall be set to '1' (i.e., signal can not be used).  Note 3: *svHealth* in case of *GNSS‑ID* indicates 'sbas' includes the 5 LSBs of the Health included in GEO Almanac Message Parameters (Type 17) [10].  Note 4: If *GNSS‑ID* indicates 'qzss', and GNSS Orbit Model-2 is included, this interpretation of *svHealth* applies.  Note 5: If *GNSS‑ID* indicates 'qzss', and GNSS Orbit Model-3 is included, this interpretation of *svHealth* applies. | | | | | | | | |

GNSS to iod Bit String(11) relation

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| GNSS | *iod* Bit String(11) | | | | | | | | | | |
| Bit 1  (MSB) | Bit 2 | Bit 3 | Bit 4 | Bit 5 | Bit 6 | Bit 7 | Bit 8 | Bit 9 | Bit 10 | Bit 11  (LSB) |
| GPS L1/CA | '0' | Issue of Data, Clock [4] | | | | | | | | | |
| Modernized GPS | toe (seconds, scale factor 300, range 0 – 604500) [4,5,6] | | | | | | | | | | |
| SBAS | '0' | '0' | '0' | Issue of Data ([10], Message Type 9) | | | | | | | |
| QZSS QZS-L1 | '0' | Issue of Data, Clock [7] | | | | | | | | | |
| QZSS  QZS-L1C/L2C/L5 | toe (seconds, scale factor 300, range 0 – 604500) [7] | | | | | | | | | | |
| GLONASS | '0' | '0' | '0' | '0' | tb (minutes, scale factor 15) [9] | | | | | | |
| Galileo | '0' | IODnav [8] | | | | | | | | | |
| BDS | 11 MSB bits of toe (seconds, scale factor 512, range 0 – 604672) [23] | | | | | | | | | | |

GNSS to svHealthExt Bit String(4) relation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| GNSS | *svHealthExt* Bit String(4) | | | |
| Bit 1  (MSB) | Bit 2 | Bit 3 | Bit 4  (LSB) |
| Galileo [8, clause 5.1.9.3] | E5b Signal Health Status | | E1-B Signal Health Status | |

#### – *StandardClockModelList*

-- ASN1START

StandardClockModelList ::= SEQUENCE (SIZE(1..2)) OF StandardClockModelElement

StandardClockModelElement ::= SEQUENCE {

stanClockToc INTEGER (0..16383),

stanClockAF2 INTEGER (-32..31),

stanClockAF1 INTEGER (-1048576..1048575),

stanClockAF0 INTEGER (-1073741824..1073741823),

stanClockTgd INTEGER (-512..511) OPTIONAL, -- Need ON

sisa INTEGER (0..255),

stanModelID INTEGER (0..1) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *StandardClockModelList* field descriptions |
| --- |
| ***standardClockModelList***  *gnss-ClockModel* Model-1 contains one or two clock model elements. If included, clock Model-1 shall be included once or twice depending on the target device capability.  If the target device is supporting multiple Galileo signals, the location server shall include both F/Nav and I/Nav clock models in *gnss-ClockModel* if the location server assumes the target device to perform location information calculation using multiple signals. |
| ***stanClockToc***  Parameter toc defined in [8].  Scale factor 60 seconds. |
| ***stanClockAF2***  Parameter af2 defined in [8].  Scale factor 2-59 seconds/second2. |
| ***stanClockAF1***  Parameter af1 defined in [8].  Scale factor 2-46 seconds/second. |
| ***stanClockAF0***  Parameter af0 defined in [8].  Scale factor 2-34 seconds. |
| ***stanClockTgd***  Parameter TGD, Broadcast Group Delay (BGD), defined in [8].  Scale factor 2-32 seconds.  This field is required if the target device supports only single frequency Galileo signal. |
| ***sisa***  Signal-In-Space Accuracy (SISA), defined in [8] clause 5.1.11. |
| ***stanModelID***  This field specifies the identity of the clock model according to the table Value of stanModelID to Identity relation below. This field is required if the location server includes both F/Nav and I/Nav Galileo clock models in *gnss-ClockModel.* |

Value of stanModelID to Identity relation

|  |  |
| --- | --- |
| Value of *stanModelID* | Identity |
| 0 | I/Nav (E1,E5b) |
| 1 | F/Nav (E1,E5a) |

#### – *NAV-ClockModel*

-- ASN1START

NAV-ClockModel ::= SEQUENCE {

navToc INTEGER (0..37799),

navaf2 INTEGER (-128..127),

navaf1 INTEGER (-32768..32767),

navaf0 INTEGER (-2097152..2097151),

navTgd INTEGER (-128..127),

...

}

-- ASN1STOP

| *NAV-ClockModel* field descriptions |
| --- |
| ***navToc***  Parameter toc, time of clock (seconds) [4,7]  Scale factor 24 seconds. |
| ***navaf2***  Parameter af2, clock correction polynomial coefficient (sec/sec2) [4,7].  Scale factor 2-55 seconds/second2. |
| ***navaf1***  Parameter af1, clock correction polynomial coefficient (sec/sec) [4,7].  Scale factor 2-43 seconds/second. |
| ***navaf0***  Parameter af0, clock correction polynomial coefficient (seconds) [4,7].  Scale factor 2-31 seconds. |
| ***navTgd***  Parameter TGD, group delay (seconds) [4,7].  Scale factor 2-31 seconds. |

#### – *CNAV-ClockModel*

-- ASN1START

CNAV-ClockModel ::= SEQUENCE {

cnavToc INTEGER (0..2015),

cnavTop INTEGER (0..2015),

cnavURA0 INTEGER (-16..15),

cnavURA1 INTEGER (0..7),

cnavURA2 INTEGER (0..7),

cnavAf2 INTEGER (-512..511),

cnavAf1 INTEGER (-524288..524287),

cnavAf0 INTEGER (-33554432..33554431),

cnavTgd INTEGER (-4096..4095),

cnavISCl1cp INTEGER (-4096..4095) OPTIONAL, -- Need ON

cnavISCl1cd INTEGER (-4096..4095) OPTIONAL, -- Need ON

cnavISCl1ca INTEGER (-4096..4095) OPTIONAL, -- Need ON

cnavISCl2c INTEGER (-4096..4095) OPTIONAL, -- Need ON

cnavISCl5i5 INTEGER (-4096..4095) OPTIONAL, -- Need ON

cnavISCl5q5 INTEGER (-4096..4095) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *CNAV-ClockModel* field descriptions |
| --- |
| ***cnavToc***  Parameter toc, clock data reference time of week (seconds) [4,5,6,7].  Scale factor 300 seconds. |
| ***cnavTop***  Parameter top, clock data predict time of week (seconds) [4,5,6,7].  Scale factor 300 seconds |
| ***cnavURA0***  Parameter URAoc Index, SV clock accuracy index (dimensionless) [4,5,6,7]. |
| ***cnavURA1***  Parameter URAoc1 Index, SV clock accuracy change index (dimensionless) [4,5,6,7]. |
| ***cnavURA2***  Parameter URAoc2 Index, SV clock accuracy change rate index (dimensionless) [4,5,6,7]. |
| ***cnavAf2***  Parameter af2-n, SV clock drift rate correction coefficient (sec/sec2) [4,5,6,7].  Scale factor 2-60 seconds/second2. |
| ***cnavAf1***  Parameter af1-n, SV clock drift correction coefficient (sec/sec) [4,5,6,7].  Scale factor 2-48 seconds/second. |
| ***cnavAf0***  Parameter af0-n, SV clock bias correction coefficient (seconds) [4,5,6,7].  Scale factor 2-35 seconds. |
| ***cnavTgd***  Parameter TGD, Group delay correction (seconds) [4,5,6,7].  Scale factor 2-35 seconds. |
| ***cnavISCl1cp***  Parameter ISCL1CP, inter signal group delay correction (seconds) [6,7].  Scale factor 2-35 seconds.  The location server should include this field if the target device is GPS capable and supports the L1C signal. |
| ***cnavISCl1cd***  Parameter ISCL1CD, inter signal group delay correction (seconds) [6,7].  Scale factor 2-35 seconds.  The location server should include this field if the target device is GPS capable and supports the L1C signal. |
| ***cnavISCl1ca***  Parameter ISCL1C/A, inter signal group delay correction (seconds) [4,5,7].  Scale factor 2-35 seconds.  The location server should include this field if the target device is GPS capable and supports the L1CA signal. |
| ***cnavISCl2c***  Parameter ISCL2C, inter signal group delay correction (seconds) [4,5,7].  Scale factor 2-35 seconds.  The location server should include this field if the target device is GPS capable and supports the L2C signal. |
| ***cnavISCl5i5***  Parameter ISCL5I5, inter signal group delay correction (seconds) [5,7].  Scale factor 2-35 seconds.  The location server should include this field if the target device is GPS capable and supports the L5 signal. |
| ***cnavISCl5q5***  Parameter ISCL5Q5, inter signal group delay correction (seconds) [5,7].  Scale factor 2-35 seconds.  The location server should include this field if the target device is GPS capable and supports the L5 signal. |

#### – *GLONASS-ClockModel*

-- ASN1START

GLONASS-ClockModel ::= SEQUENCE {

gloTau INTEGER (-2097152..2097151),

gloGamma INTEGER (-1024..1023),

gloDeltaTau INTEGER (-16..15) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *GLONASS-ClockModel* field descriptions |
| --- |
| ***gloTau***  Parameter n(tb), satellite clock offset (seconds) [9].  Scale factor 2-30 seconds. |
| ***gloGamma***  Parameter n(tb), relative frequency offset from nominal value (dimensionless) [9].  Scale factor 2-40. |
| ***gloDeltaTau***  Parameter n, time difference between transmission in G2 and G1 (seconds) [9].  Scale factor 2-30 seconds.  The location server should include this parameter if the target device is dual frequency GLONASS receiver capable. |

#### – *SBAS-ClockModel*

-- ASN1START

SBAS-ClockModel ::= SEQUENCE {

sbasTo INTEGER (0..5399),

sbasAgfo INTEGER (-2048..2047),

sbasAgf1 INTEGER (-128..127),

...

}

-- ASN1STOP

| *SBAS-ClockModel* field descriptions |
| --- |
| ***sbasTo***  Parameter t0 [10].  Scale factor 16 seconds. |
| ***sbasAgfo***  Parameter aGfo [10].  Scale factor 2-31 seconds. |
| ***sbasAgf1***  Parameter aGf1 [10].  Scale factor 2-40 seconds/second. |

#### – *BDS-ClockModel*

-- ASN1START

BDS-ClockModel-r12 ::= SEQUENCE {

bdsAODC-r12 INTEGER (0..31),

bdsToc-r12 INTEGER (0..131071),

bdsA0-r12 INTEGER (-8388608..8388607),

bdsA1-r12 INTEGER (-2097152..2097151),

bdsA2-r12 INTEGER (-1024..1023),

bdsTgd1-r12 INTEGER (-512..511),

...

}

-- ASN1STOP

| *BDS-ClockModel* field descriptions |
| --- |
| ***bdsAODC***  Parameter Age of Data, Clock (AODC), see [23], Table 5-6. |
| ***bdsToc***  Parameter Toc, Time of clock (seconds) [23].  Scale factor 23 seconds. |
| ***bdsA0***  Parameter a0, Clock correction polynomial coefficient (seconds) [23].  Scale factor 2-33 seconds. |
| ***bdsA1***  Parameter a1, Clock correction polynomial coefficient (sec/sec) [23].  Scale factor 2-50 sec/sec. |
| ***bdsA2***  Parameter a2, Clock correction polynomial coefficient (sec/sec2) [23].  Scale factor 2-66 sec/sec2. |
| ***bdsTgd1***  Parameter Equipment group delay differential TGD1 [23].  Scale factor is 0.1 nanosecond. |

#### – *NavModelKeplerianSet*

-- ASN1START

NavModelKeplerianSet ::= SEQUENCE {

keplerToe INTEGER (0 .. 16383),

keplerW INTEGER (-2147483648..2147483647),

keplerDeltaN INTEGER (-32768..32767),

keplerM0 INTEGER (-2147483648..2147483647),

keplerOmegaDot INTEGER (-8388608.. 8388607),

keplerE INTEGER (0..4294967295),

keplerIDot INTEGER (-8192..8191),

keplerAPowerHalf INTEGER (0.. 4294967295),

keplerI0 INTEGER (-2147483648..2147483647),

keplerOmega0 INTEGER (-2147483648..2147483647),

keplerCrs INTEGER (-32768..32767),

keplerCis INTEGER (-32768..32767),

keplerCus INTEGER (-32768..32767),

keplerCrc INTEGER (-32768..32767),

keplerCic INTEGER (-32768..32767),

keplerCuc INTEGER (-32768..32767),

...

}

-- ASN1STOP

| *NavModelKeplerianSet* field descriptions |
| --- |
| ***keplerToe***  Parameter toe, time-of-ephemeris in seconds [8].  Scale factor 60 seconds. |
| ***keplerW***  Parameter ω, argument of perigee (semi-circles) [8].  Scale factor 2-31 semi-circles. |
| ***keplerDeltaN***  Parameter n, mean motion difference from computed value (semi-circles/sec) [8].  Scale factor 2-43 semi-circles/second. |
| ***keplerM0***  Parameter M0, mean anomaly at reference time (semi-circles) [8].  Scale factor 2-31 semi-circles. |
| ***keplerOmegaDot***  Parameter OMEGAdot, rate of change of right ascension (semi-circles/sec) [8].  Scale factor 2-43 semi-circles/second. |
| ***keplerE***  Parameter e, eccentricity [8].  Scale factor 2-33. |
| ***KeplerIDot***  Parameter Idot, rate of change of inclination angle (semi-circles/sec) [8].  Scale factor 2-43 semi-circles/second. |
| ***keplerAPowerHalf***  Parameter sqrtA, square root of semi-major Axis in (meters) ½ [8].  Scale factor 2-19 meters ½. |
| ***keplerI0***  Parameter i0, inclination angle at reference time (semi-circles) [8].  Scale factor 2-31 semi-circles. |
| ***keplerOmega0***  Parameter OMEGA0, longitude of ascending node of orbit plane at weekly epoch (semi-circles) [8].  Scale factor 2-31 semi-circles. |
| ***keplerCrs***  Parameter Crs, amplitude of the sine harmonic correction term to the orbit radius (meters) [8].  Scale factor 2-5 meters. |
| ***keplerCis***  Parameter Cis, amplitude of the sine harmonic correction term to the angle of inclination (radians) [8].  Scale factor 2-29 radians. |
| ***keplerCus***  Parameter Cus, amplitude of the sine harmonic correction term to the argument of latitude (radians) [8].  Scale factor 2-29 radians. |
| ***keplerCrc***  Parameter Crc, amplitude of the cosine harmonic correction term to the orbit radius (meters) [8].  Scale factor 2-5 meters. |
| ***keplerCic***  Parameter Cic, amplitude of the cosine harmonic correction term to the angle of inclination (radians) [8].  Scale factor 2-29 radians. |
| ***keplerCuc***  Parameter Cuc, amplitude of the cosine harmonic correction term to the argument of latitude (radians) [8].  Scale factor 2-29 radians. |

#### – *NavModelNAV-KeplerianSet*

-- ASN1START

NavModelNAV-KeplerianSet ::= SEQUENCE {

navURA INTEGER (0..15),

navFitFlag INTEGER (0..1),

navToe INTEGER (0..37799),

navOmega INTEGER (-2147483648..2147483647),

navDeltaN INTEGER (-32768..32767),

navM0 INTEGER (-2147483648..2147483647),

navOmegaADot INTEGER (-8388608..8388607),

navE INTEGER (0..4294967295),

navIDot INTEGER (-8192..8191),

navAPowerHalf INTEGER (0..4294967295),

navI0 INTEGER (-2147483648..2147483647),

navOmegaA0 INTEGER (-2147483648..2147483647),

navCrs INTEGER (-32768..32767),

navCis INTEGER (-32768..32767),

navCus INTEGER (-32768..32767),

navCrc INTEGER (-32768..32767),

navCic INTEGER (-32768..32767),

navCuc INTEGER (-32768..32767),

addNAVparam SEQUENCE {

ephemCodeOnL2 INTEGER (0..3),

ephemL2Pflag INTEGER (0..1),

ephemSF1Rsvd SEQUENCE {

reserved1 INTEGER (0..8388607), -- 23-bit field

reserved2 INTEGER (0..16777215), -- 24-bit field

reserved3 INTEGER (0..16777215), -- 24-bit field

reserved4 INTEGER (0..65535) -- 16-bit field

},

ephemAODA INTEGER (0..31)

} OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *NavModelNAV-KeplerianSet* field descriptions |
| --- |
| ***navURA***  Parameter URA Index, SV accuracy (dimensionless) [4,7]. |
| ***navFitFlag***  Parameter Fit Interval Flag, fit interval indication (dimensionless) [4,7] |
| ***navToe***  Parameter toe, time of ephemeris (seconds) [4,7].  Scale factor 24 seconds. |
| ***navOmega***  Parameter ω, argument of perigee (semi-circles) [4,7].  Scale factor 2-31 semi-circles. |
| ***navDeltaN***  Parameter Δn, mean motion difference from computed value (semi-circles/sec) [4,7].  Scale factor 2-43 semi-circles/second. |
| ***navM0***  Parameter M0, mean anomaly at reference time (semi-circles) [4,7].  Scale factor 2-31 semi-circles. |
| ***navOmegaADot***  Parameter , rate of right ascension (semi-circles/sec) [4,7].  Scale factor 2-43 semi-circles/second. |
| ***navE***  Parameter e, eccentricity (dimensionless) [4,7].  Scale factor 2-33. |
| ***navIDot***  Parameter IDOT, rate of inclination angle (semi-circles/sec) [4,7].  Scale factor 2-43 semi-circles/second. |
| ***navAPowerHalf***  Parameter , square root of semi-major axis (meters1/2) [4,7].  Scale factor 2-19 meters ½. |
| ***navI0***  Parameter i0, inclination angle at reference time (semi-circles) [4,7].  Scale factor 2-31 semi-circles. |
| ***navOmegaA0***  Parameter 0, longitude of ascending node of orbit plane at weekly epoch (semi-circles) [4,7].  Scale factor 2-31 semi-circles. |
| ***navCrs***  Parameter Crs, amplitude of sine harmonic correction term to the orbit radius (meters) [4,7].  Scale factor 2-5 meters. |
| ***navCis***  Parameter Cis, amplitude of sine harmonic correction term to the angle of inclination (radians) [4,7].  Scale factor 2-29 radians. |
| ***navCus***  Parameter Cus, amplitude of sine harmonic correction term to the argument of latitude (radians) [4,7].  Scale factor 2-29 radians. |
| ***navCrc***  Parameter Crc, amplitude of cosine harmonic correction term to the orbit radius (meters) [4,7].  Scale factor 2-5 meters. |
| ***navCic***  Parameter Cic, amplitude of cosine harmonic correction term to the angle of inclination (radians) [4,7].  Scale factor 2-29 radians. |
| ***navCuc***  Parameter Cuc, amplitude of cosine harmonic correction term to the argument of latitude (radians) [4,7].  Scale factor 2-29 radians. |
| ***addNAVparam***  These fields include data and reserved bits in the GPS NAV message [4,14].  These additional navigation parameters, if provided by the location server, allow the target device to perform data wipe-off similar to what is done by the target device with the *GNSS-DataBitAssistance.* |

#### – *NavModelCNAV-KeplerianSet*

-- ASN1START

NavModelCNAV-KeplerianSet ::= SEQUENCE {

cnavTop INTEGER (0..2015),

cnavURAindex INTEGER (-16..15),

cnavDeltaA INTEGER (-33554432..33554431),

cnavAdot INTEGER (-16777216..16777215),

cnavDeltaNo INTEGER (-65536..65535),

cnavDeltaNoDot INTEGER (-4194304..4194303),

cnavMo INTEGER (-4294967296..4294967295),

cnavE INTEGER (0..8589934591),

cnavOmega INTEGER (-4294967296..4294967295),

cnavOMEGA0 INTEGER (-4294967296..4294967295),

cnavDeltaOmegaDot INTEGER (-65536..65535),

cnavIo INTEGER (-4294967296..4294967295),

cnavIoDot INTEGER (-16384..16383),

cnavCis INTEGER (-32768..32767),

cnavCic INTEGER (-32768..32767),

cnavCrs INTEGER (-8388608..8388607),

cnavCrc INTEGER (-8388608..8388607),

cnavCus INTEGER (-1048576..1048575),

cnavCuc INTEGER (-1048576..1048575),

...

}

-- ASN1STOP

| *NavModelCNAV-KeplerianSet* field descriptions |
| --- |
| ***cnavTop***  Parameter top, data predict time of week (seconds) [4,5,6,7].  Scale factor 300 seconds. |
| ***cnavURAindex***  Parameter URAoe Index, SV accuracy (dimensionless) [4,5,6,7]. |
| ***cnavDeltaA***  Parameter A, semi-major axis difference at reference time (meters) [4,5,6,7].  Scale factor 2-9 meters. |
| ***cnavAdot***  Parameter , change rate in semi-major axis (meters/sec) [4,5,6,7].  Scale factor 2-21 meters/sec. |
| ***cnavDeltaNo***  Parameter n0, mean motion difference from computed value at reference time (semi-circles/sec) [4,5,6,7].  Scale factor 2-44 semi-circles/second. |
| ***cnavDeltaNoDot***  Parameter , rate of mean motion difference from computed value (semi-circles/sec2) [4,5,6,7].  Scale factor 2-57 semi-circles/second2. |
| ***cnavMo***  Parameter M0-n, mean anomaly at reference time (semi-circles) [4,5,6,7].  Scale factor 2-32 semi-circles. |
| ***cnavE***  Parameter en, eccentricity (dimensionless) [4,5,6,7].  Scale factor 2-34. |
| ***cnavOmega***  Parameter n, argument of perigee (semi-circles) [4,5,6,7].  Scale factor 2-32 semi-circles. |
| ***cnavOMEGA0***  Parameter 0-n, reference right ascension angle (semi-circles) [4,5,6,7].  Scale factor 2-32 semi-circles. |
| ***cnavDeltaOmegaDot***  Parameter , rate of right ascension difference (semi-circles/sec) [4,5,6,7].  Scale factor 2-44 semi-circles/second. |
| ***cnavIo***  Parameter io-n, inclination angle at reference time (semi-circles) [4,5,6,7].  Scale factor 2-32 semi-circles. |
| ***cnavIoDot***  Parameter I0-n-DOT, rate of inclination angle (semi-circles/sec) [4,5,6,7].  Scale factor 2-44 semi-circles/second. |
| ***cnavCis***  Parameter Cis-n, amplitude of sine harmonic correction term to the angle of inclination (radians) [4,5,6,7].  Scale factor 2-30 radians. |
| ***cnavCic***  Parameter Cic-n, amplitude of cosine harmonic correction term to the angle of inclination (radians) [4,5,6,7].  Scale factor 2-30 radians. |
| ***cnavCrs***  Parameter Crs-n, amplitude of sine harmonic correction term to the orbit radius (meters) [4,5,6,7].  Scale factor 2-8 meters. |
| ***cnavCrc***  Parameter Crc-n, amplitude of cosine harmonic correction term to the orbit radius (meters) [4,5,6,7].  Scale factor 2-8 meters. |
| ***cnavCus***  Parameter Cus-n, amplitude of the sine harmonic correction term to the argument of latitude (radians) [4,5,6,7].  Scale factor 2-30 radians. |
| ***cnavCuc***  Parameter Cuc-n, amplitude of cosine harmonic correction term to the argument of latitude (radians) [4,5,6,7].  Scale factor 2-30 radians. |

#### – *NavModel-GLONASS-ECEF*

-- ASN1START

NavModel-GLONASS-ECEF ::= SEQUENCE {

gloEn INTEGER (0..31),

gloP1 BIT STRING (SIZE(2)),

gloP2 BOOLEAN,

gloM INTEGER (0..3),

gloX INTEGER (-67108864..67108863),

gloXdot INTEGER (-8388608..8388607),

gloXdotdot INTEGER (-16..15),

gloY INTEGER (-67108864..67108863),

gloYdot INTEGER (-8388608..8388607),

gloYdotdot INTEGER (-16..15),

gloZ INTEGER (-67108864..67108863),

gloZdot INTEGER (-8388608..8388607),

gloZdotdot INTEGER (-16..15),

...

}

-- ASN1STOP

| *NavModel-GLONASS-ECEF* field descriptions |
| --- |
| ***gloEn***  Parameter En, age of data (days) [9].  Scale factor 1 days. |
| ***gloP1***  Parameter P1, time interval between two adjacent values of tb (minutes) [9]. |
| ***gloP2***  Parameter P2, change of tb flag (dimensionless) [9]. |
| ***gloM***  Parameter M, type of satellite (dimensionless) [9]. |
| ***gloX***  Parameter , x-coordinate of satellite at time tb (kilometers) [9].  Scale factor 2-11 kilometers. |
| ***gloXdot***  Parameter , x-coordinate of satellite velocity at time tb (kilometers/sec) [9].  Scale factor 2-20 kilometers/second. |
| ***gloXdotdot***  Parameter , x-coordinate of satellite acceleration at time tb (kilometers/sec2) [9].  Scale factor 2-30 kilometers/second2. |
| ***gloY***  Parameter , y-coordinate of satellite at time tb (kilometers) [9].  Scale factor 2-11 kilometers. |
| ***gloYdot***  Parameter , y-coordinate of satellite velocity at time tb (kilometers/sec) [9].  Scale factor 2-20 kilometers/second. |
| ***gloYdotdot***  Parameter , y-coordinate of satellite acceleration at time tb (kilometers/sec2) [9].  Scale factor 2-30 kilometers/second2. |
| ***gloZ***  Parameter , z-coordinate of satellite at time tb (kilometers) [9].  Scale factor 2-11 kilometers. |
| ***gloZdot***  Parameter , z-coordinate of satellite velocity at time tb (kilometers/sec) [9].  Scale factor 2-20 kilometers/second. |
| ***gloZdotdot***  Parameter , z-coordinate of satellite acceleration at time tb (kilometers/sec2) [9].  Scale factor 2-30 kilometers/second2. |

#### – *NavModel-SBAS-ECEF*

-- ASN1START

NavModel-SBAS-ECEF ::= SEQUENCE {

sbasTo INTEGER (0..5399) OPTIONAL, -- Cond ClockModel

sbasAccuracy BIT STRING (SIZE(4)),

sbasXg INTEGER (-536870912..536870911),

sbasYg INTEGER (-536870912..536870911),

sbasZg INTEGER (-16777216..16777215),

sbasXgDot INTEGER (-65536..65535),

sbasYgDot INTEGER (-65536..65535),

sbasZgDot INTEGER (-131072..131071),

sbasXgDotDot INTEGER (-512..511),

sbagYgDotDot INTEGER (-512..511),

sbasZgDotDot INTEGER (-512..511),

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *ClockModel* | This field is mandatory present if *gnss-ClockModel* Model‑5 is not included; otherwise it is not present. |

| *NavModel-SBAS-ECEF* field descriptions |
| --- |
| ***sbasTo***  Parameter t0, time of applicability (seconds) [10].  Scale factor 16 seconds. |
| ***sbasAccuracy***  Parameter Accuracy, (dimensionless) [10]. |
| ***sbasXg***  Parameter XG, (meters) [10].  Scale factor 0.08 meters. |
| ***sbasYg***  Parameter YG, (meters) [10].  Scale factor 0.08 meters. |
| ***sbasZg***  Parameter ZG, (meters) [10].  Scale factor 0.4 meters. |
| ***sbasXgDot***  Parameter XG, Rate‑of‑Change, (meters/sec) [10].  Scale factor 0.000625 meters/second. |
| ***sbasYgDot***  Parameter YG, Rate‑of‑Change, (meters/sec) [10]  Scale factor 0.000625 meters/second. |
| ***sbasZgDot***  Parameter ZG, Rate‑of‑Change, (meters/sec) [10].  Scale factor 0.004 meters/second. |
| ***sbasXgDotDot***  Parameter XG,Acceleration, (meters/sec2) [10].  Scale factor 0.0000125 meters/second2. |
| ***sbagYgDotDot***  Parameter YG, Acceleration, (meters/sec2) [10].  Scale factor 0.0000125 meters/second2. |
| ***sbasZgDotDot***  Parameter ZG Acceleration, (meters/sec2) [10].  Scale factor 0.0000625 meters/second2. |

#### – *NavModel-BDS-KeplerianSet*

-- ASN1START

NavModel-BDS-KeplerianSet-r12 ::= SEQUENCE {

bdsAODE-r12 INTEGER (0..31),

bdsURAI-r12 INTEGER (0..15),

bdsToe-r12 INTEGER (0..131071),

bdsAPowerHalf-r12 INTEGER (0..4294967295),

bdsE-r12 INTEGER (0..4294967295),

bdsW-r12 INTEGER (-2147483648..2147483647),

bdsDeltaN-r12 INTEGER (-32768..32767),

bdsM0-r12 INTEGER (-2147483648..2147483647),

bdsOmega0-r12 INTEGER (-2147483648..2147483647),

bdsOmegaDot-r12 INTEGER (-8388608..8388607),

bdsI0-r12 INTEGER (-2147483648..2147483647),

bdsIDot-r12 INTEGER (-8192..8191),

bdsCuc-r12 INTEGER (-131072..131071),

bdsCus-r12 INTEGER (-131072..131071),

bdsCrc-r12 INTEGER (-131072..131071),

bdsCrs-r12 INTEGER (-131072..131071),

bdsCic-r12 INTEGER (-131072..131071),

bdsCis-r12 INTEGER (-131072..131071),

...

}

-- ASN1STOP

| *NavModel-BDS-KeplerianSet* field descriptions |
| --- |
| ***bdsAODE***  Parameter Age of Data, Ephemeris (AODE), see [23], Table 5-8. |
| ***bdsURAI***  Parameter URA Index, URA is used to describe the signal-in-space accuracy in meters as defined in [23]. |
| ***bdsToe***  Parameter toe, Ephemeris reference time (seconds) [23].  Scale factor 23 seconds. |
| ***bdsAPowerHalf***  Parameter A1/2, Square root of semi-major axis (meters1/2) [23].  Scale factor 2-19 meters1/2. |
| ***bdsE***  Parameter e, Eccentricity, dimensionless [23].  Scale factor 2-33. |
| ***bdsW***  Parameter , Argument of perigee (semi-circles) [23].  Scale factor 2-31 semi-circles. |
| ***bdsDeltaN***  Parameter n, Mean motion difference from computed value (semi-circles/sec) [23].  Scale factor 2-43 semi-circles/sec. |
| ***bdsM0***  Parameter M0, Mean anomaly at reference time (semi-circles) [23].  Scale factor 2-31 semi-circles. |
| ***bdsOmega0***  Parameter 0, Longitude of ascending node of orbital of plane computed according to reference time (semi-circles) [23].  Scale factor 2-31 semi-circles. |
| ***bdsOmegaDot***  Parameter  Rate of right ascension (semi-circles/sec) [23].  Scale factor 2-43 semi-circles/sec. |
| ***bdsI0***  Parameter i0, Inclination angle at reference time (semi-circles) [23]  Scale factor 2-31 semi-circles. |
| ***bdsIDot***  Parameter Idot, Rate of inclination angle (semi-circles/sec) [23].  Scale factor 2-43 semi-circles/sec. |
| ***bdsCuc***  Parameter Cuc, Amplitude of cosine harmonic correction term to the argument of latitude (radians) [23].  Scale factor 2-31 radians. |
| ***bdsCus***  Parameter Cus, Amplitude of sine harmonic correction term to the argument of latitude (radians) [23].  Scale factor 2-31 radians. |
| ***bdsCrc***  Parameter Crc, Amplitude of cosine harmonic correction term to the orbit radius (meters) [23].  Scale factor 2-6 meters. |
| ***bdsCrs***  Parameter Crs, Amplitude of sine harmonic correction term to the orbit radius (meters) [23].  Scale factor 2-6 meters. |
| ***bdsCic***  Parameter Cic, Amplitude of cosine harmonic correction term to the angle of inclination (radians) [23].  Scale factor 2-31 radians. |
| ***bdsCis***  Parameter Cis, Amplitude of sine harmonic correction term to the angle of inclination (radians) [23].  Scale factor 2-31 radians. |

#### – *GNSS-RealTimeIntegrity*

The IE *GNSS-RealTimeIntegrity* is used by the location server to provide parameters that describe the real-time status of the GNSS constellations. *GNSS-RealTimeIntegrity* data communicates the health of the GNSS signals to the mobile in real‑time.

The location server shall always transmit the *GNSS-RealTimeIntegrity* with the current list of unhealthy signals (i.e., not only for signals/SVs currently visible at the reference location), for any GNSS positioning attempt and whenever GNSS assistance data are sent. If the number of bad signals is zero, then the *GNSS-RealTimeIntegrity* IE shall be omitted.

-- ASN1START

GNSS-RealTimeIntegrity ::= SEQUENCE {

gnss-BadSignalList GNSS-BadSignalList,

...

}

GNSS-BadSignalList ::= SEQUENCE (SIZE(1..64)) OF BadSignalElement

BadSignalElement ::= SEQUENCE {

badSVID SV-ID,

badSignalID GNSS-SignalIDs OPTIONAL, -- Need OP

...

}

-- ASN1STOP

| *GNSS-RealTimeIntegrity* field descriptions |
| --- |
| ***gnss-BadSignalList***  This field specifies a list of satellites with bad signal or signals. |
| ***badSVID***  This field specifies the GNSS *SV‑ID* of the satellite with bad signal or signals. |
| ***badSignalID***  This field identifies the bad signal or signals of a satellite. This is represented by a bit string in *GNSS-SignalIDs*, with a one‑value at a bit position means the particular GNSS signal type of the SV is unhealthy; a zero‑value means healthy. Absence of this field means that all signals on the specific SV are bad. |

#### – *GNSS-DataBitAssistance*

The IE *GNSS-DataBitAssistance* is used by the location server to provide data bit assistance data for specific satellite signals for data wipe-off. The data bits included in the assistance data depends on the GNSS and its signal.

-- ASN1START

GNSS-DataBitAssistance ::= SEQUENCE {

gnss-TOD INTEGER (0..3599),

gnss-TODfrac INTEGER (0..999) OPTIONAL, -- Need ON

gnss-DataBitsSatList GNSS-DataBitsSatList,

...

}

GNSS-DataBitsSatList ::= SEQUENCE (SIZE(1..64))OF GNSS-DataBitsSatElement

GNSS-DataBitsSatElement ::= SEQUENCE {

svID SV-ID,

gnss-DataBitsSgnList GNSS-DataBitsSgnList,

...

}

GNSS-DataBitsSgnList ::= SEQUENCE (SIZE(1..8)) OF GNSS-DataBitsSgnElement

GNSS-DataBitsSgnElement ::= SEQUENCE {

gnss-SignalType GNSS-SignalID,

gnss-DataBits BIT STRING (SIZE (1..1024)),

...

}

-- ASN1STOP

| *GNSS-DataBitAssistance* field descriptions |
| --- |
| ***gnss-TOD***  This field specifies the reference time of the first bit of the data in *GNSS-DataBitAssistance* in integer seconds in GNSS specific system time, modulo 1 hour.  Scale factor 1 second. |
| ***gnss-TODfrac***  This field specifies the fractional part of the *gnss-TOD* in 1‑milli‑second resolution.  Scale factor 1 millisecond. The total GNSS TOD is *gnss-TOD* + *gnss-TODfrac.* |
| ***gnss-DataBitsSatList***  This list specifies the data bits for a particular GNSS satellite *SV-ID* and signal *GNSS-SignalID*. |
| ***svID***  This field specifies the GNSS *SV‑ID* of the satellite for which the *GNSS-DataBitAssistance* is given. |
| ***gnss-SignalType***  This field identifies the GNSS signal type of the *GNSS-DataBitAssistance.* |
| ***gnss-DataBits***  Data bits are contained in GNSS system and data type specific format.  In case of GPS L1 C/A, it contains the NAV data modulation bits as defined in [4] .  In case of Modernized GPS L1C, it contains the encoded and interleaved modulation symbols as defined in [6] clause 3.2.3.1. In case of Modernized GPS L2C, it contains either the NAV data modulation bits, the FEC encoded NAV data modulation symbols, or the FEC encoded CNAV data modulation symbols, dependent on the current signal configuration of this satellite as defined in [4, Table 3-III]. In case of Modernized GPS L5, it contains the FEC encoded CNAV data modulation symbols as defined in [5].  In case of SBAS, it contains the FEC encoded data modulation symbols as defined in [10].  In case of QZSS QZS-L1, it contains the NAV data modulation bits as defined in [7] clause 5.2. In case of QZSS QZS-L1C, it contains the encoded and interleaved modulation symbols as defined in [7] clause 5.3. In case of QZSS QZS-L2C, it contains the encoded modulation symbols as defined in [7] clause 5.5. In case of QZSS QZS-L5, it contains the encoded modulation symbols as defined in [7] clause 5.6.  In case of GLONASS, it contains the 100 sps differentially Manchester encoded modulation symbols as defined in [9] clause 3.3.2.2.  In case of Galileo, it contains the FEC encoded and interleaved modulation symbols. The logical levels 1 and 0 correspond to signal levels -1 and +1, respectively.  In case of BDS, it contains the encoded and interleaved modulation symbols as defined in [23, clause 5.1.3]. |

#### – *GNSS-AcquisitionAssistance*

The IE *GNSS-AcquisitionAssistance* is used by the location server to provide parameters that enable fast acquisition of the GNSS signals. Essentially, these parameters describe the range and derivatives from respective satellites to the reference location at the reference time *GNSS-SystemTime* provided in IE *GNSS-ReferenceTime*.

Whenever *GNSS-AcquisitionAssistance* is provided by the location server, the IE *GNSS-ReferenceTime* shall be provided as well. E.g., even if the target device request for assistance data includes only a request for *GNSS-AcquisitionAssistance,* the location server shall also provide the corresponding IE *GNSS-ReferenceTime.*

Figure 6.5.2.2-1 illustrates the relation between some of the fields, using GPS TOW as exemplary reference.

-- ASN1START

GNSS-AcquisitionAssistance ::= SEQUENCE {

gnss-SignalID GNSS-SignalID,

gnss-AcquisitionAssistList GNSS-AcquisitionAssistList,

...,

confidence-r10 INTEGER (0..100) OPTIONAL -- Need ON

}

GNSS-AcquisitionAssistList ::= SEQUENCE (SIZE(1..64)) OF GNSS-AcquisitionAssistElement

GNSS-AcquisitionAssistElement ::= SEQUENCE {

svID SV-ID,

doppler0 INTEGER (-2048..2047),

doppler1 INTEGER (0..63),

dopplerUncertainty INTEGER (0..4),

codePhase INTEGER (0..1022),

intCodePhase INTEGER (0..127),

codePhaseSearchWindow INTEGER (0..31),

azimuth INTEGER (0..511),

elevation INTEGER (0..127),

...,

codePhase1023 BOOLEAN OPTIONAL, -- Need OP

dopplerUncertaintyExt-r10 ENUMERATED { d60,

d80,

d100,

d120,

noInformation, ... } OPTIONAL -- Need ON

}

-- ASN1STOP

| *GNSS-AcquisitionAssistance* field descriptions |
| --- |
| ***gnss-SignalID***  This field specifies the GNSS signal for which the acquisition assistance are provided. |
| ***gnss-AcquisitionAssistList***  These fields provide a list of acquisition assistance data for each GNSS satellite. |
| ***confidence***  This field specifies the confidence level of the reference location area or volume used to calculate the acquisition assistance parameters (search windows). A high percentage value (e.g., 98% or more) indicates to the target device that the provided search windows are reliable. The location server should include this field to indicate the confidence level of the provided information. |
| ***svID***  This field specifies the GNSS *SV‑ID* of the satellite for which the *GNSS-AcquisitionAssistance* is given. |
| ***doppler0***  This field specifies the Doppler (0th order term) value. A positive value in Doppler defines the increase in satellite signal frequency due to velocity towards the target device. A negative value in Doppler defines the decrease in satellite signal frequency due to velocity away from the target device. Doppler is given in unit of m/s by multiplying the Doppler value in Hz by the nominal wavelength of the assisted signal.  Scale factor 0.5 m/s in the range from -1024 m/s to +1023.5 m/s. |
| ***doppler1***  This field specifies the Doppler (1st order term) value. A positive value defines the rate of increase in satellite signal frequency due to acceleration towards the target device. A negative value defines the rate of decrease in satellite signal frequency due to acceleration away from the target device.  Scale factor 1/210 m/s2 in the range from -0.2 m/s2 to +0.1 m/s2.  Actual value of Doppler (1st order term) is calculated as (-42 + *doppler1*) \* 1/210 m/s2, with *doppler1* in the range of 0…63. |
| ***dopplerUncertainty***  This field specifies the Doppler uncertainty value. It is defined such that the Doppler experienced by a stationary target device is in the range [DopplerDoppler Uncertainty] to [DopplerDoppler Uncertainty]. Doppler Uncertainty is given in unit of m/s by multiplying the Doppler Uncertainty value in Hz by the nominal wavelength of the assisted signal.  Defined values: 2.5 m/s, 5 m/s, 10 m/s, 20 m/s, 40 m/s as encoded by an integer *n* in the range 0-4 according to:  2-n(40) m/s; n = 0 – 4.  If the *dopplerUncertaintyExt* field is present, the target device that supports the *dopplerUncertaintyExt* shall ignore this field. |
| ***codePhase***  This field together with the *codePhase1023* field specifies the code phase, in units of milli‑seconds, in the range from 0 to 1 millisecond scaled by the nominal chipping rate of the GNSS signal, where increasing values of the field signify increasing predicted signal code phases, as seen by a receiver at the reference location at the reference time. The reference location would typically be an *a priori* estimate of the target device location.  Scale factor 2-10 msin the range from 0 to (1-2-10) ms.  Note: The value (1-2-10) ms is encoded using the *codePhase1023* IE. |
| ***intCodePhase***  This field contains integer code phase (expressed modulo 128 ms). The satellite integer milli-seconds code phase currently being transmitted at the reference time, as seen by a receiver at the reference location is calculated as reference time (expressed in milli-seconds) minus (*intCodePhase* + (n×128 ms)), as shown in Figure 6.5.2.2-1, with n = …-2,-1,0,1,2….  Scale factor 1 msin the range from 0 to 127 ms. |
| ***codePhaseSearchWindow***  This field contains the code phase search window. The code phase search window accounts for the uncertainty in the estimated target device location but not any uncertainty in reference time. It is defined such that the expected code phase is in the range [Code PhaseCode Phase Search Window] to [Code PhaseCode Phase Search Window] given in units of milli‑seconds.  Range 0-31, mapping according to the table codePhaseSearchWindow Value to Interpretation Code Phase Search Window [ms] relation shown below. |
| ***azimuth***  This field specifies the azimuth angle. An angle of x degrees means the satellite azimuth a is in the range  (x ≤ a < x+0.703125) degrees.  Scale factor 0.703125 degrees. |
| ***elevation***  This field specifies the elevation angle. An angle of y degrees means the satellite elevation e is in the range  (y ≤ e < y+0.703125) degrees.  Scale factor 0.703125 degrees. |
| ***codePhase1023***  This field if set to TRUE indicates that the code phase has the value 1023 × 2-10 = (1-2-10) ms. This field may only be set to TRUE if the value provided in the *codePhase* IE is 1022. If this field is set to FALSE, the code phase is the value provided in the *codePhase* IE in the range from 0 to (1 - 2×2-10) ms. If this field is not present and the *codePhase* IE has the value 1022, the target device may assume that the code phase is between (1 - 2×2-10) and (1 - 2-10) ms. |
| ***dopplerUncertaintyExt***  If this field is present, the target device that supports this field shall ignore the *dopplerUncertainty* field. The location server should include this field only if supported by the target device.  This field specifies the Doppler uncertainty value. It is defined such that the Doppler experienced by a stationary target device is in the range [DopplerDoppler Uncertainty] to [DopplerDoppler Uncertainty]. Doppler Uncertainty is given in unit of m/s by multiplying the Doppler Uncertainty value in Hz by the nominal wavelength of the assisted signal.  Enumerated values define 60 m/s, 80 m/s, 100 m/s, 120 ms, and "No Information". |

codePhaseSearchWindow Value to Interpretation Code Phase Search Window [ms] relation

|  |  |
| --- | --- |
| *codePhaseSearchWindow*  Value | Interpretation  Code Phase Search Window [ms] |
| '00000' | No information |
| '00001' | 0,002 |
| '00010' | 0,004 |
| '00011' | 0,008 |
| '00100' | 0,012 |
| '00101' | 0,016 |
| '00110' | 0,024 |
| '00111' | 0,032 |
| '01000' | 0,048 |
| '01001' | 0,064 |
| '01010' | 0,096 |
| '01011' | 0,128 |
| '01100' | 0,164 |
| '01101' | 0,200 |
| '01110' | 0,250 |
| '01111' | 0,300 |
| '10000' | 0,360 |
| '10001' | 0,420 |
| '10010' | 0,480 |
| '10011' | 0,540 |
| '10100' | 0,600 |
| '10101' | 0,660 |
| '10110' | 0,720 |
| '10111' | 0,780 |
| '11000' | 0,850 |
| '11001' | 1,000 |
| '11010' | 1,150 |
| '11011' | 1,300 |
| '11100' | 1,450 |
| '11101' | 1,600 |
| '11110' | 1,800 |
| '11111' | 2,000 |



Figure 6.5.2.2-1: Exemplary calculation of some GNSS Acquisition Assistance fields.

#### – *GNSS-Almanac*

The IE *GNSS-Almanac* is used by the location server to provide the coarse, long-term model of the satellite positions and clocks. The meaning of these parameters is defined in relevant ICDs of the particular GNSS and GNSS specific interpretations apply. For example, GPS and QZSS use the same model parameters but some parameters have a different interpretation [7]. *GNSS-Almanac* is useful for receiver tasks that require coarse accuracy, such as determining satellite visibility. The model is valid for up to a few weeks, typically. Since it is a long-term model, the field should be provided for all satellites available in the GNSS constellation (i.e., not only for SVs visible at the reference location and including SVs flagged as unhealthy in almanac). The *completeAlmanacProvided* field indicates whether or not the location server provided almanacs for the complete GNSS constellation.

-- ASN1START

GNSS-Almanac ::= SEQUENCE {

weekNumber INTEGER (0..255) OPTIONAL, -- Need ON

toa INTEGER (0..255) OPTIONAL, -- Need ON

ioda INTEGER (0..3) OPTIONAL, -- Need ON

completeAlmanacProvided BOOLEAN,

gnss-AlmanacList GNSS-AlmanacList,

...,

[[ toa-ext-v1240 INTEGER (256..1023) OPTIONAL, -- Need ON

ioda-ext-v1240 INTEGER (4..15) OPTIONAL -- Need ON

]]

}

GNSS-AlmanacList ::= SEQUENCE (SIZE(1..64)) OF GNSS-AlmanacElement

GNSS-AlmanacElement ::= CHOICE {

keplerianAlmanacSet AlmanacKeplerianSet, -- Model-1

keplerianNAV-Almanac AlmanacNAV-KeplerianSet, -- Model-2

keplerianReducedAlmanac AlmanacReducedKeplerianSet, -- Model-3

keplerianMidiAlmanac AlmanacMidiAlmanacSet, -- Model-4

keplerianGLONASS AlmanacGLONASS-AlmanacSet, -- Model-5

ecef-SBAS-Almanac AlmanacECEF-SBAS-AlmanacSet,-- Model-6

...,

keplerianBDS-Almanac-r12 AlmanacBDS-AlmanacSet-r12 -- Model-7

}

-- ASN1STOP

| *GNSS-Almanac* field descriptions |
| --- |
| ***weekNumber***  This field specifies the almanac reference week number in GNSS specific system time to which the almanac reference time *toa* is referenced, modulo 256 weeks. This field is required for non-GLONASS GNSS.  Note, in case of Galileo, the almanac reference week number WNa natively contains only the 2 LSB's [8], clause 5.1.10]. |
| ***toa, toa-ext***  In case of *GNSS-ID* does not indicate Galileo, this field specifies the almanac reference time given in GNSS specific system time, in units of seconds with a scale factor of 212. *toa* is required for non-GLONASS GNSS.  In case of *GNSS-ID* does indicate Galileo, this field specifies the almanac reference time given in GNSS specific system time, in units of seconds with a scale factor of 600 seconds. Either *toa* or *toa-ext* is required for Galileo GNSS. |
| ***ioda, ioda-ext***  This field specifies the issue of data*.* Either *ioda* or *ioda-ext* is required for Galileo GNSS. |
| ***completeAlmanacProvided***  If set to TRUE, the *gnss-AlmanacList* contains almanacs for the complete GNSS constellation indicated by *GNSS‑ID*. |
| ***gnss-AlmanacList***  This list contains the almanac model for each GNSS satellite in the GNSS constellation. |

#### – *AlmanacKeplerianSet*

-- ASN1START

AlmanacKeplerianSet ::= SEQUENCE {

svID SV-ID,

kepAlmanacE INTEGER (0..2047),

kepAlmanacDeltaI INTEGER (-1024..1023),

kepAlmanacOmegaDot INTEGER (-1024..1023),

kepSV-StatusINAV BIT STRING (SIZE (4)),

kepSV-StatusFNAV BIT STRING (SIZE (2)) OPTIONAL, -- Need ON

kepAlmanacAPowerHalf INTEGER (-4096..4095),

kepAlmanacOmega0 INTEGER (-32768..32767),

kepAlmanacW INTEGER (-32768..32767),

kepAlmanacM0 INTEGER (-32768..32767),

kepAlmanacAF0 INTEGER (-32768..32767),

kepAlmanacAF1 INTEGER (-4096..4095),

...

}

-- ASN1STOP

| *AlmanacKeplerianSet* field descriptions |
| --- |
| ***svID***  This field identifies the satellite for which the GNSS Almanac Model is given. |
| ***kepAlmanacE***  Parameter e, eccentricity, dimensionless [8].  Scale factor 2-16. |
| ***kepAlmanacDeltaI***  Parameter δi, inclination at reference time relative to i0=56°; semi-circles [8].  Scale factor 2-14 semi-circles. |
| ***kepAlmanacOmegaDot***  Parameter , rate of change of right ascension (semi-circles/sec) [8].  Scale factor 2-33 semi-circles/seconds. |
| ***kepSV-StatusINAV***  This field contains the I/NAV signal health status [8], clause 5.1.10 , E5bHS and E1-BHS, where E5bHS occupies the 2 MSBs in *kepSV-StatusINAV*, and E1-BHS the two LSBs. |
| ***kepSV-StatusFNAV***  This field contains the F/NAV signal health status [8], clause 5.1.10 ,E5aHS. If the target device is supporting multiple Galileo signals, the location server shall include this field. |
| ***kepAlmanacAPowerHalf***  Parameter (a1/2), difference with respect to the square root of the nominal semi-major axis, (meters)1/2 [8].  Scale factor 2-9 meters ½ . |
| ***kepAlmanacOmega0***  Parameter OMEGA0, longitude of ascending node of orbital plane at weekly epoch (semi-circles) [8].  Scale factor 2-15 semi-circles. |
| ***kepAlmanacW***  Parameter ω, argument of perigee (semi-circles) [8].  Scale factor 2-15 semi-circles. |
| ***kepAlmanacM0***  Parameter M0, mean anomaly at reference time (semi-circles) [8].  Scale factor 2-15 semi-circles. |
| ***kepAlmanacAF0***  Parameter af0, satellite clock correction bias, seconds [8].  Scale factor 2-19 seconds. |
| ***kepAlmanacAF1***  Parameter af1, satellite clock correction linear, sec/sec [8].  Scale factor 2-38 seconds/second. |

#### – *AlmanacNAV-KeplerianSet*

-- ASN1START

AlmanacNAV-KeplerianSet ::= SEQUENCE {

svID SV-ID,

navAlmE INTEGER (0..65535),

navAlmDeltaI INTEGER (-32768..32767),

navAlmOMEGADOT INTEGER (-32768..32767),

navAlmSVHealth INTEGER (0..255),

navAlmSqrtA INTEGER (0..16777215),

navAlmOMEGAo INTEGER (-8388608..8388607),

navAlmOmega INTEGER (-8388608..8388607),

navAlmMo INTEGER (-8388608..8388607),

navAlmaf0 INTEGER (-1024..1023),

navAlmaf1 INTEGER (-1024..1023),

...

}

-- ASN1STOP

| *AlmanacNAV-KeplerianSet* field descriptions |
| --- |
| ***svID***  This field identifies the satellite for which the GNSS Almanac Model is given. |
| ***navAlmE***  Parameter e, eccentricity, dimensionless [4,7].  Scale factor 2-21. |
| ***navAlmDeltaI***  Parameter δi, correction to inclination, semi-circles [4,7].  Scale factor 2-19 semi-circles. |
| ***navAlmOMEGADOT***  Parameter , rate of right ascension, semi-circles/sec [4,7].  Scale factor 2-38 semi-circles/second. |
| ***navAlmSVHealth***  Parameter SV Health, satellite health [4,7]. |
| ***navAlmSqrtA***  Parameter , square root of the semi-major axis, meters1/2 [4,7]  Scale factor 2-11 meters1/2. |
| ***navAlmOMEGAo***  Parameter 0, longitude of ascending node of orbit plane at weekly epoch, semi-circles [4,7].  Scale factor 2-23 semi-circles. |
| ***navAlmOmega***  Parameter ω, argument of perigee semi-circles [4,7].  Scale factor 2-23 semi-circles. |
| ***navAlmMo***  Parameter M0, mean anomaly at reference time semi-circles [4,7].  Scale factor 2-23 semi-circles. |
| ***navAlmaf0***  Parameter af0, apparent satellite clock correction seconds [4,7].  Scale factor 2-20 seconds. |
| ***navAlmaf1***  Parameter af1, apparent satellite clock correction sec/sec [4,7].  Scale factor 2-38 semi-circles seconds/second. |

#### – *AlmanacReducedKeplerianSet*

-- ASN1START

AlmanacReducedKeplerianSet ::= SEQUENCE {

svID SV-ID,

redAlmDeltaA INTEGER (-128..127),

redAlmOmega0 INTEGER (-64..63),

redAlmPhi0 INTEGER (-64..63),

redAlmL1Health BOOLEAN,

redAlmL2Health BOOLEAN,

redAlmL5Health BOOLEAN,

...

}

-- ASN1STOP

| *AlmanacReducedKeplerianSet* field descriptions |
| --- |
| ***svID***  This field identifies the satellite for which the GNSS Almanac Model is given. |
| ***redAlmDeltaA***  Parameter A, meters [4,5,6,7].  Scale factor 2+9 meters. |
| ***redAlmOmega0***  Parameter 0, semi-circles [4,5,6,7].  Scale factor 2-6 semi-circles. |
| ***redAlmPhi0***  Parameter 0, semi-circles [4,5,6,7].  Scale factor 2-6 semi-circles. |
| ***redAlmL1Health***  Parameter L1 Health, dimensionless [4,5,6,7]. |
| ***redAlmL2Health***  Parameter L2 Health, dimensionless [4,5,6,7]. |
| ***redAlmL5Health***  Parameter L5 Health, dimensionless [4,5,6,7]. |

#### – *AlmanacMidiAlmanacSet*

-- ASN1START

AlmanacMidiAlmanacSet ::= SEQUENCE {

svID SV-ID,

midiAlmE INTEGER (0..2047),

midiAlmDeltaI INTEGER (-1024..1023),

midiAlmOmegaDot INTEGER (-1024..1023),

midiAlmSqrtA INTEGER (0..131071),

midiAlmOmega0 INTEGER (-32768..32767),

midiAlmOmega INTEGER (-32768..32767),

midiAlmMo INTEGER (-32768..32767),

midiAlmaf0 INTEGER (-1024..1023),

midiAlmaf1 INTEGER (-512..511),

midiAlmL1Health BOOLEAN,

midiAlmL2Health BOOLEAN,

midiAlmL5Health BOOLEAN,

...

}

-- ASN1STOP

| *AlmanacMidiAlmanacSet* field descriptions |
| --- |
| ***svID***  This field identifies the satellite for which the GNSS Almanac Model is given. |
| ***midiAlmE***  Parameter e, dimensionless [4,5,6,7].  Scale factor 2-16. |
| ***midiAlmDeltaI***  Parameter i, semi-circles [4,5,6,7].  Scale factor 2-14 semi-circles. |
| ***midiAlmOmegaDot***  Parameter , semi-circles/sec [4,5,6,7].  Scale factor 2-33 semi-circles/second. |
| ***midiAlmSqrtA***  Parameter , meters1/2 [4,5,6,7].  Scale factor 2-4 meters1/2. |
| ***midiAlmOmega0***  Parameter 0, semi-circles [4,5,6,7].  Scale factor 2-15 semi-circles. |
| ***midiAlmOmega***  Parameter , semi-circles [4,5,6,7].  Scale factor 2-15 semi-circles. |
| ***midiAlmMo***  Parameter M0, semi-circles [4,5,6,7].  Scale factor 2-15 semi-circles. |
| ***midiAlmaf0***  Parameter afo, seconds [4,5,6,7].  Scale factor 2-20 seconds. |
| ***midiAlmaf1***  Parameter af1, sec/sec [4,5,6,7].  Scale factor 2-37 seconds/second. |
| ***midiAlmL1Health***  Parameter L1 Health, dimensionless [4,5,6,7]. |
| ***midiAlmL2Health***  Parameter L2 Health, dimensionless [4,5,6,7]. |
| ***midiAlmL5Health***  Parameter L5 Health, dimensionless [4,5,6,7]. |

#### – *AlmanacGLONASS-AlmanacSet*

-- ASN1START

AlmanacGLONASS-AlmanacSet ::= SEQUENCE {

gloAlm-NA INTEGER (1..1461),

gloAlmnA INTEGER (1..24),

gloAlmHA INTEGER (0..31),

gloAlmLambdaA INTEGER (-1048576..1048575),

gloAlmtlambdaA INTEGER (0..2097151),

gloAlmDeltaIa INTEGER (-131072..131071),

gloAlmDeltaTA INTEGER (-2097152..2097151),

gloAlmDeltaTdotA INTEGER (-64..63),

gloAlmEpsilonA INTEGER (0..32767),

gloAlmOmegaA INTEGER (-32768..32767),

gloAlmTauA INTEGER (-512..511),

gloAlmCA INTEGER (0..1),

gloAlmMA BIT STRING (SIZE(2)) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *AlmanacGLONASS-AlmanacSet* field descriptions |
| --- |
| ***gloAlm-NA***  Parameter NA, days [9].  Scale factor 1 days. |
| ***gloAlmnA***  Parameter nA, dimensionless [9]. |
| ***gloAlmHA***  Parameter HnA, dimensionless [9]. |
| ***gloAlmLambdaA***  Parameter nA, semi-circles [9].  Scale factor 2-20 semi-circles. |
| ***gloAlmtlambdaA***  Parameter tnA, seconds [9].  Scale factor 2-5 seconds. |
| ***gloAlmDeltaIa***  Parameter inA, semi-circles [9].  Scale factor 2-20 semi-circles. |
| ***gloAlmDeltaTA***  Parameter TnA, sec/orbit period [9].  Scale factor 2-9 seconds/orbit period. |
| ***gloAlmDeltaTdotA***  Parameter T\_DOTnA, sec/orbit period2 [9].  Scale factor 2-14 seconds/orbit period2. |
| ***gloAlmEpsilonA***  Parameter nA, dimensionless [9].  Scale factor 2-20. |
| ***gloAlmOmegaA***  Parameter nA, semi-circles [9].  Scale factor 2-15 semi-circles. |
| ***gloAlmTauA***  Parameter nA, seconds [9].  Scale factor 2-18 seconds. |
| ***gloAlmCA***  Parameter CnA, dimensionless [9]. |
| ***gloAlmMA***  Parameter MnA, dimensionless [9]. This parameter is present if its value is nonzero; otherwise it is not present. |

#### – *AlmanacECEF-SBAS-AlmanacSet*

-- ASN1START

AlmanacECEF-SBAS-AlmanacSet ::= SEQUENCE {

sbasAlmDataID INTEGER (0..3),

svID SV-ID,

sbasAlmHealth BIT STRING (SIZE(8)),

sbasAlmXg INTEGER (-16384..16383),

sbasAlmYg INTEGER (-16384..16383),

sbasAlmZg INTEGER (-256..255),

sbasAlmXgdot INTEGER (-4..3),

sbasAlmYgDot INTEGER (-4..3),

sbasAlmZgDot INTEGER (-8..7),

sbasAlmTo INTEGER (0..2047),

...

}

-- ASN1STOP

| *AlmanacECEF-SBAS-AlmanacSet* field descriptions |
| --- |
| ***sbasAlmDataID***  Parameter Data ID, dimensionless [10]. |
| ***svID***  This field identifies the satellite for which the GNSS Almanac Model is given. |
| ***sbasAlmHealth***  Parameter Health, dimensionless [10]. |
| ***sbasAlmXg***  Parameter XG, meters [10].  Scale factor 2600 meters. |
| ***sbasAlmYg***  Parameter YG, meters [10].  Scale factor 2600 meters. |
| ***sbasAlmZg***  Parameter ZG, meters [10].  Scale factor 26000 meters. |
| ***sbasAlmXgdot***  Parameter XG Rat-of-Change, meters/sec [10].  Scale factor 10 meters/second. |
| ***sbasAlmYgDot***  Parameter YG Rate-of-Change, meters/sec [10].  Scale factor 10 meters/second. |
| ***sbasAlmZgDot***  Parameter ZG Rate-of-Change, meters/sec [10].  Scale factor 40.96 meters/second. |
| ***sbasAlmTo***  Parameter t0, seconds [10].  Scale factor 64 meters/seconds. |

#### – *AlmanacBDS-AlmanacSet*

-- ASN1START

AlmanacBDS-AlmanacSet-r12 ::= SEQUENCE {

svID SV-ID,

bdsAlmToa-r12 INTEGER (0..255) OPTIONAL, -- Cond NotSameForAllSV

bdsAlmSqrtA-r12 INTEGER (0..16777215),

bdsAlmE-r12 INTEGER (0..131071),

bdsAlmW-r12 INTEGER (-8388608..8388607),

bdsAlmM0-r12 INTEGER (-8388608..8388607),

bdsAlmOmega0-r12 INTEGER (-8388608..8388607),

bdsAlmOmegaDot-r12 INTEGER (-65536..65535),

bdsAlmDeltaI-r12 INTEGER (-32768..32767),

bdsAlmA0-r12 INTEGER (-1024..1023),

bdsAlmA1-r12 INTEGER (-1024..1023),

bdsSvHealth-r12 BIT STRING (SIZE(9)) OPTIONAL, -- Cond SV-ID

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *NotSameForAllSV* | This field may be present if the toa is not the same for all SVs; otherwise it is not present and the toa is provided in *GNSS-Almanac*. |
| *SV-ID* | This field is mandatory present if *SV-ID* is between 0 and 29; otherwise it is not present. |

| *AlmanacBDS-AlmanacSet* field descriptions |
| --- |
| ***svID***  This field identifies the satellite for which the GNSS Almanac Model is given. |
| ***bdsAlmToa***  Parameter toa, Almanac reference time(seconds) [23]  Scale factor 212 seconds. |
| ***bdsAlmSqrtA***  Parameter A1/2, Square root of semi-major axis (meters1/2) [23]  Scale factor 2-11 meters1/2. |
| ***bdsAlmE***  Parameter e, Eccentricity, dimensionless [23]  Scale factor 2-21. |
| ***bdsAlmW***  Parameter , Argument of Perigee (semi-circles) [23]  Scale factor 2-23 semi-circles. |
| ***bdsAlmM0***  Parameter M0, Mean anomaly at reference time (semi-circles) [23]  Scale factor 2-23 semi-circles. |
| ***bdsAlmOmega0***  Parameter 0, Longitude of ascending node of orbital plane computed according to reference time (semi-circles) [23]  Scale factor 2-23 semi-circles. |
| ***bdsAlmOmegaDot***  Parameter  Rate of right ascension (semi-circles/sec) [23]  Scale factor 2-38 semi-circles/sec. |
| ***bdsAlmDeltaI***  Parameter i, Correction of orbit reference inclination at reference time (semi-circles) [23]  Scale factor 2-19 semi-circles. |
| ***bdsAlmA0***  Parameter a0, Satellite clock bias (seconds) [23]  Scale factor 2-20 seconds. |
| ***bdsAlmA1***  Parameter a1, Satellite clock rate (sec/sec) [23]  Scale factor 2-38 sec/sec. |
| ***bdsSvHealth***  This field indicates satellites health information as defined in [23] Table 5-15. The left most bit is the MSB. |

#### – *GNSS-UTC-Model*

The IE *GNSS-UTC-Model* is used by the location server to provide several sets of parameters needed to relate GNSS system time to Universal Time Coordinate (UTC), as defined in [4], [5], [6], [7], [8], [9], [10], [23].

The UTC time standard, UTC(k), is GNSS specific. E.g., if *GNSS-ID* indicates GPS, *GNSS-UTC-Model* contains a set of parameters needed to relate GPS system time to UTC(USNO); if *GNSS-ID* indicates QZSS, *GNSS-UTC-Model* contains a set of parameters needed to relate QZST to UTC(NICT); if *GNSS-ID* indicates GLONASS, *GNSS-UTC-Model* contains a set of parameters needed to relate GLONASS system time to UTC(RU); if *GNSS-ID* indicates SBAS, *GNSS-UTC-Model* contains a set of parameters needed to relate SBAS network time for the SBAS indicated by *SBAS-ID* to the UTC standard defined by the UTC Standard ID; if *GNSS-ID* indicates BDS, *GNSS-UTC-Model* contains a set of parameters needed to relate BDS system time to UTC (NTSC).

-- ASN1START

GNSS-UTC-Model ::= CHOICE {

utcModel1 UTC-ModelSet1, -- Model-1

utcModel2 UTC-ModelSet2, -- Model-2

utcModel3 UTC-ModelSet3, -- Model-3

utcModel4 UTC-ModelSet4, -- Model-4

...,

utcModel5-r12 UTC-ModelSet5-r12 -- Model-5

}

-- ASN1STOP

#### – *UTC-ModelSet1*

-- ASN1START

UTC-ModelSet1 ::= SEQUENCE {

gnss-Utc-A1 INTEGER (-8388608..8388607),

gnss-Utc-A0 INTEGER (-2147483648..2147483647),

gnss-Utc-Tot INTEGER (0..255),

gnss-Utc-WNt INTEGER (0..255),

gnss-Utc-DeltaTls INTEGER (-128..127),

gnss-Utc-WNlsf INTEGER (0..255),

gnss-Utc-DN INTEGER (-128..127),

gnss-Utc-DeltaTlsf INTEGER (-128..127),

...

}

-- ASN1STOP

| *UTC-ModelSet1* field descriptions |
| --- |
| ***gnss-Utc-A1***  Parameter A1, scale factor 2-50 seconds/second [4,7,8]. |
| ***gnss-Utc-A0***  Parameter A0, scale factor 2-30 seconds [4,7,8]. |
| ***gnss-Utc-Tot***  Parameter tot, scale factor 212 seconds [4,7,8]. |
| ***gnss-Utc-WNt***  Parameter WNt, scale factor 1 week [4,7,8]. |
| ***gnss-Utc-DeltaTls***  Parameter ΔtLS, scale factor 1 second [4,7,8]. |
| ***gnss-Utc-WNlsf***  Parameter WNLSF, scale factor 1 week [4,7,8]. |
| ***gnss-Utc-DN***  Parameter DN, scale factor 1 day [4,7,8]. |
| ***gnss-Utc-DeltaTlsf***  Parameter ΔtLSF, scale factor 1 second [4,7,8]. |

#### – *UTC-ModelSet2*

-- ASN1START

UTC-ModelSet2 ::= SEQUENCE {

utcA0 INTEGER (-32768..32767),

utcA1 INTEGER (-4096..4095),

utcA2 INTEGER (-64..63),

utcDeltaTls INTEGER (-128..127),

utcTot INTEGER (0..65535),

utcWNot INTEGER (0..8191),

utcWNlsf INTEGER (0..255),

utcDN BIT STRING (SIZE(4)),

utcDeltaTlsf INTEGER (-128..127),

...

}

-- ASN1STOP

| *UTC-ModelSet2* field descriptions |
| --- |
| ***utcA0***  Parameter A0-n, bias coefficient of GNSS time scale relative to UTC time scale (seconds) [4,5,6,7].  Scale factor 2-35 seconds. |
| ***utcA1***  Parameter A1-n, drift coefficient of GNSS time scale relative to UTC time scale (sec/sec) [4,5,6,7].  Scale factor 2-51 seconds/second. |
| ***utcA2***  Parameter A2-n, drift rate correction coefficient of GNSS time scale relative to UTC time scale (sec/sec2) [4,5,6,7].  Scale factor 2-68 seconds/second2. |
| ***utcDeltaTls***  Parameter ΔtLS, current or past leap second count (seconds) [4,5,6,7].  Scale factor 1 second. |
| ***utcTot***  Parameter tot, time data reference time of week (seconds) [4,5,6,7].  Scale factor 24 seconds. |
| ***utcWNot***  Parameter WNot, time data reference week number (weeks) [4,5,6,7].  Scale factor 1 week. |
| ***utcWNlsf***  Parameter WNLSF, leap second reference week number (weeks) [4,5,6,7].  Scale factor 1 week. |
| ***utcDN***  Parameter DN, leap second reference day number (days) [4,5,6,7].  Scale factor 1 day. |
| ***utcDeltaTlsf***  Parameter ΔtLSF, current or future leap second count (seconds) [4,5,6,7].  Scale factor 1 second. |

#### – *UTC-ModelSet3*

-- ASN1START

UTC-ModelSet3 ::= SEQUENCE {

nA INTEGER (1..1461),

tauC INTEGER (-2147483648..2147483647),

b1 INTEGER (-1024..1023) OPTIONAL, -- Cond GLONASS-M

b2 INTEGER (-512..511) OPTIONAL, -- Cond GLONASS-M

kp BIT STRING (SIZE(2)) OPTIONAL, -- Cond GLONASS-M

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GLONASS-M* | The field is mandatory present if GLONASS-M satellites are present in the current GLONASS constellation; otherwise it is not present. |

| *UTC-ModelSet3* field descriptions |
| --- |
| ***nA***  Parameter NA, calendar day number within four-year period beginning since the leap year (days) [9].  Scale factor 1 day. |
| ***tauC***  Parameter c, GLONASS time scale correction to UTC(SU) (seconds) [9].  Scale factor 2-31 seconds. |
| ***b1***  Parameter B1, coefficient to determine UT1 (seconds) [9].  Scale factor 2-10 seconds. |
| ***b2***  Parameter B2, coefficient to determine UT1 (seconds/msd) [9].  Scale factor 2-16 seconds/msd. |
| ***kp***  Parameter KP, notification of expected leap second correction (dimensionless) [9]. |

#### – *UTC-ModelSet4*

-- ASN1START

UTC-ModelSet4 ::= SEQUENCE {

utcA1wnt INTEGER (-8388608..8388607),

utcA0wnt INTEGER (-2147483648..2147483647),

utcTot INTEGER (0..255),

utcWNt INTEGER (0..255),

utcDeltaTls INTEGER (-128..127),

utcWNlsf INTEGER (0..255),

utcDN INTEGER (-128..127),

utcDeltaTlsf INTEGER (-128..127),

utcStandardID INTEGER (0..7),

...

}

-- ASN1STOP

| *UTC-ModelSet4* field descriptions |
| --- |
| ***utcA1wnt***  Parameter A1WNT, sec/sec ([10], Message Type 12).  Scale factor 2-50 seconds/second. |
| ***utcA0wnt***  Parameter A0WNT, seconds ([10], Message Type 12).  Scale factor 2-30 seconds. |
| ***utcTot***  Parameter tot, seconds ([10], Message Type 12).  Scale factor 212 seconds. |
| ***utcWNt***  Parameter WNt, weeks ([10], Message Type 12).  Scale factor 1 week. |
| ***utcDeltaTls***  Parameter ΔtLS, seconds ([10], Message Type 12).  Scale factor 1 second. |
| ***utcWNlsf***  Parameter WNLSF, weeks ([10], Message Type 12).  Scale factor 1 week. |
| ***utcDN***  Parameter DN, days ([10], Message Type 12).  Scale factor 1 day. |
| ***utcDeltaTlsf***  Parameter ΔtLSF, seconds ([10], Message Type 12).  Scale factor 1 second. |
| ***utcStandardID***  If *GNSS-ID* indicates 'sbas', this field indicates the UTC standard used for the SBAS network time indicated by *SBAS‑ID* to UTC relation as defined in the table Value of UTC Standard ID to UTC Standard relation shown below ([10], Message Type 12). |

Value of UTC Standard ID to UTC Standard relation

|  |  |
| --- | --- |
| Value of UTC Standard ID | UTC Standard |
| 0 | UTC as operated by the Communications Research Laboratory (CRL), Tokyo, Japan |
| 1 | UTC as operated by the National Institute of Standards and Technology (NIST) |
| 2 | UTC as operated by the U. S. Naval Observatory (USNO) |
| 3 | UTC as operated by the International Bureau of Weights and Measures (BIPM) |
| 4-7 | Reserved for future definition |

#### – *UTC-ModelSet5*

-- ASN1START

UTC-ModelSet5-r12 ::= SEQUENCE {

utcA0-r12 INTEGER (-2147483648..2147483647),

utcA1-r12 INTEGER (-8388608..8388607),

utcDeltaTls-r12 INTEGER (-128..127),

utcWNlsf-r12 INTEGER (0..255),

utcDN-r12 INTEGER (0..255),

utcDeltaTlsf-r12 INTEGER (-128..127),

...

}

-- ASN1STOP

| *UTC-ModelSet5* field descriptions |
| --- |
| ***utcA0***  Parameter A0UTC, BDS clock bias relative to UTC, seconds [23].  Scale factor 2-30 seconds. |
| ***utcA1***  Parameter A1UTC, BDS clock rate relative to UTC, sec/sec [23].  Scale factor 2-50 sec/sec. |
| ***utcDeltaTls***  Parameter ΔtLS, delta time due to leap seconds before the new leap second effective, seconds [23].  Scale factor 1 second. |
| ***utcWNlsf***  Parameter WNLSF, week number of the new leap second, weeks [23].  Scale factor 1 week. |
| ***utcDN***  Parameter DN, day number of week of the new leap second, days [23].  Scale factor 1 day. |
| ***utcDeltaTlsf***  Parameter ΔtLSF, delta time due to leap seconds after the new leap second effective, seconds [23].  Scale factor 1 second. |

#### – *GNSS-AuxiliaryInformation*

The IE *GNSS-AuxiliaryInformation* is used by the location server to provide additional information dependent on the *GNSS‑ID*. If *GNSS-AuxiliaryInformation* is provided together with other satellite dependent GNSS assistance data (i.e., any of *GNSS-DifferentialCorrections*, *GNSS-NavigationModel*, *GNSS-DataBitAssistance*, or *GNSS-AcquisitionAssistance* IEs), the *GNSS-AuxiliaryInformation* should be provided for the same satellites and in the same LPP message as the other satellite dependent GNSS assistance data.

-- ASN1START

GNSS-AuxiliaryInformation ::= CHOICE {

gnss-ID-GPS GNSS-ID-GPS,

gnss-ID-GLONASS GNSS-ID-GLONASS,

...

}

GNSS-ID-GPS ::= SEQUENCE (SIZE(1..64)) OF GNSS-ID-GPS-SatElement

GNSS-ID-GPS-SatElement ::= SEQUENCE {

svID SV-ID,

signalsAvailable GNSS-SignalIDs,

...

}

GNSS-ID-GLONASS ::= SEQUENCE (SIZE(1..64)) OF GNSS-ID-GLONASS-SatElement

GNSS-ID-GLONASS-SatElement ::= SEQUENCE {

svID SV-ID,

signalsAvailable GNSS-SignalIDs,

channelNumber INTEGER (-7..13) OPTIONAL, -- Cond FDMA

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *FDMA* | The field is mandatory present if the GLONASS SV indicated by *svID* broadcasts FDMA signals; otherwise it is not present. |

| *GNSS-AuxiliaryInformation* field descriptions |
| --- |
| ***gnss-ID-GPS***  This choice may only be present if *GNSS-ID* indicates GPS. |
| ***gnss-ID-GLONASS***  This choice may only be present if *GNSS-ID* indicates GLONASS. |
| ***svID***  This field specifies the GNSS SV for which the *GNSS-AuxiliaryInformation* is given. |
| ***signalsAvailable***  This field indicates the ranging signals supported by the satellite indicated by *svID*. This field is given as a bit string as defined in *GNSS-SignalIDs* for a particular GNSS. If a bit is set to '1' it indicates that the satellite identified by *svID* transmits ranging signals according to the signal correspondence in *GNSS-SignalIDs*. If a bit is set to '0' it indicates that the corresponding signal is not supported on the satellite identified by *svID*. |
| ***channelNumber***  This field indicates the GLONASS carrier frequency number of the satellite identified by *svID*, as defined in [9]. |

#### – *BDS-DifferentialCorrections*

The IE *BDS-DifferentialCorrections* is used by the location server to provide differential corrections to the target device.

-- ASN1START

BDS-DifferentialCorrections-r12 ::= SEQUENCE {

dbds-RefTime-r12 INTEGER (0..3599),

bds-SgnTypeList-r12 BDS-SgnTypeList-r12,

...

}

BDS-SgnTypeList-r12 ::= SEQUENCE (SIZE (1..3)) OF BDS-SgnTypeElement-r12

BDS-SgnTypeElement-r12 ::= SEQUENCE {

gnss-SignalID GNSS-SignalID OPTIONAL, -- Need ON

dbds-CorrectionList-r12 DBDS-CorrectionList-r12,

...

}

DBDS-CorrectionList-r12 ::= SEQUENCE (SIZE (1..64)) OF DBDS-CorrectionElement-r12

DBDS-CorrectionElement-r12 ::= SEQUENCE {

svID SV-ID,

bds-UDREI-r12 INTEGER (0..15),

bds-RURAI-r12 INTEGER (0..15),

bds-ECC-DeltaT-r12 INTEGER (-4096..4095),

...

}

-- ASN1STOP

| *BDS-DifferentialCorrections* field descriptions |
| --- |
| ***dbds-RefTime***  This field *specifies* the time for which the differential corrections are valid, modulo 1 hour. d*bds-RefTime* is given in BDS system time.  Scale factor 1‑second. |
| ***bds-UDREI***  This field indicates user differential range error information by user differential range error index (UDREI) as defined in [23], clause 5.3.3.7.2. |
| ***bds-RURAI***  This field indicates Regional User Range Accuracy (RURA) information by Regional User Range Accuracy Index (UDREI) as defined in [23], clause 5.3.3.6. |
| ***bds-ECC***-***DeltaT***  This field indicates the BDS differential correction information which is expressed in equivalent clock correction (t). Add the value of t to the observed pseudo-range to correct the effect caused by the satellite clock offset and ephemeris error. Value -4096 means the t is not available.  The scale factor is 0.1 meter. |

#### – *BDS-GridModelParameter*

-- ASN1START

BDS-GridModelParameter-r12 ::= SEQUENCE {

bds-RefTime-r12 INTEGER (0..3599),

gridIonList-r12 GridIonList-r12,

...

}

GridIonList-r12 ::= SEQUENCE (SIZE (1..320)) OF GridIonElement-r12

GridIonElement-r12 ::= SEQUENCE {

igp-ID-r12 INTEGER (1..320),

dt-r12 INTEGER (0..511),

givei-r12 INTEGER (0..15) ,

...

}

-- ASN1STOP

| *BDS-GridModelParamater* field descriptions |
| --- |
| ***bds-RefTime***  This field specifies the time for which the grid model parameters are valid, modulo 1 hour. *bds-RefTime* is given in BDS system time.  Scale factor 1‑second. |
| ***gridIonList***  This list provides ionospheric grid point information for each grid point. Up to 16 instances are used in this version of the specification. The values 17 to 320 are reserved for future use. |
| ***igp-ID***  This field indicates the ionospheric grid point (IGP) number as defined in [23], clause 5.3.3.8. |
| ***dt***  This field indicates dT as defined in [23], clause 5.3.3.8.1, i.e. the vertical delay at the corresponding IGP indicated by *igp-ID*.  The scale factor is 0.125 meter. |
| ***givei***  This field indicates the Grid Ionospheric Vertical Error Index (GIVEI) which is used to describe the delay correction accuracy at ionospheric grid point indicated by *igp-ID*, the mapping between GIVEI and GIVE is defined in [23], clause 5.3.3.8.2. |

#### *– GNSS-RTK-Observations*

The IE *GNSS-RTK-Observations* is used by the location server to provide GNSS reference station observables (pseudorange, phaserange, phaserange-rate (Doppler), and carrier-to-noise ratio) of the GNSS signals. Essentially, these parameters describe the range and derivatives from respective satellites to the reference station location provided in IE *GNSS-RTK-ReferenceStationInfo*.

The parameters provided in IE *GNSS-RTK-Observations* are used as specified for message type 1071-1127 in [30].

-- ASN1START

GNSS-RTK-Observations-r15 ::= SEQUENCE {

epochTime-r15 GNSS-SystemTime,

gnss-ObservationList-r15 GNSS-ObservationList-r15,

...

}

GNSS-ObservationList-r15 ::= SEQUENCE (SIZE(1..64)) OF GNSS-RTK-SatelliteDataElement-r15

GNSS-RTK-SatelliteDataElement-r15 ::= SEQUENCE{

svID-r15 SV-ID,

integer-ms-r15 INTEGER (0..254) OPTIONAL, -- Need ON

rough-range-r15 INTEGER (0..1023),

rough-phase-range-rate-r15 INTEGER (-8192..8191) OPTIONAL, -- Need ON

gnss-rtk-SatelliteSignalDataList-r15 GNSS-RTK-SatelliteSignalDataList-r15,

...

}

GNSS-RTK-SatelliteSignalDataList-r15 ::= SEQUENCE (SIZE(1..24)) OF

GNSS-RTK-SatelliteSignalDataElement-r15

GNSS-RTK-SatelliteSignalDataElement-r15 ::= SEQUENCE {

gnss-SignalID-r15 GNSS-SignalID,

fine-PseudoRange-r15 INTEGER (-524288..524287),

fine-PhaseRange-r15 INTEGER (-8388608..8388607),

lockTimeIndicator-r15 INTEGER (0..1023),

halfCycleAmbiguityIndicator-r15 BIT STRING (SIZE (1)),

carrier-to-noise-ratio-r15 INTEGER (0..1023) OPTIONAL, -- Need ON

fine-PhaseRangeRate-r15 INTEGER (-16384..16383) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *GNSS-RTK-Observations* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the observations. The *gnss-TimeID* in *GNSS SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement.* |
| ***svID***  This field specifies the GNSS *SV‑ID* of the satellite for which the GNSS Observations are provided. |
| ***integer-ms***  This field contains the integer number of milliseconds in the satellite rough range. Rough range can be used to restore complete observables for a given satellite.  Scale factor 1 milli-second in the range from 0 to 254 milli-seconds. |
| ***rough-range***  This field contains the sub-milliseconds in the satellite rough range (modulo 1 millisecond).  Scale factor 2-10 milli-seconds in the range from 0 to (1-2-10) milli-seconds. |
| ***rough-phase-range-rate***  This field contains the GNSS satellite rough phaserange rate.  Scale factor 1 m/s. Range ±8191 m/s. |
| ***gnss-SignalID***  This field specifies the GNSS signal for which the GNSS observations are provided. |
| ***fine-PseudoRange***  This field contains the GNSS signal fine pseudorange.  Being added to fields *integer-ms* and *rough-range* allows getting the full pseudorange observable corresponding to given signal. NOTE 1.  Scale factor 2–29 milli-seconds. Range ±(2–10–2–29) milli-seconds. |
| ***fine-PhaseRange***  This field contains the GNSS signal fine phaserange.  Being added to fields *integer-ms* and *rough-range* allows getting the full phaserange observable corresponding to given signal. NOTE 2.  Scale factor 2–31 milli-seconds. Range ±(2–8–2–31) milli-seconds. |
| ***lockTimeIndicator***  This field provides a measure of the amount of time during which the receiver has maintained continuous lock on that satellite signal. If a cycle slip occurs during the previous measurement cycle, the lock time indicator shall be reset to zero.  Mapping according to the table *lockTimeIndicator* value to interpretation lock-time relation shown below. |
| ***halfCycleAmbiguityIndicator***  Value 0 indicates no half-cycle ambiguity. Value 1 indicates half-cycle ambiguity.  When providing phaserange with unresolved polarity encoding this bit shall be set to 1. A target device that is not capable of handling half-cycle ambiguities shall skip such phaserange observables. If polarity resolution forced phaserange to be corrected by half-a-cycle, then the *lockTimeIndicator* must be reset to zero, indicating that despite continuous tracking the final phaserange experienced non-continuity. |
| ***carrier-to-noise-ratio***  This field provides the GNSS signal carrier-to-noise-ratio in dB-Hz.  Scale factor 2–4 dB-Hz in the range from 0.0625 to 63.9375 dB-Hz. |
| ***fine-PhaseRangeRate***  This field contains the GNSS signal fine Phase Range Rate.  Full phaserange rate is the sum of this field and the *rough-phase-range-rate* field. NOTE 3.  Scale factor 0.0001 m/s. Range ±1.6383 m/s. |

NOTE 1: Complete Pseudorange for each signal (i) of given satellite can be restored as follows:   
Pseudorange(i) = c/1000 × (*integer-ms* + *rough\_range*/1024 + 2–29 × *fine\_Pseudorange*(i)), meter.

NOTE 2: Complete Phaserange for each signal (i) of given satellite can be restored as follows:  
Phaserange(i) = c/1000 × (*integer-ms* + *rough\_range*/1024 + 2–31 × *fine\_Phaserange*(i)), meter.

NOTE 3: Complete PhaseRangeRate for each signal (i) of given satellite can be restored as follows:  
PhaseRangeRate(i) = *rough-phase-range-rate* + 0.0001\**fine-PhaseRangeRate* (i), meter/sec.

NOTE 4: The speed of light c is 299,792,458 meters per second.

*lockTimeIndicator* value to interpretation lock-time relation

|  |  |  |  |
| --- | --- | --- | --- |
| Indicator (i) | Supplementary coefficient (k) | Minimum Lock Time (ms) | Range of Indicated Lock Times (t) (ms) |
| 0 – 63 | 1 | i | 0 ≤ t < 64 |
| 64 – 95 | 2 | 2 × i – 64 | 64 ≤ t < 128 |
| 96 – 127 | 4 | 4 × i – 256 | 128 ≤ t < 256 |
| 128 – 159 | 8 | 8 × i – 768 | 256 ≤ t < 512 |
| 160 – 191 | 16 | 16 × i – 2048 | 512 ≤ t < 1024 |
| 192 – 223 | 32 | 32 × i – 5120 | 1024 ≤ t < 2048 |
| 224 – 255 | 64 | 64 × i – 12288 | 2048 ≤ t < 4096 |
| 256 – 287 | 128 | 128 × i – 28672 | 4096 ≤ t < 8192 |
| 288 – 319 | 256 | 256 × i – 65536 | 8192 ≤ t < 16384 |
| 320 – 351 | 512 | 512 × i – 147456 | 16384 ≤ t < 32768 |
| 352 – 383 | 1024 | 1024 × i – 327680 | 32768 ≤ t < 65536 |
| 384 – 415 | 2048 | 2048 × i – 720896 | 65536 ≤ t < 131072 |
| 416 – 447 | 4096 | 4096 × i – 1572864 | 131072 ≤ t < 262144 |
| 448 – 479 | 8192 | 8192 × i – 3407872 | 262144 ≤ t < 524288 |
| 480 – 511 | 16384 | 16384 × i – 7340032 | 524288 ≤ t < 1048576 |
| 512 – 543 | 32768 | 32768 × i – 15728640 | 1048576 ≤ t < 2097152 |
| 544 – 575 | 65536 | 65536 × i – 33554432 | 2097152 ≤ t < 4194304 |
| 576 – 607 | 131072 | 131072 × i – 71303168 | 4194304 ≤ t < 8388608 |
| 608 – 639 | 262144 | 262144 × i – 150994944 | 8388608 ≤ t < 16777216 |
| 640 – 671 | 524288 | 524288 × i – 318767104 | 16777216 ≤ t < 33554432 |
| 672 – 703 | 1048576 | 1048576 × i – 671088640 | 33554432 ≤ t < 67108864 |
| 704 | 2097152 | 2097152 × i – 1409286144 | 67108864 ≤ t |
| 705 – 1023 | Reserved | | |

#### *– GLO-RTK-BiasInformation*

The IE *GLO-RTK-BiasInformation* is used by the location server to provide the so-called "GLONASS Code-Phase bias values" (CPB) for up to all FDMA GLONASS observations.

If IE *GNSS-RTK-Observations* for *gnss-ID* = *glonass* are provided, but IE *GLO-RTK-BiasInformation* is not provided, the target device assumes that the CPB information has been applied to the GLONASS observation data a priori.

The parameters provided in IE *GLO-RTK-BiasInformation* are used as specified for message type 1230 in [30].

-- ASN1START

GLO-RTK-BiasInformation-r15 ::= SEQUENCE{

referenceStationID-r15 GNSS-ReferenceStationID-r15,

cpbIndicator-r15 BIT STRING (SIZE(1)),

l1-ca-cpBias-r15 INTEGER (-32768..32767) OPTIONAL, -- Need ON

l1-p-cpBias-r15 INTEGER (-32768..32767) OPTIONAL, -- Need ON

l2-ca-cpBias-r15 INTEGER (-32768..32767) OPTIONAL, -- Need ON

l2-p-cpBias-r15 INTEGER (-32768..32767) OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *GLO-RTK-BiasInformation* field descriptions |
| --- |
| ***referenceStationID***  This field specifies the Station ID for which the *GLO-RTK-BiasInformation* is provided. |
| ***cpbIndicator***  This field specifies the GLONASS Code-Phase Bias Indicator. The interpretation of the value is as follows:  0 – The GLONASS Pseudorange and Phaserange observations in IE *GNSS-RTK-Observations* are not aligned to the same measurement epoch.  1 – The GLONASS Pseudorange and Phaserange observations in IE *GNSS-RTK-Observations* are aligned to the same measurement epoch. |
| ***l1-ca-cpBias***  This field specifies the GLONASS L1 C/A Code-Phase Bias, which represents the offset between the L1 C/A Pseudorange and L1 Phaserange measurement epochs in meters.  If *cpbIndicator* is set to 0, the measurement epoch of the GLONASS L1 Phaserange measurements may be aligned using:  Aligned GLONASS L1 Phaserange = Full GLONASS L1 Phaserange + GLONASS L1 C/A Code-Phase Bias.  If *cpbIndicator* is set to 1, the measurement epoch of the GLONASS L1 Phaserange measurements may be unaligned using:  Unaligned GLONASS L1 Phaserange = Full GLONASS L1 Phaserange – GLONASS L1 C/A Code-Phase Bias.  Scale factor 0.02 m. Range ±655.34 m. |
| ***l1-p-cpBias***  This field specifies the GLONASS L1 P Code-Phase Bias, which represents the offset between the L1 P Pseudorange and L1 Phaserange measurement epochs in meters.  If *cpbIndicator* is set to 0, the measurement epoch of the GLONASS L1 Phaserange measurements may be aligned using:  Aligned GLONASS L1 Phaserange = Full GLONASS L1 Phaserange + GLONASS L1 P Code-Phase Bias.  If *cpbIndicator* is set to 1, the measurement epoch of the GLONASS L1 Phaserange measurements may be unaligned using:  Unaligned GLONASS L1 Phaserange = Full GLONASS L1 Phaserange – GLONASS L1 P Code-Phase Bias.  Scale factor 0.02 m. Range ±655.34 m. |
| ***l2-ca-cpBias***  This field specifies the GLONASS L2 C/A Code-Phase Bias, which represents the offset between the L2 C/A Pseudorange and L2 Phaserange measurement epochs in meters.  If *cpbIndicator* is set to 0, the measurement epoch of the GLONASS L2 Phaserange measurements may be aligned using:  Aligned GLONASS L2 Phaserange = Full GLONASS L2 Phaserange + GLONASS L2 C/A Code-Phase Bias.  If *cpbIndicator* is set to 1, the measurement epoch of the GLONASS L2 Phaserange measurements may be unaligned using:  Unaligned GLONASS L2 Phaserange = Full GLONASS L2 Phaserange – GLONASS L2 C/A Code-Phase Bias.  Scale factor 0.02 m. Range ±655.34 m. |
| ***l2-p-cpBias***  This field specifies the GLONASS L2 P Code-Phase Bias, which represents the offset between the L2 P Pseudorange and L2 Phaserange measurement epochs in meters.  If *cpbIndicator* is set to 0, the measurement epoch of the GLONASS L2 Phaserange measurements may be aligned using:  Aligned GLONASS L2 Phaserange = Full GLONASS L2 Phaserange + GLONASS L2 P Code-Phase Bias.  If *cpbIndicator* is set to 1, the measurement epoch of the GLONASS L2 Phaserange measurements may be unaligned using:  Unaligned GLONASS L2 Phaserange = Full GLONASS L2 Phaserange – GLONASS L2 P Code-Phase Bias.  Scale factor 0.02 m. Range ±655.34 m. |

#### *– GNSS-RTK-MAC-CorrectionDifferences*

The IE *GNSS-RTK-MAC-CorrectionDifferences* is used by the location server to provide dispersive (ionospheric) and non-dispersive (geometric) correction difference components for up to 32 pairs of Auxiliary and Master Reference Stations. The Master Reference Station coordinates are provided in IE *GNSS-RTK-ReferenceStationInfo* and the Auxiliary Station coordinates are provided in IE *GNSS-RTK-AuxiliaryStationData*.

The parameters provided in IE *GNSS-RTK-MAC-CorrectionDifferences* are used as specified for message type 1017 and 1039 in [30] and apply to all GNSS.

-- ASN1START

GNSS-RTK-MAC-CorrectionDifferences-r15 ::= SEQUENCE {

networkID-r15 GNSS-NetworkID-r15,

subNetworkID-r15 GNSS-SubNetworkID-r15 OPTIONAL, -- Need ON

master-ReferenceStationID-r15 GNSS-ReferenceStationID-r15,

l1-r15 GNSS-FrequencyID-r15 OPTIONAL, -- Need OP

l2-r15 GNSS-FrequencyID-r15 OPTIONAL, -- Need OP

rtkCorrectionDifferencesList-r15 RTK-CorrectionDifferencesList-r15,

...

}

RTK-CorrectionDifferencesList-r15 ::= SEQUENCE (SIZE (1..32)) OF

RTK-CorrectionDifferencesElement-r15

RTK-CorrectionDifferencesElement-r15 ::= SEQUENCE {

epochTime-r15 GNSS-SystemTime,

auxiliary-referenceStationID-r15 GNSS-ReferenceStationID-r15,

geometric-ionospheric-corrections-differences-r15

Geometric-Ionospheric-Corrections-Differences-r15,

...

}

Geometric-Ionospheric-Corrections-Differences-r15 ::= SEQUENCE (SIZE(1..64)) OF

Geometric-Ionospheric-Corrections-Differences-Element-r15

Geometric-Ionospheric-Corrections-Differences-Element-r15 ::= SEQUENCE {

svID-r15 SV-ID,

ambiguityStatusFlag-r15 INTEGER (0..3),

non-synch-count-r15 INTEGER (0..7),

geometricCarrierPhaseCorrectionDifference-r15 INTEGER (-65536..65535),

iod-r15 BIT STRING (SIZE(11)),

ionosphericCarrierPhaseCorrectionDifference-r15 INTEGER (-65536..65535),

...

}

-- ASN1STOP

| *GNSS-RTK-MAC-CorrectionDifferences* field descriptions |
| --- |
| ***networkID***  This field provides the network ID. |
| ***subNetworkID***  This field identifies the subnetwork of a network identified by *networkID*. |
| ***master-ReferenceStationID***  This field specifies the station ID of the Master Reference Station. |
| ***l1, l2***  These fields specify the dual-frequency combination of L1 and L2 link/frequencies for which the *rtkCorrectionDifferencesList* is provided. If the fields are absent, the default interpretation in table 'L1/L2 default interpretation' applies. |
| ***rtkCorrectionDifferencesList***  This field provides the correction differences for Auxiliary-Master Reference Station pairs. |
| ***epochTime***  This field specifies the epoch time of observations used to derive the correction differences. The *gnss-TimeID* in *GNSS‑SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***auxiliary-referenceStationID***  This field specifies the station ID of the Auxiliary Reference Station. |
| ***svID***  This field specifies the satellite for which the data is provided. |
| ***ambiguityStatusFlag***  This field provides the ambiguity status. 'L1' below corresponds to the link indicated by the *l1* field; 'L2' below corresponds to the link indicated by the *l2* field.  0 - Reserved for future use (artificial observations)  1 - Correct Integer Ambiguity Level for L1 and L2  2 - Correct Integer Ambiguity Level for L1-L2 widelane  3 - Uncertain Integer Ambiguity Level. Only a likely guess is used. |
| ***non-synch-count***  This field provides the count of unrecoverable cycle slips. Whenever an unrecoverable cycle slip occurs this count shall be increased. The counter shall not be increased more than once per minute. Data for satellites with cycle slips more frequent than once per minute should not be provided. |
| ***geometricCarrierPhaseCorrectionDifference***  This field provides the Geometric Carrier Phase Correction Difference (GCPCD), which is the Correction Difference for the geometric part (troposphere and orbits) calculated based on integer leveled L1 and L2 correction differences (L1CD and L2CD).    L1CD, L2CD, and ICPCD are presented in meters. 'L1' below corresponds to the link indicated by the *l1* field; 'L2' below corresponds to the link indicated by the *l2* field.  Scale factor 0.5 milli-meter; range ±32.767 meters. |
| ***iod***  This field specifies the IOD value of the broadcast ephemeris used for calculation of Correction Differences (see IE *GNSS-NavigationModel*). |
| ***ionosphericCarrierPhaseCorrectionDifference***  This field provides the Ionospheric Carrier Phase Correction Difference (ICPCD), which is the Correction Difference for the ionospheric part calculated based on integer leveled L1 and L2 correction differences (L1CD and L2CD).    L1CD, L2CD, and ICPCD are presented in meters. 'L1' below corresponds to the link indicated by the *l1* field; 'L2' below corresponds to the link indicated by the *l2* field.  Scale factor 0.5 milli-meter; range ±32.767 meters. |

L1/L2 default interpretation

|  |  |  |
| --- | --- | --- |
| GNSS | *l1* | *l2* |
| GPS | L1 | L2 |
| SBAS | L1 | L5 |
| QZSS | L1 | L2 |
| Galileo | E1 | E5a |
| GLONASS | G1 | G2 |
| BDS | B1 | B2 |

#### *– GNSS-RTK-Residuals*

The IE *GNSS-RTK-Residuals* is used by the location server to provide Network RTK correction residual error information.

If the interpolation of the corrections for the target device location is performed at the location server, resulting in a non-physical reference station, the *GNSS-RTK-Residuals* are referenced to the non-physical reference station.

If the interpolation of the corrections is performed by the target device (e.g., using *GNSS‑RTK‑MAC‑CorrectionDifferences)*, the *GNSS-RTK-Residuals* are referenced to the closest master or auxiliary station to the target device.

The parameters provided in IE *GNSS-RTK-Residuals* are used as specified for message type 1030 and 1031 in [30] and apply to all GNSS.

-- ASN1START

GNSS-RTK-Residuals-r15 ::= SEQUENCE {

epochTime-r15 GNSS-SystemTime,

referenceStationID-r15 GNSS-ReferenceStationID-r15,

n-Refs-r15 INTEGER (0..127),

l1-r15 GNSS-FrequencyID-r15 OPTIONAL, -- Need OP

l2-r15 GNSS-FrequencyID-r15 OPTIONAL, -- Need OP

rtk-residuals-list-r15 RTK-Residuals-List-r15,

...

}

RTK-Residuals-List-r15 ::= SEQUENCE (SIZE(1..64)) OF RTK-Residuals-Element-r15

RTK-Residuals-Element-r15 ::= SEQUENCE {

svID-r15 SV-ID,

s-oc-r15 INTEGER (0..255),

s-od-r15 INTEGER (0..511),

s-oh-r15 INTEGER (0..63),

s-lc-r15 INTEGER (0..1023),

s-ld-r15 INTEGER (0..1023),

...

}

-- ASN1STOP

| *GNSS-RTK-Residuals* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the Network RTK Residual Error data. The *gnss-TimeID* in *GNSS‑SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***referenceStationID***  This field specifies the Reference Station ID. The Reference Station may be a physical or non-physical station. |
| ***n-Refs***  This field specifies the number of reference stations used to derive the residual statistics (1 to 127; 127 indicates 127 or more stations). The number of reference stations should never be zero. If zero is encountered the target device should ignore the message. |
| ***l1, l2***  These fields specify the dual-frequency combination of L1 and L2 link/frequencies for which the *rtk residuals-list* is provided. If the fields are absent, the default interpretation in table 'L1/L2 default interpretation' in IE *GNSS‑RTK‑MAC‑CorrectionDifferences* applies. |
| **svID**  This field specifies the satellite for which the data is provided. |
| ***s-oc***  This field specifies the constant term of standard deviation (1 sigma) for non-dispersive interpolation residuals, *s0c*.  Scale factor 0.5 milli-meter; range 0–127 milli-meter. NOTE 1. |
| ***s-od***  This field specifies the distance dependent term of standard deviation (1 sigma) for nondispersive interpolation residuals, *s0d*.  Scale factor 0.01 ppm; range 0–5.11 ppm. NOTE 1. |
| ***s-oh***  This field specifies the height dependent term of standard deviation (1 sigma) for nondispersive interpolation residuals, *s0h*.  Scale factor 0.1 ppm; range 0–5.1 ppm. NOTE 1. |
| ***s-lc***  This field specifies the constant term of standard deviation (1 sigma) for dispersive interpolation residuals (as affecting L1 frequency), *slc*. 'L1' corresponds to the link indicated by the *l1* field.  Scale factor 0.5 milli-meter; range 0–511 milli-meter |
| ***s-ld***  This field specifies the distance dependent term of standard deviation (1 sigma) for dispersive interpolation residuals (as affecting L1 frequency), *sld*. 'L1' corresponds to the link indicated by the *l1* field. NOTE 2. |

NOTE 1: The complete standard deviation for the expected non-dispersive interpolation residual is computed from *s-oc*, *s-od* and *s-oh* using the formula:  
  
where *dRef* is the distance of the target device from the nearest physical reference station in [km] and |*dhRef*| is the absolute value of the height difference between the nearest physical reference station and the target device in [km].

NOTE 2: The complete standard deviation for the expected dispersive interpolation residual is computed from *s-lc* and *s-ld* using the formula:  
  
where *dRef* is the distance of the target device from the nearest physical reference station in [km].   
The standard deviation for the L2 frequency is calculated using the formula:  
. 'L2' corresponds to the link indicated by the *l2* field; *c/f1c/f2* are the nominal wavelengths of the links indicated by the *l1*, *l2* fields, respectively.

#### *– GNSS-RTK-FKP-Gradients*

The IE *GNSS-RTK-FKP-Gradients* is used by the location server to provide the FKP Network RTK gradients of distance-dependent errors like ionosphere, troposphere and orbits. The target device may use the gradients to compute the influence of the distance dependent errors for its own position.

The parameters provided in IE *GNSS-RTK-FKP-Gradients* are used as specified for message type 1034 and 1035 in [30] and apply to all GNSS.

-- ASN1START

GNSS-RTK-FKP-Gradients-r15 ::= SEQUENCE {

referenceStationID-r15 GNSS-ReferenceStationID-r15,

epochTime-r15 GNSS-SystemTime,

l1-r15 GNSS-FrequencyID-r15 OPTIONAL, -- Need OP

l2-r15 GNSS-FrequencyID-r15 OPTIONAL, -- Need OP

fkp-gradients-list-r15 FKP-Gradients-List-r15,

...

}

FKP-Gradients-List-r15 ::= SEQUENCE (SIZE(1..64)) OF FKP-Gradients-Element-r15

FKP-Gradients-Element-r15 ::= SEQUENCE {

svID-r15 SV-ID,

iod-r15 BIT STRING (SIZE(11)),

north-geometric-gradient-r15 INTEGER (-2048..2047),

east-geometric-gradient-r15 INTEGER (-2048..2047),

north-ionospheric-gradient-r15 INTEGER (-8192..8191),

east-ionospheric-gradient-r15 INTEGER (-8192..8191),

...

}

-- ASN1STOP

| *GNSS-RTK-FKP-Gradients* field descriptions |
| --- |
| ***referenceStationID***  This field specifies the Reference Station ID. The Reference Station may be a physical or non-physical station. |
| ***epochTime***  This field specifies the epoch time of the FKP data. The *gnss-TimeID* in *GNSS‑SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***l1, l2***  These fields specify the dual-frequency combination of L1 and L2 link/frequencies for which the *fkp-gradients-list* is provided. If the fields are absent, the default interpretation in table 'L1/L2 default interpretation' in IE *GNSS‑RTK‑MAC‑CorrectionDifferences* applies. NOTE. |
| ***svID***  This field specifies the satellite for which the data is provided. |
| ***iod***  This field specifies the IOD value of the broadcast ephemeris used for calculation of FKP data (see IE *GNSS‑NavigationModel*). |
| ***north-geometric-gradient***  This field specifies the gradient (FKP) of the geometric (non-dispersive) error components in South-North direction in parts per million of the south-north distance to the reference station.  Scale factor 0.01 ppm; range ±20.47 ppm. |
| ***east-geometric-gradient***  This field specifies the gradient (FKP) of the geometric (non-dispersive) error components in West-East direction in parts per million of the west-east distance to the reference station.  Scale factor 0.01 ppm; range ±20.47 ppm. |
| ***north-ionospheric-gradient***  This field specifies the gradient (FKP) of the ionospheric (dispersive) error component in South-North direction.  Scale factor 0.01 ppm; range ±81.91 ppm. |
| ***east-ionospheric-gradient***  This field specifies the gradient (FKP) of the ionospheric (dispersive) error component in West-East direction.  Scale factor 0.01 ppm; range ±81.91 ppm. |

NOTE: As described in [30], the distance dependent error for the geometric part *0* and ionospheric part *I* is computed from the gradients provided in *FKP-Gradients-Element*. The distance dependent error for a carrier phase measurements *Ф* on a signal with frequency *f* can be computed by:  


where *f1*, *f* is the link/frequency indicated by the *l1*, *l2* fields, respectively.

#### *– GNSS-SSR-OrbitCorrections*

The IE *GNSS-SSR-OrbitCorrections* is used by the location server to provide radial, along-track and cross-track orbit corrections. The target device may use the parameters to compute a satellite position correction to be combined with the satellite position calculated from broadcast ephemeris.

The parameters provided in IE *GNSS-SSR-OrbitCorrections* are used as specified for SSR Clock Messages (e.g., message type 1057 and 1063) in [30] and apply to all GNSS.

-- ASN1START

GNSS-SSR-OrbitCorrections-r15 ::= SEQUENCE {

epochTime-r15 GNSS-SystemTime,

ssrUpdateInterval-r15 INTEGER (0..15),

satelliteReferenceDatum-r15 ENUMERATED { itrf, regional, ... },

iod-ssr-r15 INTEGER (0..15),

ssr-OrbitCorrectionList-r15 SSR-OrbitCorrectionList-r15,

...

}

SSR-OrbitCorrectionList-r15 ::= SEQUENCE (SIZE(1..64)) OF SSR-OrbitCorrectionSatelliteElement-r15

SSR-OrbitCorrectionSatelliteElement-r15 ::= SEQUENCE {

svID-r15 SV-ID,

iod-r15 BIT STRING (SIZE(11)),

delta-radial-r15 INTEGER (-2097152..2097151),

delta-AlongTrack-r15 INTEGER (-524288..524287),

delta-CrossTrack-r15 INTEGER (-524288..524287),

dot-delta-radial-r15 INTEGER (-1048576..1048575) OPTIONAL,

dot-delta-AlongTrack-r15 INTEGER (-262144..262143) OPTIONAL,

dot-delta-CrossTrack-r15 INTEGER (-262144..262143) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-SSR-OrbitCorrections* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the orbit corrections. The *gnss-TimeID* in *GNSS-SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***ssrUpdateInterval***  This field specifies the SSR Update Interval. The SSR Update Intervals for all SSR parameters start at time 00:00:00 of the GPS time scale. A change of the SSR Update Interval during the transmission of SSR data should ensure consistent data for a target device. See table Value to SSR Update Interval Relation below. NOTE 1. |
| ***satelliteReferenceDatum***  This field specifies the satellite refence datum for the orbit corrections. |
| ***iod-ssr***  This field specifies the Issue of Data number for the SSR data. A change of *iod-ssr* is used to indicate a change in the SSR generating configuration. |
| ***svID***  This field specifies the satellite for which the orbit corrections are provided. |
| ***iod***  This field specifies the IOD value of the broadcast ephemeris for which the orbit corrections are valid (see IE *GNSS‑NavigationModel*). NOTE 2. |
| ***delta-radial***  This field specifies the radial orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.1 mm; range ±209.7151 m. |
| ***delta-AlongTrack***  This field specifies the along-track orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.4 mm; range ±209.7148 m. |
| ***delta-CrossTrack***  This field specifies the cross-track orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.4 mm; range ±209.7148 m. |
| ***dot-delta-radial***  This field specifies the velocity of radial orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.001 mm/s; range ±1.048575 m/s. |
| ***dot-delta-AlongTrack***  This field specifies the velocity of along-track orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.004 mm/s; range ±1.048572 m/s. |
| ***dot-delta-CrossTrack***  This field specifies the velocity of cross-track orbit correction for broadcast ephemeris. NOTE 3.  Scale factor 0.004 mm/s; range ±1.048572 m/s. |

NOTE 1: The update intervals are aligned to the GPS time scale for all GNSS in order to allow synchronous operation for multiple GNSS services. This means that the update intervals may not be aligned to the beginning of the day for another GNSS. Due to the leap seconds, this is generally the case for GLONASS.

NOTE 2: In case the *gnss-ID* indicates 'gps' or 'qzss', the *iod* refers to the NAV broadcast ephemeris (GPS L1 C/A or QZSS QZS-L1, respectively, in table GNSS to iod Bit String(11) relation in IE *GNSS‑NavigationModel).*

NOTE 3: The reference time *t0* is *epochTime* + ½ × *ssrUpdateInterval*. The reference time *t0* for *ssrUpdateInterval* '0' is *epochTime*.

Value to SSR Update Interval Relation

|  |  |
| --- | --- |
| Value of ssrUpdateInterval | SSR Update Interval |
| 0 | 1 second |
| 1 | 2 seconds |
| 2 | 5 seconds |
| 3 | 10 seconds |
| 4 | 15 seconds |
| 5 | 30 seconds |
| 6 | 60 seconds |
| 7 | 120 seconds |
| 8 | 240 seconds |
| 9 | 300 seconds |
| 10 | 600 seconds |
| 11 | 900 seconds |
| 12 | 1800 seconds |
| 13 | 3600 seconds |
| 14 | 7200 seconds |
| 15 | 10800 seconds |

#### *– GNSS-SSR-ClockCorrections*

The IE *GNSS-SSR-ClockCorrections* is used by the location server to provide clock correction parameters. The target device may use the parameters to compute a clock correction to be applied to the broadcast satellite clock parameters, identified by *iod* of corresponding *GNSS-SSR-OrbitCorrections*.

The parameters provided in IE *GNSS-SSR-ClockCorrections* are used as specified for SSR Clock Messages (e.g., message type 1058 and 1064) in [30] and apply to all GNSS.

-- ASN1START

GNSS-SSR-ClockCorrections-r15 ::= SEQUENCE {

epochTime-r15 GNSS-SystemTime,

ssrUpdateInterval-r15 INTEGER (0..15),

iod-ssr-r15 INTEGER (0..15),

ssr-ClockCorrectionList-r15 SSR-ClockCorrectionList-r15,

...

}

SSR-ClockCorrectionList-r15 ::= SEQUENCE (SIZE(1..64)) OF SSR-ClockCorrectionSatelliteElement-r15

SSR-ClockCorrectionSatelliteElement-r15 ::= SEQUENCE {

svID-r15 SV-ID,

delta-Clock-C0-r15 INTEGER (-2097152..2097151),

delta-Clock-C1-r15 INTEGER (-1048576..1048575) OPTIONAL,

delta-Clock-C2-r15 INTEGER (-67108864..67108863) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-SSR-ClockCorrections* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the clock corrections. The gnss-TimeID in *GNSS-SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement.* |
| ***ssrUpdateInterval***  This field specifies the SSR Update Interval. The SSR Update Intervals for all SSR parameters start at time 00:00:00 of the GPS time scale. A change of the SSR Update Interval during the transmission of SSR data should ensure consistent data for a target device. See table Value to SSR Update Interval Relation in IE *GNSS‑SSR‑OrbitCorrections*. |
| ***iod-ssr***  This field specifies the Issue of Data number for the SSR data. A change of iod-ssr is used to indicate a change in the SSR generating configuration. |
| ***svID***  This field specifies the satellite for which the clock corrections are provided. |
| ***delta-Clock-C0***  This field specifies the C0 polynomial coefficient for correction of broadcast satellite clock. NOTE 1.  Scale factor 0.1 mm; range ±209.7151 m. |
| ***delta-Clock-C1***  This field specifies the C1 polynomial coefficient for correction of broadcast satellite clock. NOTE 1.  Scale factor 0.001 mm/s; range ±1.048575 m/s. |
| ***delta-Clock-C2***  This field specifies the C2 polynomial coefficient for correction of broadcast satellite clock. NOTE 1.  Scale factor 0.00002 mm/s2; range ±1.34217726 m/s2. |

NOTE 1: The reference time *t0* is *epochTime* + ½ × *ssrUpdateInterval*. The reference time *t0* for *ssrUpdateInterval* '0' is *epochTime*.

#### *– GNSS-SSR-CodeBias*

The IE *GNSS-SSR-CodeBias* is used by the location server to provide GNSS signal code bias. The target device may add the code bias to the pseudo-range measurement of the corresponding code signal to get corrected pseudo-ranges.

NOTE: Any code biases transmitted in the broadcast messages (e.g., the GPS group delay differential TGD [4] (*NAV‑ClockModel*)) are not applied at all by the target device.

The parameters provided in IE *GNSS-SSR-CodeBias* are used as specified for SSR Code Bias Messages (e.g., message type 1059 and 1065) in [30] and apply to all GNSS.

-- ASN1START

GNSS-SSR-CodeBias-r15 ::= SEQUENCE {

epochTime-r15 GNSS-SystemTime,

ssrUpdateInterval-r15 INTEGER (0..15),

iod-ssr-r15 INTEGER (0..15),

ssr-CodeBiasSatList-r15 SSR-CodeBiasSatList-r15,

...

}

SSR-CodeBiasSatList-r15 ::= SEQUENCE (SIZE(1..64)) OF SSR-CodeBiasSatElement-r15

SSR-CodeBiasSatElement-r15 ::= SEQUENCE {

svID-r15 SV-ID,

ssr-CodeBiasSignalList-r15 SSR-CodeBiasSignalList-r15,

...

}

SSR-CodeBiasSignalList-r15 ::= SEQUENCE (SIZE(1..16)) OF SSR-CodeBiasSignalElement-r15

SSR-CodeBiasSignalElement-r15 ::= SEQUENCE {

signal-and-tracking-mode-ID-r15 GNSS-SignalID,

codeBias-r15 INTEGER (-8192..8191),

...

}

-- ASN1STOP

| *GNSS-SSR-CodeBias* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the code bias data. The *gnss-TimeID* in *GNSS-SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***ssrUpdateInterval***  This field specifies the SSR Update Interval. The SSR Update Intervals for all SSR parameters start at time 00:00:00 of the GPS time scale. A change of the SSR Update Interval during the transmission of SSR data should ensure consistent data for a target device. See table Value to SSR Update Interval Relation in IE *GNSS‑SSR‑OrbitCorrections*. |
| ***iod-ssr***  This field specifies the Issue of Data number for the SSR data. A change of *iod-ssr* is used to indicate a change in the SSR generating configuration. |
| ***svID***  This field specifies the GNSS satellite for which the code biases are provided. |
| ***signal-and-tracking-mode-ID***  This field specifies the GNSS signal for which the code biases are provided. |
| ***codeBias***  This field provides the code bias for the GNSS signal indicated by *signal-and-tracking-mode-ID*.  Scale factor 0.01 m; range ±81.91 m. |

#### *– GNSS-SSR-URA*

The IE *GNSS-SSR-URA* is used by the location server to provide quality information for the provided SSR assistance data.

The parameters provided in IE *GNSS-SSR-URA* are used as specified for the SSR URA Messages (e.g., message type 1061 and 1067) in [30] and apply to all GNSS.

-- ASN1START

GNSS-SSR-URA-r16 ::= SEQUENCE {

epochTime-r16 GNSS-SystemTime,

ssrUpdateInterval-r16 INTEGER (0..15),

iod-ssr-r16 INTEGER (0..15),

ssr-URA-SatList-r16 SSR-URA-SatList-r16,

...

}

SSR-URA-SatList-r16 ::= SEQUENCE (SIZE(1..64)) OF SSR-URA-SatElement-r16

SSR-URA-SatElement-r16 ::= SEQUENCE {

svID-r16 SV-ID,

ssr-URA-r16 BIT STRING (SIZE (6)),

...

}

-- ASN1STOP

| *GNSS-SSR-URA* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the SSR User Range Accuracy (URA). The *gnss-TimeID* in *GNSS-SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***ssrUpdateInterval***  This field specifies the SSR Update Interval. The SSR Update Intervals for all SSR parameters start at time 00:00:00 of the GPS time scale. A change of the SSR Update Interval during the transmission of SSR data should ensure consistent data for a target device. See table Value to SSR Update Interval Relation in IE *GNSS‑SSR‑OrbitCorrections*. |
| ***iod-ssr***  This field specifies the Issue of Data number for the SSR data. A change of *iod-ssr* is used to indicate a change in the SSR generating configuration. |
| ***svID***  This field specifies the GNSS satellite for which the SSR URA is provided. |
| ***ssr-URA***  This field specifies the User Range Accuracy (URA) (1-sigma) for the range correction provided in the SSR assistance data. The URA is represented by a combination of CLASS and VALUE. The 3 MSB define the CLASS with a range of 0-7 and the 3 LSB define the VALUE with a range of 0-7. The URA is computed by:  See Table ‘Relationship between SSR troposphere quality and URA indicator and physical quantity’ in IE *GNSS‑SSR‑GriddedCorrection*. |

#### *– GNSS-SSR-PhaseBias*

The IE *GNSS-SSR-PhaseBias* is used by the location server to provide GNSS signal phase bias. The target device may add the phase bias to the phase-range measurement of the corresponding phase signal to get corrected phase-ranges.

The parameters provided in IE *GNSS-SSR-PhaseBias* are used as specified for Compact SSR GNSS Satellite Phase Bias Messages (e.g., message type 4073,5) in [xx] and apply to all GNSS.

-- ASN1START

GNSS-SSR-PhaseBias-r16 ::= SEQUENCE {

epochTime-r16 GNSS-SystemTime,

ssrUpdateInterval-r16 INTEGER (0..15),

iod-ssr-r16 INTEGER (0..15),

ssr-PhaseBiasSatList-r16 SSR-PhaseBiasSatList-r16,

...

}

SSR-PhaseBiasSatList-r16 ::= SEQUENCE (SIZE(1..64)) OF SSR-PhaseBiasSatElement-r16

SSR-PhaseBiasSatElement-r16 ::= SEQUENCE {

svID-r16 SV-ID,

ssr-PhaseBiasSignalList-r16 SSR-PhaseBiasSignalList-r16,

...

}

SSR-PhaseBiasSignalList-r16 ::= SEQUENCE (SIZE(1..16)) OF SSR-PhaseBiasSignalElement-r16

SSR-PhaseBiasSignalElement-r16 ::= SEQUENCE {

signal-and-tracking-mode-ID-r16 GNSS-SignalID,

phaseBias-r16 INTEGER (-16384..16383),

phaseDiscontinuityIndicator-r16 INTEGER (0..3),

phaseBiasIntegerIndicator-r16 INTEGER (0..3) OPTIONAL, -- Need OP

...

}

-- ASN1STOP

| *GNSS-SSR-PhaseBias* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the phase bias data. The *gnss-TimeID* in *GNSS-SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***ssrUpdateInterval***  This field specifies the SSR Update Interval. The SSR Update Intervals for all SSR parameters start at time 00:00:00 of the GPS time scale. A change of the SSR Update Interval during the transmission of SSR data should ensure consistent data for a target device. See table Value to SSR Update Interval Relation in IE *GNSS‑SSR‑OrbitCorrections*. |
| ***iod-ssr***  This field specifies the Issue of Data number for the SSR data. A change of *iod-ssr* is used to indicate a change in the SSR generating configuration. |
| ***svID***  This field specifies the GNSS satellite for which the phase biases are provided. |
| ***signal-and-tracking-mode-ID***  This field specifies the GNSS signal for which the phase biases are provided. |
| ***phaseBias***  This field provides the phase bias for the GNSS signal indicated by *signal-and-tracking-mode-ID*.  Scale factor 0.001 m; range ±16383 m. |
| ***phaseDiscontinuityIndicator***  This field provides the phase discontinuity counter for the GNSS signal indicated by *signal-and-tracking-mode-ID*. This counter is increased for every discontinuity in phase (roll-over from 3 to 0). |
| ***phaseBiasIntegerIndicator***  This field informs whether the phase bias is Undifferenced Integer (Value 0), Widelane Integer (Value 1) or Non-Integer (Value 2):  Value 0: The Undifferenced Integer Phase Bias supports PPP-RTK fixed, widelane or float mode.  Value 1: The Widelane Integer Phase Bias indicates that after application of the Phase Bias value, this signal can be differenced with any other signal from the same satellite that also has Widelane Integer Phase Bias indicated to form a new combined carrier phase measurement of integer quality, supporting PPP-RTK widelane fixed mode.  Value 2: The Non-Integer Phase Bias supports PPP-RTK float mode.  Value 3: Reserved.  If the *phaseBiasIntegerIndicator* field is not present then it is interpreted as having Value 0 (Undifferenced Integer). |

#### *– GNSS-SSR-STEC-Correction*

The IE *GNSS-SSR-STEC-Correction* is used by the location server to provide ionosphere slant delay correction. The ionosphere slant delay (STEC) consists of the polynomial part provided in *GNSS-SSR-STEC-Correction* and the residual part provided in *GNSS-SSR-GriddedCorrection*.

The parameters provided in IE *GNSS-SSR-STEC-Correction* are used as specified for Compact SSR STEC Correction Messages (e.g., message type 4073,8) in [xx] and apply to all GNSS.

-- ASN1START

GNSS-SSR-STEC-Correction-r16 ::= SEQUENCE {

epochTime-r16 GNSS-SystemTime,

ssrUpdateInterval-r16 INTEGER (0..15),

iod-ssr-r16 INTEGER (0..15),

correctionPointSetID-r16 INTEGER (0..16383),

stec-SatList-r16 STEC-SatList-r16,

...

}

STEC-SatList-r16 ::= SEQUENCE (SIZE(1..64)) OF STEC-SatElement-r16

STEC-SatElement-r16 ::= SEQUENCE {

svID-r16 SV-ID,

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

stec-C00-r16 INTEGER (-8192..8191),

stec-C01-r16 INTEGER (-2048..2047) OPTIONAL,

stec-C10-r16 INTEGER (-2048..2047) OPTIONAL,

stec-C11-r16 INTEGER (-512..511) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-SSR-STEC-Correction* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the STEC correction data. The *gnss-TimeID* in *GNSS-SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***ssrUpdateInterval***  This field specifies the SSR Update Interval. The SSR Update Intervals for all SSR parameters start at time 00:00:00 of the GPS time scale. A change of the SSR Update Interval during the transmission of SSR data should ensure consistent data for a target device. See table Value to SSR Update Interval Relation in IE *GNSS‑SSR‑OrbitCorrections*. |
| ***correctionPointSetID***  This field provides the ID of the *GNSS-SSR-CorrectionPoints* set. The reference point used for the STEC calculations (see NOTE below) is the reference pointprovided in IE *GNSS-SSR-CorrectionPoints* with the same *correctionPointSetID.* |
| ***iod-ssr***  This field specifies the Issue of Data number for the SSR data. A change of *iod-ssr* is used to indicate a change in the SSR generating configuration. |
| ***svID***  This field specifies the GNSS satellite for which the STEC corrections are provided. |
| ***stecQualityIndicator***  This field specifies SSR STEC quality indicator. The STEC quality indicator is represented by a combination of CLASS and VALUE. The 3 MSB define the CLASS with a range of 0-7 and the 3 LSB define the VALUE with a range of 0-7. See Table ‘Relationship between SSR STEC quality indicator and physical quantity’ below. |
| ***stec-C00***  This field provides the polynomial coefficient *C00* used to define the STEC. as defined in [xx]. NOTE  Scale factor 0.05 TECU; range ±409.55 TECU. |
| ***stec-C01***  This field provides the polynomial coefficient *C01* used to define the STEC as defined in [xx]. NOTE  Scale factor 0.02 TECU/deg; range ±40.94 TECU/deg. |
| ***stec-C10***  This field provides the polynomial coefficient *C10* used to define the STEC as defined in [xx]. NOTE  Scale factor 0.02 TECU/deg; range ±40.94 TECU/deg. |
| ***stec-C11***  This field provides the polynomial coefficient *C11* used to define the STEC as defined in [xx]. NOTE  Scale factor 0.02 TECU/deg2; range ±10.22 TECU/deg2. |

NOTE: The polynomial coefficients *C00*, *C01*, *C10*, *C11* are used to define the STEC as follows:

(1) If only *C00* is included in *STEC-SatElement*:

*Iai* = *C00*.

(2) If only *C00, C01* and *C10* are included in *STEC-SatElement*:

*Iai* = *C00 + C01*(* – 0*) *+ C10*(* – 0*).

(3) If all of *C00, C01, C10* and *C11* are included in *STEC-SatElement*:

*Iai* = *C00 + C01*(* – 0*)+ *C10*(* – 0*)*+C11*(* – 0*)(* – 0*).

Other combinations of *C00*, *C01*, *C10*, *C11* than (1)-(3) above are undefined in this version of the sepcification.

The equations above depend on the latitude ** and longitude ** of an evaluated point and latitude *0* and longitude *0* of the reference point which is defined in IE *GNSS-SSR-CorrectionPoints* (*referencePointLatitude* and *referencePointLongitude*).

Relationship between SSR STEC quality indicator and physical quantity

|  |  |  |  |
| --- | --- | --- | --- |
| CLASS | VALUE | Index | SSR STEC Quality Indicator Q [TECU] |
| 7 | 7 | 63 | 33.6664 < Q |
| 7 | 6 | 62 | 30.2992 < Q ≤ 33.6664 |
| 7 | 5 | 61 | 26.9319 < Q ≤ 30.2992 |
| 7 | 4 | 60 | 23.5647 < Q ≤ 26.9319 |
| 7 | 3 | 59 | 20.1974 < Q ≤ 23.5647 |
| 7 | 2 | 58 | 16.8301 < Q ≤ 20.1974 |
| 7 | 1 | 57 | 13.4629 < Q ≤ 16.8301 |
| 7 | 0 | 56 | 12.3405 < Q ≤ 13.4629 |
| 6 | 7 | 55 | 11.2180 < Q ≤ 12.3405 |
| 6 | 6 | 54 | 10.0956 < Q ≤ 11.2180 |
| 6 | 5 | 53 | 8.9732 < Q ≤ 10.0956 |
| 6 | 4 | 52 | 7.8508 < Q ≤ 8.9732 |
| 6 | 3 | 51 | 6.7284 < Q ≤ 7.8508 |
| 6 | 2 | 50 | 5.6059 < Q ≤ 6.7284 |
| 6 | 1 | 49 | 4.4835 < Q ≤ 5.6059 |
| 6 | 0 | 48 | 4.1094 < Q ≤ 4.4835 |
| 5 | 7 | 47 | 3.7352 < Q ≤ 4.1094 |
| 5 | 6 | 46 | 3.3611 < Q ≤ 3.7352 |
| 5 | 5 | 45 | 2.9870 < Q ≤ 3.3611 |
| 5 | 4 | 44 | 2.6128 < Q ≤ 2.9870 |
| 5 | 3 | 43 | 2.2387 < Q ≤ 2.6128 |
| 5 | 2 | 42 | 1.8645 < Q ≤ 2.2387 |
| 5 | 1 | 41 | 1.4904 < Q ≤ 1.8645 |
| 5 | 0 | 40 | 1.3657 < Q ≤ 1.4904 |
| 4 | 7 | 39 | 1.2410 < Q ≤ 1.3657 |
| 4 | 6 | 38 | 1.1163 < Q ≤ 1.2410 |
| 4 | 5 | 37 | 0.9915 < Q ≤ 1.1163 |
| 4 | 4 | 36 | 0.8668 < Q ≤ 0.9915 |
| 4 | 3 | 35 | 0.7421 < Q ≤ 0.8668 |
| 4 | 2 | 34 | 0.6174 < Q ≤ 0.7421 |
| 4 | 1 | 33 | 0.4927 < Q ≤ 0.6174 |
| 4 | 0 | 32 | 0.4511 < Q ≤ 0.4927 |
| 3 | 7 | 31 | 0.4096 < Q ≤ 0.4511 |
| 3 | 6 | 30 | 0.3680 < Q ≤ 0.4096 |
| 3 | 5 | 29 | 0.3264 < Q ≤ 0.3680 |
| 3 | 4 | 28 | 0.2848 < Q ≤ 0.3264 |
| 3 | 3 | 27 | 0.2433 < Q ≤ 0.2848 |
| 3 | 2 | 26 | 0.2017 < Q ≤ 0.2433 |
| 3 | 1 | 25 | 0.1601 < Q ≤ 0.2017 |
| 3 | 0 | 24 | 0.1463 < Q ≤ 0.1601 |
| 2 | 7 | 23 | 0.1324 < Q ≤ 0.1463 |
| 2 | 6 | 22 | 0.1186 < Q ≤ 0.1324 |
| 2 | 5 | 21 | 0.1047 < Q ≤ 0.1186 |
| 2 | 4 | 20 | 0.0908 < Q ≤ 0.1047 |
| 2 | 3 | 19 | 0.0770 < Q ≤ 0.0908 |
| 2 | 2 | 18 | 0.0631 < Q ≤ 0.0770 |
| 2 | 1 | 17 | 0.0493 < Q ≤ 0.0631 |
| 2 | 0 | 16 | 0.0447 < Q ≤ 0.0493 |
| 1 | 7 | 15 | 0.0400 < Q ≤ 0.0447 |
| 1 | 6 | 14 | 0.0354 < Q ≤ 0.0400 |
| 1 | 5 | 13 | 0.0308 < Q ≤ 0.0354 |
| 1 | 4 | 12 | 0.0262 < Q ≤ 0.0308 |
| 1 | 3 | 11 | 0.0216 < Q ≤ 0.0262 |
| 1 | 2 | 10 | 0.0169 < Q ≤ 0.0216 |
| 1 | 1 | 9 | 0.0123 < Q ≤ 0.0169 |
| 1 | 0 | 8 | 0.0108 < Q ≤ 0.0123 |
| 0 | 7 | 7 | 0.0092 < Q ≤ 0.0108 |
| 0 | 6 | 6 | 0.0077 < Q ≤ 0.0092 |
| 0 | 5 | 5 | 0.0062 < Q ≤ 0.0077 |
| 0 | 4 | 4 | 0.0046 < Q ≤ 0.0062 |
| 0 | 3 | 3 | 0.0031 < Q ≤ 0.0046 |
| 0 | 2 | 2 | 0.0015 < Q ≤ 0.0031 |
| 0 | 1 | 1 | Q ≤ 0.0015 |
| 0 | 0 | 0 | undefined/unknown |

#### *– GNSS-SSR-GriddedCorrection*

The IE *GNSS-SSR-GriddedCorrection* is used by the location server to provide troposphere delay correction, together with the residual part of the STEC corrections.

The parameters provided in IE *GNSS-SSR-GriddedCorrection* are used as specified for Compact SSR Gridded Correction Message (e.g., message type 4073,9) in [xx] and apply to all GNSS.

-- ASN1START

GNSS-SSR-GriddedCorrection-r16 ::= SEQUENCE {

epochTime-r16 GNSS-SystemTime,

ssrUpdateInterval-r16 INTEGER (0..15),

iod-ssr-r16 INTEGER (0..15),

troposphericDelayQualityIndicator-r16 BIT STRING (SIZE(6)) OPTIONAL, -- Cond Tropo

correctionPointSetID-r16 INTEGER (0..16383),

gridList-r16 GridList-r16, ...

}

GridList-r16 ::= SEQUENCE (SIZE(1..64)) OF GridElement-r16

GridElement-r16 ::= SEQUENCE {

tropospericDelayCorrection-r16 TropospericDelayCorrection-r16 OPTIONAL,

stec-ResidualSatList-r16 STEC-ResidualSatList-r16 OPTIONAL,

...

}

TropospericDelayCorrection-r16 ::= SEQUENCE {

tropoHydroStaticVerticalDelay-r16 INTEGER (-256..255),

tropoWetVerticalDelay-r16 INTEGER (-128..127),

...

}

STEC-ResidualSatList-r16 ::= SEQUENCE (SIZE(1..64)) OF STEC-ResidualSatElement-r16

STEC-ResidualSatElement-r16 ::= SEQUENCE {

svID-r16 SV-ID,

stecResidualCorrection-r16 CHOICE {

b7-r16 INTEGER (-64..63),

b16-r16 INTEGER (-32768..32767)

},

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *Tropo* | The field is mandatory present if *tropospericDelayCorrection* is included in *gridList*. Otherwise it is not present. |

| *GNSS-SSR-GriddedCorrection* field descriptions |
| --- |
| ***epochTime***  This field specifies the epoch time of the gridded correction data. The *gnss-TimeID* in *GNSS-SystemTime* shall be the same as the *GNSS-ID* in IE *GNSS-GenericAssistDataElement*. |
| ***ssrUpdateInterval***  This field specifies the SSR Update Interval. The SSR Update Intervals for all SSR parameters start at time 00:00:00 of the GPS time scale. A change of the SSR Update Interval during the transmission of SSR data should ensure consistent data for a target device. See table Value to SSR Update Interval Relation in IE *GNSS‑SSR‑OrbitCorrections*. |
| ***iod-ssr***  This field specifies the Issue of Data number for the SSR data. A change of *iod-ssr* is used to indicate a change in the SSR generating configuration. |
| ***troposphericDelayQualityIndicator***  This field specifies the quality indicator of the tropospheric delay. The troposphere quality indicator is represented by a combination of CLASS and VALUE. The 3 MSB define the CLASS with a range of 0-7 and the 3 LSB define the VALUE with a range of 0-7. The troposphere quality indicator is computed by:  See Table ‘Relationship between SSR troposphere quality and URA indicator and physical quantity’ below. |
| ***correctionPointSetID***  This field provides the ID of the *GNSS-SSR-CorrectionPoints* set. The *GNSS-SSR-GriddedCorrection* are valid for the correction points provided in IE *GNSS-SSR-CorrectionPoints* with the same *correctionPointSetID.* |
| ***gridList***  This field provides the troposphere delay correction together with the residual part of the STEC corrections for up to 64 correction points defined in IE *GNSS-SSR-CorrectionPoints*.  If the IE *GNSS-SSR-CorrectionPoints,* which belongs to the *correctionPointSetID*, includes the *listOfCorrectionPoints*, the *gridList* includes the same number of entries, and listed in the same order, as in the *listOfCorrectionPoints.*  If the IE *GNSS-SSR-CorrectionPoints,* which belongs to this *correctionPointSetID*, includes the *arrayOfCorrectionPoints* the *gridList* includes the same number of entries, and listed in the same order, as defined by the enabled bits in the *bitmaskOfGrids*. |
| ***tropoHydroStaticVerticalDelay***  This field specifies the variation in the hydro static troposphere vertical delay relative to nominal value. The target device should add the constant nominal value of 2.3 m to calculate the tropospheric hydro-static vertical delay.  Scale factor 0.004 m; range ±1.02 m. |
| ***tropoWetVerticalDelay***  This field specifies the variation in the wet troposphere vertical delay relative to nominal value. The target device should add the constant value of 0.252 m to calculate the tropospheric wet (non hydro-static) vertical delay.  Scale factor 0.004 m; range ±0.508 m. |
| ***svID***  This field specifies the GNSS satellite for which the STEC residual corrections are provided. |
| ***stecResidualCorrection***  This field specifies the STEC residual correction.  Scale factor 0.04 TECU; range ±2.52 TECU (b7) or ±1310.68 TECU (b16). |

Relationship between SSR troposphere quality and URA indicator and physical quantity

|  |  |  |  |
| --- | --- | --- | --- |
| CLASS | VALUE | Index | SSR troposphere quality indicator  and  SSR URA  Q [mm] |
| 7 | 7 | 63 | 5466.50 < Q |
| 7 | 6 | 62 | 4919.75 < Q ≤ 5466.50 |
| 7 | 5 | 61 | 4373.75 < Q ≤ 4919.75 |
| 7 | 4 | 60 | 3826.25 < Q ≤ 4373.00 |
| 7 | 3 | 59 | 3279.50 < Q ≤ 3826.25 |
| 7 | 2 | 58 | 2732.75 < Q ≤ 3279.50 |
| 7 | 1 | 57 | 2186.00 < Q ≤ 2732.75 |
| 7 | 0 | 56 | 2003.75 < Q ≤ 2186.00 |
| 6 | 7 | 55 | 1821.50 < Q ≤ 2003.75 |
| 6 | 6 | 54 | 1639.25 < Q ≤ 1821.50 |
| 6 | 5 | 53 | 1457.00 < Q ≤ 1639.25 |
| 6 | 4 | 52 | 1274.75 < Q ≤ 1457.00 |
| 6 | 3 | 51 | 1092.50 < Q ≤ 1274.75 |
| 6 | 2 | 50 | 910.25 < Q ≤ 1092.50 |
| 6 | 1 | 49 | 728.00 < Q ≤ 910.25 |
| 6 | 0 | 48 | 667.25 < Q ≤ 728.00 |
| 5 | 7 | 47 | 606.50 < Q ≤ 667.25 |
| 5 | 6 | 46 | 545.75 < Q ≤ 606.50 |
| 5 | 5 | 45 | 485.00 < Q ≤ 545.75 |
| 5 | 4 | 44 | 424.25 < Q ≤ 485.00 |
| 5 | 3 | 43 | 363.50 < Q ≤ 425.25 |
| 5 | 2 | 42 | 302.75 < Q ≤ 363.50 |
| 5 | 1 | 41 | 242.00 < Q ≤ 302.75 |
| 5 | 0 | 40 | 221.75 < Q ≤ 242.00 |
| 4 | 7 | 39 | 201.50 < Q ≤ 221.75 |
| 4 | 6 | 38 | 181.25 < Q ≤ 201.50 |
| 4 | 5 | 37 | 161.00 < Q ≤ 181.25 |
| 4 | 4 | 36 | 140.75 < Q ≤ 161.00 |
| 4 | 3 | 35 | 120.50 < Q ≤ 140.75 |
| 4 | 2 | 34 | 100.25 < Q ≤ 120.50 |
| 4 | 1 | 33 | 80.00 < Q ≤ 100.25 |
| 4 | 0 | 32 | 73.25 < Q ≤ 80.00 |
| 3 | 7 | 31 | 66.50 < Q ≤ 73.25 |
| 3 | 6 | 30 | 59.75 < Q ≤ 66.50 |
| 3 | 5 | 29 | 53.00 < Q ≤ 59.75 |
| 3 | 4 | 28 | 46.25 < Q ≤ 53.00 |
| 3 | 3 | 27 | 39.50 < Q ≤ 46.25 |
| 3 | 2 | 26 | 32.75 < Q ≤ 39.50 |
| 3 | 1 | 25 | 26.00 < Q ≤ 32.75 |
| 3 | 0 | 24 | 23.75 < Q ≤ 26.00 |
| 2 | 7 | 23 | 21.50 < Q ≤ 23.75 |
| 2 | 6 | 22 | 19.25 < Q ≤ 21.50 |
| 2 | 5 | 21 | 17.00 < Q ≤ 19.25 |
| 2 | 4 | 20 | 14.75 < Q ≤ 17.00 |
| 2 | 3 | 19 | 12.50 < Q ≤ 14.75 |
| 2 | 2 | 18 | 10.25 < Q ≤ 12.50 |
| 2 | 1 | 17 | 8.00 < Q ≤ 10.25 |
| 2 | 0 | 16 | 7.25 < Q ≤ 8.00 |
| 1 | 7 | 15 | 6.50 < Q ≤ 7.25 |
| 1 | 6 | 14 | 5.75 < Q ≤ 6.50 |
| 1 | 5 | 13 | 5.00 < Q ≤ 5.75 |
| 1 | 4 | 12 | 4.25 < Q ≤ 5.00 |
| 1 | 3 | 11 | 3.50 < Q ≤ 4.25 |
| 1 | 2 | 10 | 2.75 < Q ≤ 3.50 |
| 1 | 1 | 9 | 2.00 < Q ≤ 2.75 |
| 1 | 0 | 8 | 1.75 < Q ≤ 2.00 |
| 0 | 7 | 7 | 1.50 < Q ≤ 1.75 |
| 0 | 6 | 6 | 1.25 < Q ≤ 1.50 |
| 0 | 5 | 5 | 1.00 < Q ≤ 1.25 |
| 0 | 4 | 4 | 0.75 < Q ≤ 1.00 |
| 0 | 3 | 3 | 0.50 < Q ≤ 0.75 |
| 0 | 2 | 2 | 0.25 < Q ≤ 0.50 |
| 0 | 1 | 1 | Q ≤ 0.25 |
| 0 | 0 | 0 | undefined/unknown |

#### 6.5.2.3 GNSS Assistance Data Request

#### – *A-GNSS-RequestAssistanceData*

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

-- ASN1START

A-GNSS-RequestAssistanceData ::= SEQUENCE {

gnss-CommonAssistDataReq GNSS-CommonAssistDataReq OPTIONAL, -- Cond CommonADReq

gnss-GenericAssistDataReq GNSS-GenericAssistDataReq OPTIONAL, -- Cond GenADReq

...,

[[

gnss-PeriodicAssistDataReq-r15

GNSS-PeriodicAssistDataReq-r15 OPTIONAL -- Cond PerADReq

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *CommonADReq* | The field is mandatory present if the target device requests *GNSS-CommonAssistData*; otherwise it is not present. |
| *GenADReq* | This field is mandatory present if the target device requests *GNSS-GenericAssistData* for one or more specific GNSS; otherwise it is not present. |
| *PerADReq* | This field is mandatory present if the target device requests periodic GNSS assistance data delivery. This field may only be included if any of the fields are included in IE *GNSS‑GenericAssistDataReq:*  - *GNSS-RTK-ObservationsReq*,  - *GLO-RTK-BiasInformationReq*,  - *GNSS-RTK-MAC-CorrectionDifferencesReq*,  - *GNSS-RTK-ResidualsReq,*  - *GNSS-RTK-FKP-GradientsReq*,  - *GNSS-SSR-OrbitCorrectionsReq*,  - *GNSS-SSR-ClockCorrectionsReq*,  - *GNSS-SSR-CodeBiasReq,*  *- GNSS-SSR-URA-Req,*  *- GNSS-SSR-PhaseBiasReq,*  *- GNSS-SSR-STEC-CorrectionReq, or*  *- GNSS-SSR-GriddedCorrectionReq.* |

#### – *GNSS-CommonAssistDataReq*

The IE *GNSS-CommonAssistDataReq* is used by the target device to request assistance data that are applicable to any GNSS from a location server.

-- ASN1START

GNSS-CommonAssistDataReq ::= SEQUENCE {

gnss-ReferenceTimeReq GNSS-ReferenceTimeReq

OPTIONAL, -- Cond RefTimeReq

gnss-ReferenceLocationReq GNSS-ReferenceLocationReq

OPTIONAL, -- Cond RefLocReq

gnss-IonosphericModelReq GNSS-IonosphericModelReq

OPTIONAL, -- Cond IonoModReq

gnss-EarthOrientationParametersReq GNSS-EarthOrientationParametersReq

OPTIONAL, -- Cond EOPReq

...,

[[

gnss-RTK-ReferenceStationInfoReq-r15

GNSS-RTK-ReferenceStationInfoReq-r15

OPTIONAL, -- Cond ARPReq

gnss-RTK-AuxiliaryStationDataReq-r15

GNSS-RTK-AuxiliaryStationDataReq-r15

OPTIONAL -- Cond AuxARPReq

]],

[[

gnss-SSR-CorrectionPointsReq-r16

GNSS-SSR-CorrectionPointsReq-r16

OPTIONAL -- Cond PointsReq

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *RefTimeReq* | The field is mandatory present if the target device requests *GNSS-ReferenceTime*; otherwise it is not present. |
| *RefLocReq* | This field is mandatory present if the target device requests *GNSS-ReferenceLocation*; otherwise it is not present. |
| *IonoModReq* | This field is mandatory present if the target device requests *GNSS-IonosphericModel*; otherwise it is not present. |
| *EOPReq* | This field is mandatory present if the target device requests *GNSS-EarthOrientationParameters*; otherwise it is not present. |
| *ARPReq* | This field is mandatory present if the target device requests *GNSS‑RTK‑ReferenceStationInfo*; otherwise it is not present. |
| *AuxARPReq* | This field is mandatory present if the target device requests *GNSS‑RTK‑AuxiliaryStationData*; otherwise it is not present. |
| *PointsReq* | This field is mandatory present if the target device requests *GNSS-SSR-CorrectionPoints*; otherwise it is not present. |

#### – *GNSS-GenericAssistDataReq*

The IE *GNSS-GenericAssistDataReq* is used by the target device to request assistance data from a location server for one or more specific GNSS (e.g., GPS, Galileo, GLONASS, BDS, etc.). The specific GNSS for which the assistance data are requested is indicated by the IE *GNSS‑ID* and (if applicable) by the IE *SBAS‑ID*. Assistance for up to 16 GNSSs can be requested.

-- ASN1START

GNSS-GenericAssistDataReq ::= SEQUENCE (SIZE (1..16)) OF GNSS-GenericAssistDataReqElement

GNSS-GenericAssistDataReqElement ::= SEQUENCE {

gnss-ID GNSS-ID,

sbas-ID SBAS-ID OPTIONAL, -- Cond GNSS-ID-SBAS

gnss-TimeModelsReq GNSS-TimeModelListReq OPTIONAL, -- Cond TimeModReq

gnss-DifferentialCorrectionsReq GNSS-DifferentialCorrectionsReq OPTIONAL, -- Cond DGNSS-Req

gnss-NavigationModelReq GNSS-NavigationModelReq OPTIONAL, -- Cond NavModReq

gnss-RealTimeIntegrityReq GNSS-RealTimeIntegrityReq OPTIONAL, -- Cond RTIReq

gnss-DataBitAssistanceReq GNSS-DataBitAssistanceReq OPTIONAL, -- Cond DataBitsReq

gnss-AcquisitionAssistanceReq GNSS-AcquisitionAssistanceReq OPTIONAL, -- Cond AcquAssistReq

gnss-AlmanacReq GNSS-AlmanacReq OPTIONAL, -- Cond AlmanacReq

gnss-UTCModelReq GNSS-UTC-ModelReq OPTIONAL, -- Cond UTCModReq

gnss-AuxiliaryInformationReq GNSS-AuxiliaryInformationReq OPTIONAL, -- Cond AuxInfoReq

...,

[[

bds-DifferentialCorrectionsReq-r12

BDS-DifferentialCorrectionsReq-r12

OPTIONAL, -- Cond DBDS-Req

bds-GridModelReq-r12 BDS-GridModelReq-r12 OPTIONAL -- Cond BDS-GridModReq

]],

[[

gnss-RTK-ObservationsReq-r15

GNSS-RTK-ObservationsReq-r15 OPTIONAL, -- Cond RTK-OSR-Req

glo-RTK-BiasInformationReq-r15

GLO-RTK-BiasInformationReq-r15 OPTIONAL, -- Cond GLO-CPB-Req

gnss-RTK-MAC-CorrectionDifferencesReq-r15

GNSS-RTK-MAC-CorrectionDifferencesReq-r15

OPTIONAL, -- Cond MAC-Req

gnss-RTK-ResidualsReq-r15 GNSS-RTK-ResidualsReq-r15 OPTIONAL, -- Cond Res-Req

gnss-RTK-FKP-GradientsReq-r15

GNSS-RTK-FKP-GradientsReq-r15 OPTIONAL, -- Cond FKP-Req

gnss-SSR-OrbitCorrectionsReq-r15

GNSS-SSR-OrbitCorrectionsReq-r15

OPTIONAL, -- Cond OC-Req

gnss-SSR-ClockCorrectionsReq-r15

GNSS-SSR-ClockCorrectionsReq-r15

OPTIONAL, -- Cond CC-Req

gnss-SSR-CodeBiasReq-r15 GNSS-SSR-CodeBiasReq-r15 OPTIONAL -- Cond CB-Req

]],

[[

gnss-SSR-URA-Req-r16 GNSS-SSR-URA-Req-r16 OPTIONAL, -- Cond URA-Req

gnss-SSR-PhaseBiasReq-r16 GNSS-SSR-PhaseBiasReq-r16 OPTIONAL, -- Cond PB-Req

gnss-SSR-STEC-CorrectionReq-r16

GNSS-SSR-STEC-CorrectionReq-r16 OPTIONAL, -- Cond STEC-Req

gnss-SSR-GriddedCorrectionReq-r16

GNSS-SSR-GriddedCorrectionReq-r16

OPTIONAL -- Cond Grid-Req

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *TimeModReq* | The field is mandatory present if the target device requests *GNSS-TimeModelList*; otherwise it is not present. |
| *DGNSS-Req* | The field is mandatory present if the target device requests *GNSS-DifferentialCorrections*; otherwise it is not present. |
| *NavModReq* | The field is mandatory present if the target device requests *GNSS-NavigationModel*; otherwise it is not present. |
| *RTIReq* | The field is mandatory present if the target device requests *GNSS-RealTimeIntegrity*; otherwise it is not present. |
| *DataBitsReq* | The field is mandatory present if the target device requests *GNSS-DataBitAssistance*; otherwise it is not present. |
| *AcquAssistReq* | The field is mandatory present if the target device requests *GNSS-AcquisitionAssistance*; otherwise it is not present. |
| *AlmanacReq* | The field is mandatory present if the target device requests *GNSS-Almanac*; otherwise it is not present. |
| *UTCModReq* | The field is mandatory present if the target device requests *GNSS-UTCModel*; otherwise it is not present. |
| *AuxInfoReq* | The field is mandatory present if the target device requests *GNSS-AuxiliaryInformation*; otherwise it is not present. |
| *DBDS-Req* | The field is mandatory present if the target device requests *BDS-DifferentialCorrections*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *BDS-GridModReq* | The field is mandatory present if the target device requests *BDS-GridModel*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *RTK-OSR-Req* | The field is mandatory present if the target device requests *GNSS-RTK-Observations*; otherwise it is not present. |
| *GLO-CPB-Req* | The field is mandatory present if the target device requests *GLO-RTK-BiasInformation*; otherwise it is not present. |
| *MAC-Req* | The field is mandatory present if the target device requests *GNSS‑RTK‑MAC‑CorrectionDifferences*; otherwise it is not present. |
| *Res-Req* | The field is mandatory present if the target device requests *GNSS-RTK-Residuals*; otherwise it is not present. |
| *FKP-Req* | The field is mandatory present if the target device requests *GNSS-RTK-FKP-Gradients*; otherwise it is not present. |
| *OC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-OrbitCorrections*; otherwise it is not present. |
| *CC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-ClockCorrections*; otherwise it is not present. |
| *CB-Req* | The field is mandatory present if the target device requests *GNSS-SSR-CodeBias*; otherwise it is not present. |
| *URA-Req* | The field is mandatory present if the target device requests *GNSS-SSR-URA*; otherwise it is not present. |
| *PB-Req* | The field is mandatory present if the target device requests *GNSS-SSR-PhaseBias*; otherwise it is not present. |
| *STEC-Req* | The field is mandatory present if the target device requests *GNSS-SSR-STEC-Correction*; otherwise it is not present. |
| *Grid-Req* | The field is mandatory present if the target device requests *GNSS‑SSR‑GriddedCorrection*; otherwise it is not present. |

#### *– GNSS-PeriodicAssistDataReq*

The IE *GNSS-PeriodicAssistDataReq* is used by the target device to request periodic assistance data delivery from a location server.

-- ASN1START

GNSS-PeriodicAssistDataReq-r15 ::= SEQUENCE {

gnss-RTK-PeriodicObservationsReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pOSR

glo-RTK-PeriodicBiasInformationReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pCPB

gnss-RTK-MAC-PeriodicCorrectionDifferencesReq-r15

GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pMAC

gnss-RTK-PeriodicResidualsReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pRes

gnss-RTK-FKP-PeriodicGradientsReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pFKP

gnss-SSR-PeriodicOrbitCorrectionsReq-r15

GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pOC

gnss-SSR-PeriodicClockCorrectionsReq-r15

GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pCC

gnss-SSR-PeriodicCodeBiasReq-r15 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pCB

...,

[[

gnss-SSR-PeriodicURA-Req-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pURA

gnss-SSR-PeriodicPhaseBiasReq-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pPB

gnss-SSR-PeriodicSTEC-CorrectionReq-r16 GNSS-PeriodicControlParam-r15 OPTIONAL, -- Cond pSTEC

gnss-SSR-PeriodicGriddedCorrectionReq-r16

GNSS-PeriodicControlParam-r15 OPTIONAL -- Cond pGrid

]]

}

-- ASN1STOP

| *Conditional presence* | Explanation |
| --- | --- |
| *pOSR* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑Observations*; otherwise it is not present. |
| *pCPB* | The field is mandatory present if the target device requests periodic *GLO‑RTK‑BiasInformation*; otherwise it is not present. |
| *pMAC* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑MAC‑CorrectionDifferences*; otherwise it is not present. |
| *pRes* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑Residuals*; otherwise it is not present. |
| *pFKP* | The field is mandatory present if the target device requests periodic *GNSS‑RTK‑FKP‑Gradients*; otherwise it is not present. |
| *pOC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑OrbitCorrections*; otherwise it is not present. |
| *pCC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑ClockCorrections*; otherwise it is not present. |
| *pCB* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑CodeBias*; otherwise it is not present. |
| *pURA* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑URA*; otherwise it is not present. |
| *pPB* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑PhaseBias*; otherwise it is not present. |
| *pSTEC* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑STEC‑Correction*; otherwise it is not present. |
| *pGrid* | The field is mandatory present if the target device requests periodic *GNSS‑SSR‑GriddedCorrection*; otherwise it is not present. |

#### 6.5.2.4 GNSS Assistance Data Request Elements

#### – *GNSS-ReferenceTimeReq*

The IE *GNSS-ReferenceTimeReq* is used by the target device to request the *GNSS-ReferenceTime* assistance from the location server.

-- ASN1START

GNSS-ReferenceTimeReq ::= SEQUENCE {

gnss-TimeReqPrefList SEQUENCE (SIZE (1..8)) OF GNSS-ID,

gps-TOW-assistReq BOOLEAN OPTIONAL, -- Cond gps

notOfLeapSecReq BOOLEAN OPTIONAL, -- Cond glonass

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *gps* | The field is mandatory present if *gnss-TimeReqPrefList* includes a *GNSS-ID*= 'gps'; otherwise it is not present. |
| *glonass* | The field is mandatory present if *gnss-TimeReqPrefList* includes a *GNSS-ID*= 'glonass'; otherwise it is not present. |

| *GNSS-ReferenceTimeReq* field descriptions |
| --- |
| ***gnss-TimeReqPrefList***  This field is used by the target device to request the system time for a specific GNSS, specified by GNSS-ID in the order of preference. The first *GNSS-ID* in the list is the most preferred GNSS for reference time, the second *GNSS-ID* is the second most preferred, etc. |
| ***gps-TOW-assistReq***  This field is used by the target device to request the *gps-TOW-Assist* field in *GNSS-SystemTime*. TRUE means requested. |
| ***notOfLeapSecReq***  This field is used by the target device to request the *notificationOfLeapSecond* field in *GNSS-SystemTime*. TRUE means requested. |

#### – *GNSS-ReferenceLocationReq*

The IE *GNSS-ReferenceLocationReq* is used by the target device to request the *GNSS-ReferenceLocation* assistancefrom the location server.

-- ASN1START

GNSS-ReferenceLocationReq ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-IonosphericModelReq*

The IE *GNSS-IonosphericModelReq* is used by the target device to request the *GNSS-IonosphericModel* assistancefrom the location server.

-- ASN1START

GNSS-IonosphericModelReq ::= SEQUENCE {

klobucharModelReq BIT STRING (SIZE(2)) OPTIONAL, -- Cond klobuchar

neQuickModelReq NULL OPTIONAL, -- Cond nequick

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *klobuchar* | The field is mandatory present if the target device requests *klobucharModel*; otherwise it is not present. The BIT STRING defines the *dataID* requested, defined in IE *KlobucharModelParameter*. |
| *nequick* | The field is mandatory present if the target device requests *neQuickModel*; otherwise it is not present. |

#### – *GNSS-EarthOrientationParametersReq*

The IE *GNSS-EarthOrientationParametersReq* is used by the target device to request the *GNSS-EarthOrientationParameters* assistancefrom the location server.

-- ASN1START

GNSS-EarthOrientationParametersReq ::= SEQUENCE {

...

}

-- ASN1STOP

#### *– GNSS-RTK-ReferenceStationInfoReq*

The IE *GNSS-RTK-ReferenceStationInfoReq* is used by the target device to request the *GNSS‑RTK‑ReferenceStationInfo* assistancefrom the location server.

-- ASN1START

GNSS-RTK-ReferenceStationInfoReq-r15 ::= SEQUENCE {

antennaDescriptionReq-r15 BOOLEAN,

antennaHeightReq-r15 BOOLEAN,

physicalReferenceStationReq-r15 BOOLEAN,

stationID-r15 GNSS-ReferenceStationID-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-RTK-ReferenceStationInfoReq* field descriptions |
| --- |
| ***antennaDescriptionReq***  This field specifies whether or not the location server is requested to include the field *AntennaDescription* in the *GNSS-RTK-ReferenceStationInfo* IE. TRUE means requested. |
| ***antennaHeightReq***  This field specifies whether or not the location server is requested to include the field *antennaHeight* in the *GNSS‑RTK-ReferenceStationInfo* IE. TRUE means requested. |
| ***physicalReferenceStationReq***  This field specifies whether or not the location server is requested to include the field *physical-reference-station-info* in the *GNSS‑RTK-ReferenceStationInfo* IE. TRUE means requested. |
| ***stationID***  This field specifies the Station ID for which the *GNSS-RTK-ReferenceStationInfo* is requested. |

#### *– GNSS-RTK-AuxiliaryStationDataReq*

The IE *GNSS-RTK-AuxiliaryStationDataReq* is used by the target device to request the *GNSS‑RTK‑AuxiliaryStationData* assistancefrom the location server.

-- ASN1START

GNSS-RTK-AuxiliaryStationDataReq-r15 ::= SEQUENCE {

master-referenceStationID-r15 GNSS-ReferenceStationID-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-RTK-AuxiliaryStationDataReq* field descriptions |
| --- |
| ***master-referenceStationID***  This field specifies the Master Reference Station ID for which the Auxiliary Stations are requested. |

#### – *GNSS-SSR-CorrectionPointsReq*

The IE *GNSS-SSR-CorrectionPointsReq* is used by the target device to request the *GNSS-SSR-CorrectionPoints* assistancefrom the location server.

-- ASN1START

GNSS-SSR-CorrectionPointsReq-r16 ::= SEQUENCE {

correctionPointSetID-Req-r16 INTEGER (0..16383) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-SSR-CorrectionPointsReq* field descriptions |
| --- |
| ***correctionPointSetID-Req***  This field specifies the ID of the Atmospheric Correction Point set for which the *GNSS-SSR-CorrectionPoints* are requested. |

#### – *GNSS-TimeModelListReq*

The IE *GNSS-TimeModelListReq* is used by the target device to request the *GNSS-TimeModelElement* assistancefrom the location server.

-- ASN1START

GNSS-TimeModelListReq ::= SEQUENCE (SIZE(1..15)) OF GNSS-TimeModelElementReq

GNSS-TimeModelElementReq ::= SEQUENCE {

gnss-TO-IDsReq INTEGER (1..15),

deltaTreq BOOLEAN,

...

}

-- ASN1STOP

| *GNSS-TimeModelElementReq* field descriptions |
| --- |
| ***gnss-TO-IDsReq***  This field specifies the requested *gnss-TO-ID*. The meaning and encoding is the same as the *gnss-TO-ID* field in the *GNSS-TimeModelElement* IE. |
| ***deltaTreq***  This field specifies whether or not the location server is requested to include the *deltaT* field in the *GNSS-TimeModelElement* IE. TRUE means requested. |

#### – *GNSS-DifferentialCorrectionsReq*

The IE *GNSS-DifferentialCorrectionsReq* is used by the target device to request the *GNSS-DifferentialCorrections* assistancefrom the location server.

-- ASN1START

GNSS-DifferentialCorrectionsReq ::= SEQUENCE {

dgnss-SignalsReq GNSS-SignalIDs,

dgnss-ValidityTimeReq BOOLEAN,

...

}

-- ASN1STOP

| *GNSS-DifferentialCorrectionsReq* field descriptions |
| --- |
| ***dgnss-SignalsReq***  This field specifies the GNSS Signal(s) for which the *GNSS-DifferentialCorrections* are requested. A one‑value at a bit position means DGNSS corrections for the specific signal are requested; a zero‑value means not requested. The target device shall set a maximum of three bits to value 'one'. |
| ***dgnss-ValidityTimeReq***  This field specifies whether the *udreGrowthRate* and *udreValidityTime* in *GNSS-DifferentialCorrections* are requested or not. TRUE means requested. |

#### – *GNSS-NavigationModelReq*

The IE *GNSS-NavigationModelReq* is used by the target device to request the *GNSS-NavigationModel* assistancefrom the location server.

-- ASN1START

GNSS-NavigationModelReq ::= CHOICE {

storedNavList StoredNavListInfo,

reqNavList ReqNavListInfo,

...

}

StoredNavListInfo ::= SEQUENCE {

gnss-WeekOrDay INTEGER (0..4095),

gnss-Toe INTEGER (0..255),

t-toeLimit INTEGER (0..15),

satListRelatedDataList SatListRelatedDataList OPTIONAL,

...

}

SatListRelatedDataList ::= SEQUENCE (SIZE (1..64)) OF SatListRelatedDataElement

SatListRelatedDataElement ::= SEQUENCE {

svID SV-ID,

iod BIT STRING (SIZE(11)),

clockModelID INTEGER (1..8) OPTIONAL,

orbitModelID INTEGER (1..8) OPTIONAL,

...

}

ReqNavListInfo ::= SEQUENCE {

svReqList BIT STRING (SIZE (64)),

clockModelID-PrefList SEQUENCE (SIZE (1..8)) OF INTEGER (1..8) OPTIONAL,

orbitModelID-PrefList SEQUENCE (SIZE (1..8)) OF INTEGER (1..8) OPTIONAL,

addNavparamReq BOOLEAN OPTIONAL, -- Cond orbitModelID-2

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *orbitModelID-2* | The field is mandatory present if *orbitModelID-PrefList* is absent or includes a Model-ID = '2'; otherwise it is not present. |

| *GNSS-NavigationModelReq* field descriptions |
| --- |
| ***storedNavList***  This list provides information to the location server about which *GNSS-NavigationModel* data the target device has currently stored for the particular GNSS indicated by *GNSS-ID*. |
| ***reqNavList***  This list provides information to the location server which *GNSS-NavigationModel* data are requested by the target device. |
| ***gnss-WeekOrDay***  If *GNSS-ID* does not indicate 'glonass', this field defines the GNSS Week number of the assistance currently held by the target device.  If *GNSS-ID* is set to 'glonass', this field defines the calendar number of day within the four-year interval starting from 1st of January in a leap year, as defined by the parameter NT in [9] of the assistance currently held by the target device. |
| ***gnss-Toe***  If *GNSS-ID* does not indicate 'glonass', this field defines the GNSS time of ephemeris in hours of the latest ephemeris set contained by the target device.  If *GNSS-ID* is set to 'glonass', this field defines the time of ephemeris in units of 15 minutes of the latest ephemeris set contained by the target device (range 0 to 95 representing time values between 0 and 1425 minutes). In this case, values 96 to 255 shall not be used by the sender. |
| ***t-toeLimit***  If *GNSS-ID* does not indicate 'glonass', this IE defines the ephemeris age tolerance of the target device in units of hours.  If *GNSS-ID* is set to 'glonass', this IE defines the ephemeris age tolerance of the target device in units of 30 minutes. |
| ***satListRelatedDataList***  This list defines the clock and orbit models currently held by the target device for each SV. This field is not included if the target device does not have any stored clock and orbit models for any SV. |
| ***svID***  This field identifies the particular GNSS satellite. |
| ***iod***  This field identifies the issue of data currently held by the target device. |
| ***clockModelID, orbitModelID***  These fields define the clock and orbit model number currently held by the target device. If these fields are absent, the default interpretation of the table GNSS-ID to clockModelID & orbitModelID relation below applies. |
| ***svReqList***  This field defines the SV for which the navigation model assistance is requested. Each bit position in this BIT STRING represents a *SV-ID*. Bit 0 represents *SV-ID*=0 and bit 63 represents *SV-ID*=63. A one-value at a bit position means the navigation model data for the corresponding *SV-ID* is requested, a zero-value means not requested. |
| ***clockModelIDPrefList, orbitModelID-PrefList***  These fields define the Model-IDs of the clock and orbit models that the target device wishes to obtain in the order of preference. The first Model-ID in the list is the most preferred model, the second Model-ID the second most preferred, etc. If these fields are absent, the default interpretation of the table GNSS-ID to clockModelID-PrefList & orbitModelIDPrefList relation below applies. |
| ***addNavparamReq***  This field specifies whether the location server is requested to include the *addNAVparam* fields in *GNSS-NavigationModel* IE (*NavModel-NAVKeplerianSet* field) or not. TRUE means requested. |

GNSS-ID to clockModelID & orbitModelID relation

|  |  |  |
| --- | --- | --- |
| *GNSS-ID* | *clockModelID* | *orbitModelID* |
| gps | 2 | 2 |
| sbas | 5 | 5 |
| qzss | 2 | 2 |
| galileo | 1 | 1 |
| glonass | 4 | 4 |
| bds | 6 | 6 |

GNSS-ID to clockModelID-PrefList & orbitModelID-PrefList relation

|  |  |  |
| --- | --- | --- |
| *GNSS-ID* | *clockModelID-PrefList* | *orbitModelID-PrefList* |
| gps | Model-2 | Model-2 |
| sbas | Model-5 | Model-5 |
| qzss | Model-2 | Model-2 |
| galileo | Model-1 | Model-1 |
| glonass | Model-4 | Model-4 |
| bds | Model-6 | Model-6 |

#### – *GNSS-RealTimeIntegrityReq*

The IE *GNSS-RealTimeIntegrityReq* is used by the target device to request the *GNSS-RealTimeIntegrity* assistancefrom the location server.

-- ASN1START

GNSS-RealTimeIntegrityReq ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-DataBitAssistanceReq*

The IE *GNSS-DataBitAssistanceReq* is used by the target device to request the *GNSS-DataBitAssistance* assistancefrom the location server.

-- ASN1START

GNSS-DataBitAssistanceReq ::= SEQUENCE {

gnss-TOD-Req INTEGER (0..3599),

gnss-TOD-FracReq INTEGER (0..999) OPTIONAL,

dataBitInterval INTEGER (0..15),

gnss-SignalType GNSS-SignalIDs,

gnss-DataBitsReq GNSS-DataBitsReqSatList OPTIONAL,

...

}

GNSS-DataBitsReqSatList ::= SEQUENCE (SIZE(1..64)) OF GNSS-DataBitsReqSatElement

GNSS-DataBitsReqSatElement ::= SEQUENCE {

svID SV-ID,

...

}

-- ASN1STOP

| *GNSS-DataBitAssistanceReq* field descriptions |
| --- |
| ***gnss-TOD-Req***  This field specifies the reference time for the first data bit requested in GNSS specific system time, modulo 1 hour.  Scale factor 1 second. |
| ***gnss-TOD-FracReq***  This field specifies the fractional part of *gnss-TOD-Req* in 1-milli‑second resolution.  Scale factor 1 millisecond. |
| ***dataBitInterval***  This field specifies the time length for which the Data Bit Assistance is requested. The *GNSS-DataBitAssistance* shall be relative to the time interval (*gnss-TOD-Req*, *gnss-TOD-Req* + *dataBitInterval*).  The *dataBitInterval**r*, expressed in seconds, is mapped to a binary number K with the following formula:  *r* =0.1 × 2 K  Value K=15 means that the time interval is not specified. |
| ***gnss-SignalType***  This field specifies the GNSS Signal(s) for which the *GNSS-DataBitAssistance* are requested. A one‑value at a bit position means *GNSS-DataBitAssistance* for the specific signal is requested; a zero‑value means not requested. |
| ***gnss-DataBitsReq***  This list contains the SV-IDs for which the *GNSS-DataBitAssistance* is requested. |

#### – *GNSS-AcquisitionAssistanceReq*

The IE *GNSS-AcquisitionAssistanceReq* is used by the target device to request the *GNSS-AcquisitionAssistance* assistancefrom the location server.

-- ASN1START

GNSS-AcquisitionAssistanceReq ::= SEQUENCE {

gnss-SignalID-Req GNSS-SignalID,

...

}

-- ASN1STOP

| *GNSS-AcquisitionAssistanceReq* field descriptions |
| --- |
| ***gnss-SignalID-Req***  This field specifies the GNSS signal type for which *GNSSAcquisitionAssistance* is requested. |

#### – *GNSS-AlmanacReq*

The IE *GNSS-AlmanacReq* is used by the target device to request the *GNSS-Almanac* assistancefrom the location server.

-- ASN1START

GNSS-AlmanacReq ::= SEQUENCE {

modelID INTEGER(1..8) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-AlmanacReq* field descriptions |
| --- |
| ***modelID***  This field specifies the Almanac Model ID requested. If this field is absent, the default interpretation as in the table GNSS-ID to modelID relation below applies. |

GNSS-ID to modelID relation

|  |  |
| --- | --- |
| *GNSS-ID* | *modelID* |
| gps | 2 |
| sbas | 6 |
| qzss | 2 |
| galileo | 1 |
| glonass | 5 |
| bds | 7 |

#### – *GNSS-UTC-ModelReq*

The IE *GNSS-UTC-ModelReq* is used by the target device to request the *GNSS-UTC-Model* assistancefrom the location server.

-- ASN1START

GNSS-UTC-ModelReq ::= SEQUENCE {

modelID INTEGER(1..8) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-UTC-ModelReq* field descriptions |
| --- |
| ***modelID***  This field specifies the *GNSS-UTCModel* set requested. If this field is absent, the default interpretation as in the table GNSS-ID to modelID relation below applies. |

GNSS-ID to modelID relation

|  |  |
| --- | --- |
| *GNSS-ID* | *modelID* |
| gps | 1 |
| sbas | 4 |
| qzss | 1 |
| galileo | 1 |
| glonass | 3 |
| bds | 5 |

#### – *GNSS-AuxiliaryInformationReq*

The IE *GNSS-AuxiliaryInformationReq* is used by the target device to request the *GNSS-AuxiliaryInformation* assistancefrom the location server.

-- ASN1START

GNSS-AuxiliaryInformationReq ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *BDS-DifferentialCorrectionsReq*

The IE *BDS-DifferentialCorrectionsReq* is used by the target device to request the *BDS-DifferentialCorrections* assistancefrom the location server.

-- ASN1START

BDS-DifferentialCorrectionsReq-r12 ::= SEQUENCE {

dgnss-SignalsReq GNSS-SignalIDs,

...

}

-- ASN1STOP

| *BDS-DifferentialCorrectionsReq* field descriptions |
| --- |
| ***dgnss-SignalsReq***  This field specifies the BDS Signal(s) for which the *BDS-DifferentialCorrections* are requested. A one‑value at a bit position means BDS differential corrections for the specific signal are requested; a zero‑value means not requested. The target device shall set a maximum of three bits to value 'one'. |

#### – *BDS-GridModelReq*

The IE *BDS-GridModelReq* is used by the target device to request the *BDS-GridModel* assistancefrom the location server.

-- ASN1START

BDS-GridModelReq-r12 ::= SEQUENCE {

...

}

-- ASN1STOP

#### *– GNSS-RTK-ObservationsReq*

The IE *GNSS-RTK-ObservationsReq* is used by the target device to request the *GNSS-RTK-Observations* assistancefrom the location server.

-- ASN1START

GNSS-RTK-ObservationsReq-r15::= SEQUENCE {

gnss-RTK-SignalsReq-r15 GNSS-SignalIDs,

gnss-RTK-Integer-ms-Req-r15 BOOLEAN,

gnss-RTK-PhaseRangeRateReq-r15 BOOLEAN,

gnss-RTK-CNR-Req-r15 BOOLEAN,

stationID-r15 GNSS-ReferenceStationID-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-RTK-ObservationsReq* field descriptions |
| --- |
| ***gnss-RTK-SignalsReq***  This field specifies the GNSS Signal(s) for which the *GNSS-RTK-Observations* are requested. A one‑value at a bit position means RTK observations for the specific signal are requested; a zero‑value means not requested. |
| ***gnss-RTK-Integer-ms-Req***  This field specifies whether the integer-ms is requested or not. TRUE means requested. |
| ***gnss-RTK-PhaseRangeRateReq***  This field specifies whether the *rough-phase-range-rate* and *fine-PhaseRangeRate* are requested or not. TRUE means requested. |
| ***gnss-RTK-CNR-Req***  This field specifies whether the *carrier-to-noise-ratio* is requested or not. TRUE means requested. |
| ***stationID***  This field specifies the Station ID for which the GNSS-RTK-Observations are requested. |

#### *– GLO-RTK-BiasInformationReq*

The IE *GLO-RTK-BiasInformationReq* is used by the target device to request the *GLO-RTK-BiasInformation* assistancefrom the location server.

-- ASN1START

GLO-RTK-BiasInformationReq-r15 ::= SEQUENCE {

stationID-r15 GNSS-ReferenceStationID-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GLO-RTK-BiasInformationReq* field descriptions |
| --- |
| ***stationID***  This field specifies the Station ID for which the *GLO-RTK-BiasInformation* is requested. |

#### *– GNSS-RTK-MAC-CorrectionDifferencesReq*

The IE *GNSS-RTK-MAC-CorrectionDifferencesReq* is used by the target device to request the *GNSS‑RTK‑MAC‑CorrectionDifferences* assistancefrom the location server.

-- ASN1START

GNSS-RTK-MAC-CorrectionDifferencesReq-r15 ::= SEQUENCE {

master-ReferenceStationID-r15 GNSS-ReferenceStationID-r15 OPTIONAL,

aux-ReferenceStationList-r15 AUX-ReferenceStationList-r15 OPTIONAL,

linkCombinations-PrefList-r15 GNSS-Link-CombinationsList-r15 OPTIONAL,

...

}

AUX-ReferenceStationList-r15 ::= SEQUENCE (SIZE (1..32)) OF AUX-ReferenceStationID-Element-r15

AUX-ReferenceStationID-Element-r15 ::= SEQUENCE {

aux-stationID-r15 GNSS-ReferenceStationID-r15,

...

}

-- ASN1STOP

| *GNSS-RTK-MAC-CorrectionDifferencesReq* field descriptions |
| --- |
| ***master-ReferenceStationID, aux-ReferenceStationList***  These fields specify the Master and Auxiliary Reference Station IDs for which the *GNSS‑RTK‑MAC‑CorrectionDifferences* are requested. |
| ***linkCombinations-PrefList***  This field specifies the dual-frequency combination of L1 and L2 link/frequencies for which the target device wishes to obtain the *GNSS‑RTK‑MAC‑CorrectionDifferences* in the order of preference. The first *GNSS‑Link‑Combinations* in *GNSS-Link-CombinationsList* is the most preferred combination, the second *GNSS‑Link‑Combinations* in *GNSS‑Link‑CombinationsList* is the second most preferred, etc. |

#### *– GNSS-RTK-ResidualsReq*

The IE *GNSS-RTK-ResidualsReq* is used by the target device to request the *GNSS-RTK-Residuals* assistancefrom the location server.

-- ASN1START

GNSS-RTK-ResidualsReq-r15 ::= SEQUENCE {

stationID-r15 GNSS-ReferenceStationID-r15 OPTIONAL,

linkCombinations-PrefList-r15 GNSS-Link-CombinationsList-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-RTK-ResidualsReq* field descriptions |
| --- |
| ***stationID***  This field specifies the Station ID for which the *GNSS-RTK-Residuals* are requested. |
| ***linkCombinations-PrefList***  This field specifies the dual-frequency combination of L1 and L2 link/frequencies for which the target device wishes to obtain the *GNSS-RTK-Residuals* in the order of preference. The first *GNSS‑Link‑Combinations* in *GNSS‑Link‑CombinationsList* is the most preferred combination, the second *GNSS‑Link‑Combinations* in *GNSS‑Link‑CombinationsList* is the second most preferred, etc. |

#### *– GNSS-RTK-FKP-GradientsReq*

The IE *GNSS-RTK-FKP-GradientsReq* is used by the target device to request the *GNSS-RTK-FKP-Gradients* assistancefrom the location server.

-- ASN1START

GNSS-RTK-FKP-GradientsReq-r15 ::= SEQUENCE {

stationID-r15 GNSS-ReferenceStationID-r15 OPTIONAL,

linkCombinations-PrefList-r15 GNSS-Link-CombinationsList-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-RTK-FKP-GradientsReq* field descriptions |
| --- |
| ***stationID***  This field specifies the Station ID for which the *GNSS-RTK-FKP-Gradients* are requested. |
| ***linkCombinations-PrefList***  This field specifies the dual-frequency combination of L1 and L2 link/frequencies for which the target device wishes to obtain the *GNSS-RTK-FKP-Gradients* in the order of preference. The first *GNSS‑Link‑Combinations* in *GNSS‑Link‑CombinationsList* is the most preferred combination, the second *GNSS‑Link‑Combinations* in *GNSS‑Link‑CombinationsList* is the second most preferred, etc. |

#### *– GNSS-SSR-OrbitCorrectionsReq*

The IE *GNSS-SSR-OrbitCorrectionsReq* is used by the target device to request the *GNSS-SSR-OrbitCorrections* assistancefrom the location server.

-- ASN1START

GNSS-SSR-OrbitCorrectionsReq-r15 ::= SEQUENCE {

storedNavList-r15 GNSS-NavListInfo-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-SSR-OrbitCorrectionsReq* field descriptions |
| --- |
| ***storedNavList***  This list provides information to the location server about which NAV data the target device has currently stored for the particular GNSS indicated by *GNSS-ID*. |

#### *– GNSS-SSR-ClockCorrectionsReq*

The IE *GNSS-SSR-ClockCorrectionsReq* is used by the target device to request the *GNSS-SSR-ClockCorrections* assistancefrom the location server.

-- ASN1START

GNSS-SSR-ClockCorrectionsReq-r15 ::= SEQUENCE {

storedNavList-r15 GNSS-NavListInfo-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-SSR-ClockCorrectionsReq* field descriptions |
| --- |
| ***storedNavList***  This list provides information to the location server about which NAV data the target device has currently stored for the particular GNSS indicated by *GNSS-ID*. |

#### *– GNSS-SSR-CodeBiasReq*

The IE *GNSS-SSR-CodeBiasReq* is used by the target device to request the *GNSS-SSR-CodeBias* assistancefrom the location server.

-- ASN1START

GNSS-SSR-CodeBiasReq-r15 ::= SEQUENCE {

signal-and-tracking-mode-ID-Map-r15 GNSS-SignalIDs,

storedNavList-r15 GNSS-NavListInfo-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-SSR-CodeBiasReq* field descriptions |
| --- |
| ***signal-and-tracking-mode-ID-Map***  This field specifies the GNSS signal(s) for which the *GNSS-SSR-CodeBias* is requested. |
| ***storedNavList***  This list provides information to the location server about which NAV data the target device has currently stored for the particular GNSS indicated by *GNSS-ID*. |

#### *– GNSS-SSR-URA-Req*

The IE *GNSS-SSR-URA-Req* is used by the target device to request the *GNSS-SSR-URA* assistancefrom the location server.

-- ASN1START

GNSS-SSR-URA-Req-r16 ::= SEQUENCE {

...

}

-- ASN1STOP

#### *– GNSS-SSR-PhaseBiasReq*

The IE *GNSS-SSR-PhaseBiasReq* is used by the target device to request the *GNSS-SSR-PhaseBias* assistancefrom the location server.

-- ASN1START

GNSS-SSR-PhaseBiasReq-r16 ::= SEQUENCE {

signal-and-tracking-mode-ID-Map-r15 GNSS-SignalIDs,

storedNavList-r15 GNSS-NavListInfo-r15 OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-SSR-PhaseBiasReq* field descriptions |
| --- |
| ***signal-and-tracking-mode-ID-Map***  This field specifies the GNSS signal(s) for which the *GNSS-SSR-PhaseBias* is requested. |
| ***storedNavList***  This list provides information to the location server about which NAV data the target device has currently stored for the particular GNSS indicated by *GNSS-ID*. |

#### *– GNSS-SSR-STEC-CorrectionReq*

The IE *GNSS-SSR-STEC-CorrectionReq* is used by the target device to request the *GNSS-SSR-STEC-Correction* assistancefrom the location server.

-- ASN1START

GNSS-SSR-STEC-CorrectionReq-r16 ::= SEQUENCE {

...

}

-- ASN1STOP

#### *– GNSS-SSR-GriddedCorrectionReq*

The IE *GNSS-SSR-GriddedCorrectionReq* is used by the target device to request the *GNSS-SSR-GriddedCorrection* assistancefrom the location server.

-- ASN1START

GNSS-SSR-GriddedCorrectionReq-r16 ::= SEQUENCE {

...

}

-- ASN1STOP

#### 6.5.2.5 GNSS Location Information

#### – *A-GNSS-ProvideLocationInformation*

The IE *A-GNSS-ProvideLocationInformation* is used by the target device to provide location measurements (e.g., pseudo‑ranges, location estimate, velocity) to the location server, together with time information. It may also be used to provide GNSS positioning specific error reason.

-- ASN1START

A-GNSS-ProvideLocationInformation ::= SEQUENCE {

gnss-SignalMeasurementInformation GNSS-SignalMeasurementInformation OPTIONAL,

gnss-LocationInformation GNSS-LocationInformation OPTIONAL,

gnss-Error A-GNSS-Error OPTIONAL,

...

}

-- ASN1STOP

#### 6.5.2.6 GNSS Location Information Elements

#### – *GNSS-SignalMeasurementInformation*

The IE *GNSS-SignalMeasurementInformation* is used by the target device to provide GNSSsignal measurement information to the location server and GNSS‑network time association if requested by the location server. This information includes the measurements of code phase, Doppler, C/No and optionally accumulated carrier phase, also called accumulated deltarange (ADR), which enable the UE‑assisted GNSS method where position is computed in the location server. Figure 6.5.2.6-1 illustrates the relation between some of the fields.

-- ASN1START

GNSS-SignalMeasurementInformation ::= SEQUENCE {

measurementReferenceTime MeasurementReferenceTime,

gnss-MeasurementList GNSS-MeasurementList,

...

}

-- ASN1STOP

| *GNSS-SignalMeasurementInformation* field descriptions |
| --- |
| ***measurementReferenceTime***  This field specifies the GNSS system time for which the information provided in *gnss-MeasurementList* is valid. It may also include network time, if requested by the location server and supported by the target device. |
| ***gnss-MeasurementList***  This fieldprovides GNSS signal measurement information for up to 16 GNSSs. |

#### – *MeasurementReferenceTime*

The IE *MeasurementReferenceTime* is used to specify the time when the measurements provided in *A-GNSS-ProvideLocationInformation* are valid. It may also include GNSS-network time association, in which case reported measurements shall be valid for the cellular frame boundary defined in the network time association.

-- ASN1START

MeasurementReferenceTime ::= SEQUENCE {

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

gnss-TOD-frac INTEGER (0..3999) OPTIONAL,

gnss-TOD-unc INTEGER (0..127) OPTIONAL,

gnss-TimeID GNSS-ID,

networkTime CHOICE {

eUTRA SEQUENCE {

physCellId INTEGER (0..503),

cellGlobalId CellGlobalIdEUTRA-AndUTRA OPTIONAL,

systemFrameNumber BIT STRING (SIZE (10)),

...

},

uTRA SEQUENCE {

mode CHOICE {

fdd SEQUENCE {

primary-CPICH-Info INTEGER (0..511),

...

},

tdd SEQUENCE {

cellParameters INTEGER (0..127),

...

}

},

cellGlobalId CellGlobalIdEUTRA-AndUTRA OPTIONAL,

referenceSystemFrameNumber

INTEGER (0..4095),

...

},

gSM SEQUENCE {

bcchCarrier INTEGER (0..1023),

bsic INTEGER (0..63),

cellGlobalId CellGlobalIdGERAN OPTIONAL,

referenceFrame SEQUENCE {

referenceFN INTEGER (0..65535),

referenceFNMSB INTEGER (0..63) OPTIONAL,

...

},

deltaGNSS-TOD INTEGER (0 .. 127) OPTIONAL,

...

},

...,

nbIoT-r14

SEQUENCE {

nbPhysCellId-r14 INTEGER (0..503),

nbCellGlobalId-r14 ECGI OPTIONAL,

sfn-r14 BIT STRING (SIZE (10)),

hyperSFN-r14 BIT STRING (SIZE (10)) OPTIONAL,

...

},

nr-r15 SEQUENCE {

nrPhysCellId-r15 INTEGER (0..1007),

nrCellGlobalID-r15 NCGI-r15 OPTIONAL,

nr-sfn-r15 BIT STRING (SIZE (10)),

...

}

} OPTIONAL,

...

}

-- ASN1STOP

| *MeasurementReferenceTime* field descriptions |
| --- |
| ***gnss-TOD-msec***  This field specifies the GNSS TOD for which the measurements and/or location estimate are valid. The 22 bits of GNSS TOD are the least significant bits. The most significant bits shall be derived by the location server to unambiguously derive the GNSS TOD.  The value for GNSS TOD is derived from the GNSS specific system time indicated in *gnss-TimeID* rounded down to the nearest millisecond unit.  Scale factor 1 millisecond. |
| ***gnss-TOD-frac***  This field specifies the fractional part of the GNSS TOD in 250 ns resolution. The total GNSS TOD is given by *gnss-TOD-msec* + *gnss-TOD-frac*.  Scale factor 250 nanoseconds. |
| ***gnss-TOD-unc***  This field provides the accuracy of the relation GNSS-network time when GNSS-network time association is provided. When GNSS-network time association is not provided, this element can be included to provide the accuracy of the reported *gnss-TOD-msec*.  If GNSS TOD is the given GNSS time, then the true GNSS time, corresponding to the provided network time if applicable, as observed at the target device location, lies in the interval [GNSS TOD – *gnss-TOD-unc*, GNSS TOD + *gnss-TOD-unc*].  The uncertainty *r*, expressed in microseconds, is mapped to a number K, with the following formula:  *r* = C\*(((1+x)K)-1)  with C = 0.5 and x = 0.14. To encode any higher value of uncertainty than that corresponding in the above formula to K=127, the same value, K=127, shall also be used. The uncertainty is then coded on 7 bits, as the binary encoding of K. Examples of *gnss-TOD-unc* value are as in the table Value of K to Value of uncertainty relation below.  This field shall be included if the target device provides GNSS-network time relationship. |
| ***gnss-TimeID***  This field specifies the GNSS system time for which the *gnss-TOD-msec* (and *gnss-TOD-frac* if applicable) is provided. |
| ***networkTime***  These fields specify the network time event which the GNSS TOD time stamps.  This field shall be included if the target device provides GNSS-network time relationship. |
| ***physCellId***  This field identifies the reference cell (E-UTRA), as defined in TS 36.331 [12], that is used for the GNSS-network time relation. |
| ***cellGlobalId***  This field specifies the globally unique cell identifier (Evolved Cell Global Identifier (ECGI) in E-UTRA, global UTRAN Cell Identifier in UTRA, or Cell Global Identification (CGI) in GERAN) of the reference cell, as defined in TS 36.331 [12] for E-UTRA and in TS 25.331 [13] for UTRA, for which the GNSS network time relation is provided. |
| ***systemFrameNumber***  This field specifies the system frame number in E-UTRA which the GNSS time time stamps, as defined in TS 36.331 [12]. |
| ***mode***  This field identifies the reference cell for the GNSS-network time relation, as defined in TS 25.331 [13]. |
| ***referenceSystemFrameNumber***  This field specifies the system frame number in UTRA, as defined in TS 25.331 [13], which is used for time stamping. |
| ***bcchCarrier, bsic***  This field identifies the reference cell for the GNSS-network time relation in GERAN, as defined in TS 44.031 [14]. |
| ***referenceFN, referenceFNMSB***  These fields specify the frame number in GERAN which the GNSS time time stamps, as defined in TS 44.031 [14]. The time of the reference frame boundary is as observed by the target device, i.e. without Timing Advance compensation. The *referenceFNMSB* field indicates the most significant bits of the frame number of the reference BTS corresponding to the *GNSS-MeasurementList*. Starting from the complete GSM frame number denoted FN, the target device calculates Reference FN MSB as  Reference FN MSB = floor(FN/42432)  The complete GSM frame number FN can then be reconstructed in the location server by combining the fields *referenceFN* with *referenceFNMSB* in the following way  FN = *referenceFNMSB* \*42432 + *referenceFN* |
| ***deltaGNSS-TOD***  This field specifies the difference in milliseconds between *gnss-TOD-msec*reported and the milli-second part of the SV time tsv\_1 of the first SV in the list reported from the target device, as defined in TS 44.031 [14]. The *deltaGNSS-TOD* is defined as  *deltaGNSS-TOD* = *gnss-TOD-msec* - fix(tsv\_1)  where fix() denotes rounding to the nearest integer towards zero. |
| ***nbPhysCellId***  This field identifies the reference cell, as defined in TS 36.331 [12] that is used for the GNSS-network time relation. |
| ***nbCellGlobalId***  This field specifies the global cell identifier of the NB-IoT reference cell, as defined in TS 36.331 [12], for which the GNSS network time relation is provided. |
| ***sfn***  This field specifies the system frame number in NB-IoT which the GNSS time time stamps, as defined in TS 36.331 [12]. |
| ***hyperSFN***  This field specifies the hyper-SFN in NB-IoT which the GNSS time time stamps, as defined in TS 36.331 [12]. |
| ***nrPhysCellId***  This field identifies the reference cell (NR), as defined in TS 38.331 [35], that is used for the GNSS-network time relation. |
| ***nrCellGlobalID***  This field specifies the NR Cell Global Identifier (NCGI) of the reference cell, as defined in TS 38.331 [35], for which the GNSS network time relation is provided. |
| ***nr-sfn***  This field specifies the system frame number in NR which the GNSS time time stamps, as defined in TS 38.331 [35], |

Value of K to Value of uncertainty relation

|  |  |
| --- | --- |
| **Value of K** | **Value of uncertainty** |
| 0 | 0 microseconds |
| 1 | 0.07 microseconds |
| 2 | 0.1498 microseconds |
| - | - |
| 50 | 349.62 microseconds |
| - | - |
| 127 | ≥ 8430000 microseconds |

#### – *GNSS-MeasurementList*

The IE *GNSS-MeasurementList* is used by the target device to provide measurements of code phase, Doppler, C/No and optionally accumulated carrier phase, also called accumulated deltarange (ADR).

-- ASN1START

GNSS-MeasurementList ::= SEQUENCE (SIZE(1..16)) OF GNSS-MeasurementForOneGNSS

GNSS-MeasurementForOneGNSS ::= SEQUENCE {

gnss-ID GNSS-ID,

gnss-SgnMeasList GNSS-SgnMeasList,

...

}

GNSS-SgnMeasList ::= SEQUENCE (SIZE(1..8)) OF GNSS-SgnMeasElement

GNSS-SgnMeasElement ::= SEQUENCE {

gnss-SignalID GNSS-SignalID,

gnss-CodePhaseAmbiguity INTEGER (0..127) OPTIONAL,

gnss-SatMeasList GNSS-SatMeasList,

...

}

GNSS-SatMeasList ::= SEQUENCE (SIZE(1..64)) OF GNSS-SatMeasElement

GNSS-SatMeasElement ::= SEQUENCE {

svID SV-ID,

cNo INTEGER (0..63),

mpathDet ENUMERATED {notMeasured (0), low (1), medium (2), high (3), ...},

carrierQualityInd INTEGER (0..3) OPTIONAL,

codePhase INTEGER (0..2097151),

integerCodePhase INTEGER (0..127) OPTIONAL,

codePhaseRMSError INTEGER (0..63),

doppler INTEGER (-32768..32767) OPTIONAL,

adr INTEGER (0..33554431) OPTIONAL,

...,

[[

adrMSB-r15 INTEGER (0..15) OPTIONAL,

adrSign-r15 ENUMERATED {positive, negative} OPTIONAL,

adrRMSerror-r15 INTEGER (0..127) OPTIONAL,

delta-codePhase-r15 INTEGER (0..7) OPTIONAL

]]

}

-- ASN1STOP

| *GNSS-MeasurementList* field descriptions |
| --- |
| ***gnss-ID***  This field identifies the GNSS constellation on which the GNSS signal measurements were measured. Measurement information for up to 16 GNSSs can be included. |
| ***gnss-SgnMeasList***  This list provides GNSS signal measurement information for up to 8 GNSS signal types per GNSS. |
| ***gnss-SignalID***  This field identifies the signal on which GNSS signal measurement parameters were measured. |
| ***gnss-CodePhaseAmbiguity***  This field provides the ambiguity of the code phase measurement. It is given in units of milli-seconds in the range between between 0 and 127 milli-seconds.  The total code phase for a satellite k (Satk) is given modulo this *gnss-CodePhaseAmbiguity* and is reconstructed with:  Code\_Phase\_Tot(Satk) = *codePhase*(Satk) + *integerCodePhase*(Satk) + n \* *gnss-CodePhaseAmbiguity*, n= 0,1,2,...  If there is no code phase ambiguity, the *gnss-CodePhaseAmbiguity* shall be set to 0.  The field is optional. If *gnss-CodePhaseAmbiguity* is absent, the default value is 1 milli-second. |
| ***gnss-SatMeasList***  This list provides GNSS signal measurement information for up to 64 GNSS satellites. |
| ***svID***  This field identifies the satellite on which the GNSS signal measurements were measured. |
| ***cNo***  This field provides an estimate of the carrier‑to‑noise ratio of the received signal from the particular satellite. The target device shall set this field to the value of the satellite C/N0, as referenced to the antenna connector, in units of 1 dB‑Hz, in the range from 0 to 63 dB‑Hz.  Scale factor 1 dB‑Hz. |
| ***mpathDet***  This field contains the multipath indicator value, defined in the table Value of mpathDet to Multipath Indication relation below. |
| ***carrierQualityInd***  If the fields *adrMSB*, *adrSign*, *adrRMSerror*, and *delta-codePhase* are not present:  This field indicates the quality of a carrier phase measurement. The LSB indicates the data polarity, that is, if the data from a specific satellite is received inverted, this is indicated by setting the LSB value to '1'. In the case the data is not inverted, the LSB is set to '0'. The MSB indicates if accumulation of the carrier phase has been continuous, that is, without cycle slips since the previous measurement report. If the carrier phase accumulation has been continuous, the MSB value is set to '1X'. Otherwise, the MSB is set to '0X'.  This field is optional but shall be included if the *adr* field is included. See table Bit to Polarity Indication relation below.  If any of the fields *adrMSB*, *adrSign*, *adrRMSerror*, or *delta-codePhase* are present:  This field indicates the quality of a carrier phase measurement. The LSB indicates the half-cycle ambiguity, that is, if there are no half-cycle ambiguities present in the ADR measurement report the LSB is set to '0'. In case there are half-cycle ambiguities present in the ADR measurement report the LSB is set to '1'. When reporting ADR with unresolved polarity encoding the target device shall set this bit to 1.  The MSB indicates if accumulation of the carrier phase has been continuous, that is, without cycle slips since the previous measurement report. If the carrier phase accumulation has been continuous (no cycle slips), the MSB value is set to '1X'. Otherwise, the MSB is set to '0X'. If polarity resolution forced the ADR measurement to be corrected by half-a-cycle, then the MSB must be set to '0', indicating that despite continuous tracking the reported ADR experienced non-continuity. See table Bit to Ambiguity Indication relation below.  The target device shall include this field if the *adr* field is included. |
| ***codePhase***  This field contains the whole and fractional value of the code-phase measurement made by the target device for the particular satellite signal at the time of measurement in the units of ms. GNSS specific code phase measurements (e.g. chips) are converted into unit of ms by dividing the measurements by the nominal values of the measured signal chipping rate.  Scale factor 2-21 milli‑seconds, in the range from 0 to (1-2-21) milli‑seconds. |
| ***integerCodePhase***  This field indicates the integer milli‑second part of the code phase that is expressed modulo the *gnss-CodePhaseAmbiguity*. The value of the ambiguity is given in the *gnss-CodePhaseAmbiguity* field.  The *integerCodePhase*is optional. If *integerCodePhase* is absent, the default value is 0 milli-second.  Scale factor 1 milli-second, in the range from 0 to 127 milli‑seconds. |
| ***codePhaseRMSError***  This field contains the pseudorange RMS error value. This parameter is specified according to a floating-point representation shown in the table below. |
| ***doppler***  This field contains the Doppler measured by the target device for the particular satellite signal. This information can be used to compute the 3-D velocity of the target device. Doppler measurements are converted into unit of m/s by multiplying the Doppler measurement in Hz by the nominal wavelength of the measured signal.  Scale factor 0.04 meter/seconds. This field is optional, but shall be included, if the *velocityRequest* in *CommonIEsRequestLocationInformation* is set to TRUE. |
| ***adr***  This field contains the absolute value of the ADR measurement measured by the target device for the particular satellite signal. This information can be used to compute the 3-D velocity or high-accuracy position of the target device. ADR measurements are converted into units of meter by multiplying the ADR measurement by the nominal wavelength of the measured signal.  Scale factor 2-10 meters, in the range from 0 to 32767.5 meters. This field is optional, but shall be included, if the *adrMeasReq* in *GNSS-PositioningInstructions* is set to TRUE and if ADR measurements are supported by the target device (i.e., *adr-Support* is set to TRUE in *A-GNSS-ProvideCapabilities*). |
| ***adrMSB***  This field contains the 4-MSBs of the ADR measurement in case the ADR measurement is outside the range of the field *adr* alone. Scale factor 32768 meters.  If present, the full ADR measurement is constructed as *adrMSB* × 32768 + *adr* × 2-10 meters, representing measurements in the range from 0 to 524287.9990234375 meters.  This field is optional, but shall be included, if the capability *adrEnhancementsSupport* is set to TRUE and the ADR measurement is outside the range of the *adr* field. |
| ***adrSign***  This field indicates the sign of the ADR measurement. |
| ***adrRMSerror***  This field contains the ADR root mean squared error value. Scale factor 2-10 meters. |
| ***delta-codePhase***  This field specifies the higher resolution of the *codePhase* measurement. Scale factor 2-24 milli‑seconds.  The full code phase measurement is constructed as *codePhase* × 2-21 + *delta-codePhase* × 2-24 milli-seconds, in the range from 0 to (1-2-24) milli‑seconds. |

Value of mpathDet to Multipath Indication relation

|  |  |
| --- | --- |
| Value of *mpathDet* | Multipath Indication |
| 00 | Not measured |
| 01 | Low, MP error < 5m |
| 10 | Medium, 5m < MP error < 43m |
| 11 | High, MP error > 43m |

Bit to Polarity Indication relation

|  |  |
| --- | --- |
| Value | Polarity Indication |
| 0 | Data Direct, carrier phase not continuous |
| 1 | Data Inverted, carrier phase not continuous |
| 2 | Data Direct, carrier phase continuous |
| 3 | Data Inverted, carrier phase continuous |

Bit to Ambiguity Indication relation

|  |  |  |
| --- | --- | --- |
| Value | Value MSB, LSB | Polarity Indication |
| 0 | 00 | carrier phase not continuous, no half-cycle ambiguity |
| 1 | 01 | carrier phase not continuous, half-cycle ambiguity |
| 2 | 10 | carrier phase continuous, no half-cycle ambiguity |
| 3 | 11 | carrier phase continuous, half-cycle ambiguity |

floating-point representation

| Index | Mantissa | Exponent | Floating-Point value, xi | Pseudorange value, P |
| --- | --- | --- | --- | --- |
| 0 | 000 | 000 | 0.5 | P < 0.5 |
| 1 | 001 | 000 | 0.5625 | 0.5 <= P < 0.5625 |
| I | x | y | 0.5 \* (1 + x/8) \* 2y | xi-1 <= P < xi |
| 62 | 110 | 111 | 112 | 104 <= P < 112 |
| 63 | 111 | 111 | -- | 112 <= P |



Figure 6.5.2.6-1: Exemplary calculation of some GNSS Signal Measurement Information fields.

#### – *GNSS-LocationInformation*

The IE *GNSS-LocationInformation* is included by the target device when location and optionally velocity information derived using GNSS or hybrid GNSS and other measurements is provided to the location server.

-- ASN1START

GNSS-LocationInformation ::= SEQUENCE {

measurementReferenceTime MeasurementReferenceTime,

agnss-List GNSS-ID-Bitmap,

...

}

-- ASN1STOP

| *GNSS-LocationInformation* field descriptions |
| --- |
| ***measurementReferenceTime***  This field specifies the GNSS system time for which the location estimate and optionally velocity are valid. It may also include GNSS-network time relationship, if requested by the location server and supported by the target device. |
| ***agnss-List***  This fieldprovides a list of satellite systems used by the target device to calculate the location estimate and velocity estimate, if included. This is represented by a bit string in *GNSS-ID-Bitmap*, with a one‑value at the bit position means the particular method has been used; a zero‑value means not used. |

#### 6.5.2.7 GNSS Location Information Request

#### – *A-GNSS-RequestLocationInformation*

The IE *A-GNSS-RequestLocationInformation* is used by the location server to request location information from the target device using GNSS.

-- ASN1START

A-GNSS-RequestLocationInformation ::= SEQUENCE {

gnss-PositioningInstructions GNSS-PositioningInstructions,

...

}

-- ASN1STOP

#### 6.5.2.8 GNSS Location Information Request Elements

#### – *GNSS-PositioningInstructions*

The IE *GNSS-PositioningInstructions* is used to provide GNSS measurement instructions.

-- ASN1START

GNSS-PositioningInstructions ::= SEQUENCE {

gnss-Methods GNSS-ID-Bitmap,

fineTimeAssistanceMeasReq BOOLEAN,

adrMeasReq BOOLEAN,

multiFreqMeasReq BOOLEAN,

assistanceAvailability BOOLEAN,

...,

[[

ha-GNSS-Req-r15 ENUMERATED { true } OPTIONAL -- Cond UEB

]]

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *UEB* | The field is optionally present, need OP, if the *locationInformationType* is set to *locationEstimateRequired, locationEstimatePreferred, or* *locationMeasurementsPreferred*; oltherwise it is not present. |

| *GNSS-PositioningInstructions* field descriptions |
| --- |
| ***gnssMethods***  This field indicates the satellite systems allowed by the location server. This is represented by a bit string in *GNSS-ID-Bitmap*, with a one‑value at the bit position means the particular GNSS is allowed; a zero‑value means not allowed. The target device shall not request assistance data or report or obtain measurements for systems that are not indicated in this bit map. At least one of the bits in this bit map shall be set to value one. |
| ***fineTimeAssistanceMeasReq***  This field indicates whether the target device is requested to report GNSS-network time association. TRUE means requested. |
| ***adrMeasReq***  This field indicates whether the target device is requested to include ADR measurements in *GNSS-MeasurementList* IE or not. TRUE means requested. |
| ***multiFreqMeasReq***  This field indicates whether the target device is requested to report measurements on multiple supported GNSS signal types in *GNSS-MeasurementList* IE or not. TRUE means requested. |
| ***assistanceAvailability***  This field indicates whether the target device may request additional GNSS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***ha-GNSS-Req***  This field, if present, indicates that any location estimate provided by the target device should be obtained using high accuracy RTK/PPP methods. |

#### 6.5.2.9 GNSS Capability Information

#### – *A-GNSS-ProvideCapabilities*

The IE *A-GNSS-Provide-Capabilities* is used by the target device to indicate its capability to support A-GNSS and to provide its A-GNSS location capabilities (e.g., GNSSs and assistance data supported) to the location server.

-- ASN1START

A-GNSS-ProvideCapabilities ::= SEQUENCE {

gnss-SupportList GNSS-SupportList OPTIONAL,

assistanceDataSupportList AssistanceDataSupportList OPTIONAL,

locationCoordinateTypes LocationCoordinateTypes OPTIONAL,

velocityTypes VelocityTypes OPTIONAL,

...,

[[ periodicalReportingNotSupported-r14

PositioningModes OPTIONAL,

idleStateForMeasurements-r14

ENUMERATED { required } OPTIONAL

]],

[[ periodicAssistanceData-r15

BIT STRING { solicited (0),

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

]]

}

GNSS-SupportList ::= SEQUENCE (SIZE(1..16)) OF GNSS-SupportElement

GNSS-SupportElement ::= SEQUENCE {

gnss-ID GNSS-ID,

sbas-IDs SBAS-IDs OPTIONAL, -- Cond GNSS-ID-SBAS

agnss-Modes PositioningModes,

gnss-Signals GNSS-SignalIDs,

fta-MeasSupport SEQUENCE {

cellTime AccessTypes,

mode PositioningModes,

...

} OPTIONAL, -- Cond fta

adr-Support BOOLEAN,

velocityMeasurementSupport BOOLEAN,

...,

[[

adrEnhancementsSupport-r15 ENUMERATED { true } OPTIONAL,

ha-gnss-Modes-r15 PositioningModes OPTIONAL

]]

}

AssistanceDataSupportList ::= SEQUENCE {

gnss-CommonAssistanceDataSupport GNSS-CommonAssistanceDataSupport,

gnss-GenericAssistanceDataSupport GNSS-GenericAssistanceDataSupport,

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *fta* | The field is mandatory present if the target device supports the reporting of fine time assistance measurements; otherwise it is not present. |

| *A-GNSS-ProvideCapabilities* field descriptions |
| --- |
| ***gnss-SupportList***  This field specifies the list of GNSS supported by the target device and the target device capabilities associated with each of the supported GNSS. This field shall be present if the *gnss-SupportListReq* in the A-GNSS *-RequestCapabilities* IE is set to TRUE and if the target device supports the A-GNSS positioning method. If the IE *A-GNSS-Provide-Capabilities* is provided unsolicited, this field shall be included if the target device supports the assisted GNSS positioning method. |
| ***gnss-ID***  This field specifies the GNSS supported by the target device for which the capabilities in *GNSS-SupportElement* are provided. |
| ***sbas-IDs***  This field specifies the SBAS(s) supported by the target device. This is represented by a bit string, with a one‑value at the bit position means the particular SBAS is supported; a zero‑value means not supported. |
| ***agnss-Modes***  This field specifies the GNSS mode(s) supported by the target device for the GNSS indicated by *gnss-ID*. This is represented by a bit string, with a one‑value at the bit position means the particular GNSS mode is supported; a zero‑value means not supported. |
| ***gnss-Signals***  This field specifies the GNSS signal(s) supported by the target device for the GNSS indicated by *gnss-ID*. This is represented by a bit string, with a one‑value at the bit position means the particular GNSS signal type is supported; a zero‑value means not supported. |
| ***fta-MeasSupport***  This field specifies that the target device is capable of performing fine time assistance measurements (i.e., GNSS‑cellular time association reporting). The *cellTime* field specifies for which cellular network(s) this capability is supported. This is represented by a bit string, with a one‑value at the bit position means FTA measurements for the specific cellular network time is supported; a zero‑value means not supported. The *mode* field specifies for which GNSS mode(s) FTA measurements are supported by the target device. This is represented by a bit string, with a one‑value at the bit position means FTA measurements for the GNSS mode is supported; a zero‑value means not supported. |
| ***adr-Support***  This field specifies whether the target device supports ADR measurement reporting. TRUE means supported. |
| ***velocityMeasurementSupport***  This field specifies whether the target device supports measurement reporting related to velocity. TRUE means supported. |
| ***assistanceDataSupportList***  This list defines the assistance data and assistance data choices supported by the target device. This field shall be present if the *assistanceDataSupportListReq* in the A-GNSS*-RequestCapabilities* IE is set to TRUE and if the target device supports GNSS assistance data. If the IE *A-GNSS-Provide-Capabilities* is provided unsolicited, this field shall be included if the target device supports any GNSS assistance data. |
| ***locationCoordinateTypes***  This parameter identifies the geographical location coordinate types that a target device supports for GNSS. TRUE indicates that a location coordinate type is supported and FALSE that it is not. This field shall be present if the *locationVelocityTypesReq* in the A-GNSS*-RequestCapabilities* IE is set to TRUE and if the target device supports UE-based or standalone GNSS positioning method. If the IE *A-GNSS-Provide-Capabilities* is provided unsolicited, this field shall be included if the target device supports UE-based or standalone GNSS positioning method. |
| ***velocityTypes***  This parameter identifies the velocity types that a target device supports for GNSS. TRUE indicates that a velocity type is supported and FALSE that it is not. FALSE for all velocity types indicates that velocity reporting is not supported. This field shall be present if the *locationVelocityTypesReq* in the A-GNSS*-RequestCapabilities* IE is set to TRUE and if the target device supports UE-based or standalone GNSS positioning method. If the IE *A-GNSS-Provide-Capabilities* is provided unsolicited, this field shall be included if the target device supports UE-based or standalone GNSS positioning method. |
| ***periodicalReportingNotSupported***  This field, if present, specifies the positioning modes for which the target device does not support *periodicalReporting.* This is represented by a bit string, with a one‑value at the bit position means *periodicalReporting* for the positioning mode is not supported; a zero‑value means supported. If this field is absent, the location server may assume that the target device supports *periodicalReporting* in *CommonIEsRequestLocationInformation* for each supported positioning mode. |
| ***idleStateForMeasurements***  This field, if present, indicates that the target device requires idle state to perform GNSS measurements. |
| ***periodicAssistanceData***  This field identifies the periodic assistance data delivery procedures supported by the target device. This is represented by a bit string, with a one value at the bit position means the periodic assistance data delivery procedure is supported; a zero value means not supported. Bit 0 (solicited) represents the procedure according to clause 5.2.1a; bit (1) (unsolicited) represents the procedure according to clause 5.2.2a. |
| ***adrEnhancementsSupport***  This field, if present, indicates that the target device supports the fields *adrMSB*, *adrSign*, *adrRMSerror*, and *delta‑codePhase* in IE *GNSS-MeasurementList*.  This field may only be present if *adr-Support* is set to TRUE, and shall be absent if *adr-Support* is set to FALSE. |
| **ha-gnss-Modes**  This field specifies the High-Accuracy GNSS mode(s) supported by the target device for the GNSS indicated by *gnss‑ID*. This is represented by a bit string, with a one‑value at the bit position means the particular GNSS mode is supported; a zero‑value means not supported. |

#### 6.5.2.10 GNSS Capability Information Elements

#### – *GNSS-CommonAssistanceDataSupport*

The IE *GNSS-CommonAssistanceDataSupport* is used by the target device to provide information on supported GNSS common assistance data types to the location server.

-- ASN1START

GNSS-CommonAssistanceDataSupport ::= SEQUENCE {

gnss-ReferenceTimeSupport GNSS-ReferenceTimeSupport

OPTIONAL, -- Cond RefTimeSup

gnss-ReferenceLocationSupport GNSS-ReferenceLocationSupport

OPTIONAL, -- Cond RefLocSup

gnss-IonosphericModelSupport GNSS-IonosphericModelSupport

OPTIONAL, -- Cond IonoModSup

gnss-EarthOrientationParametersSupport GNSS-EarthOrientationParametersSupport

OPTIONAL, -- Cond EOPSup

...,

[[

gnss-RTK-ReferenceStationInfoSupport-r15

GNSS-RTK-ReferenceStationInfoSupport-r15

OPTIONAL, -- Cond ARPSup

gnss-RTK-AuxiliaryStationDataSupport-r15

GNSS-RTK-AuxiliaryStationDataSupport-r15

OPTIONAL -- Cond AuxARPSup

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *RefTimeSup* | The field is mandatory present if the target device supports *GNSS-ReferenceTime*; otherwise it is not present. |
| *RefLocSup* | This field is mandatory present if the target device supports *GNSS-ReferenceLocation*; otherwise it is not present. |
| *IonoModSup* | This field is mandatory present if the target device supports *GNSS-IonosphericModel*; otherwise it is not present. |
| *EOPSup* | This field is mandatory present if the target device supports *GNSS-EarthOrientationParameters*; otherwise it is not present. |
| *ARPSup* | This field is mandatory present if the target device supports *GNSS‑RTK‑ReferenceStationInfo*; otherwise it is not present. |
| *AuxARPSup* | This field is mandatory present if the target device supports *GNSS‑RTK‑AuxiliaryStationData*; otherwise it is not present. |

#### – *GNSS-ReferenceTimeSupport*

-- ASN1START

GNSS-ReferenceTimeSupport ::= SEQUENCE {

gnss-SystemTime GNSS-ID-Bitmap,

fta-Support AccessTypes OPTIONAL, -- Cond fta

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *fta* | The field is mandatory present if the target device supports fine time assistance in *GNSSReferenceTime* IE; otherwise it is not present. |

| *GNSS-ReferenceTimeSupport* field descriptions |
| --- |
| ***gnss-SystemTime***  This field specifies the GNSS system time(s) supported by the target device. This is represented by a bit string in *GNSS-ID-Bitmap*, with a one‑value at the bit position means the particular GNSS system time is supported; a zero‑value means not supported. |
| ***fta-Support***  This field specifies that the target device supports fine time assistance (i.e., GNSS‑cellular time association) in *GNSS-ReferenceTime* IE. This is represented by a bit string in *AccessTypes*, with a one‑value at the bit position means FTA for the specific cellular network time is supported; a zero‑value means not supported. |

#### – *GNSS-ReferenceLocationSupport*

-- ASN1START

GNSS-ReferenceLocationSupport ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-IonosphericModelSupport*

-- ASN1START

GNSS-IonosphericModelSupport ::= SEQUENCE {

ionoModel BIT STRING { klobuchar (0),

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

...

}

-- ASN1STOP

| *GNSS-IonosphericModelSupport* field descriptions |
| --- |
| ***ionoModel***  This field specifies the ionospheric model(s) supported by the target device. This is represented by a bit string, with a one‑value at the bit position means the particular ionospheric model is supported; a zero‑value means not supported. |

#### – *GNSS-EarthOrientationParametersSupport*

-- ASN1START

GNSS-EarthOrientationParametersSupport ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-RTK-ReferenceStationInfoSupport*

-- ASN1START

GNSS-RTK-ReferenceStationInfoSupport-r15 ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-RTK-AuxiliaryStationDataSupport*

-- ASN1START

GNSS-RTK-AuxiliaryStationDataSupport-r15 ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-GenericAssistanceDataSupport*

The IE *GNSS-GenericAssistanceDataSupport* is used by the target device to provide information on supported GNSS generic assistance data types to the location server for each supported GNSS.

-- ASN1START

GNSS-GenericAssistanceDataSupport ::=

SEQUENCE (SIZE (1..16)) OF GNSS-GenericAssistDataSupportElement

GNSS-GenericAssistDataSupportElement ::= SEQUENCE {

gnss-ID GNSS-ID,

sbas-ID SBAS-ID OPTIONAL, -- Cond GNSS‑ID‑SBAS

gnss-TimeModelsSupport GNSS-TimeModelListSupport

OPTIONAL, -- Cond TimeModSup

gnss-DifferentialCorrectionsSupport GNSS-DifferentialCorrectionsSupport

OPTIONAL, -- Cond DGNSS-Sup

gnss-NavigationModelSupport GNSS-NavigationModelSupport

OPTIONAL, -- Cond NavModSup

gnss-RealTimeIntegritySupport GNSS-RealTimeIntegritySupport

OPTIONAL, -- Cond RTISup

gnss-DataBitAssistanceSupport GNSS-DataBitAssistanceSupport

OPTIONAL, -- Cond DataBitsSup

gnss-AcquisitionAssistanceSupport GNSS-AcquisitionAssistanceSupport

OPTIONAL, -- Cond AcquAssistSup

gnss-AlmanacSupport GNSS-AlmanacSupport

OPTIONAL, -- Cond AlmanacSup

gnss-UTC-ModelSupport GNSS-UTC-ModelSupport

OPTIONAL, -- Cond UTCModSup

gnss-AuxiliaryInformationSupport GNSS-AuxiliaryInformationSupport

OPTIONAL, -- Cond AuxInfoSup

...,

[[

bds-DifferentialCorrectionsSupport-r12

BDS-DifferentialCorrectionsSupport-r12

OPTIONAL, -- Cond DBDS-Sup

bds-GridModelSupport-r12 BDS-GridModelSupport-r12

OPTIONAL -- Cond BDS-GridModSup

]],

[[

gnss-RTK-ObservationsSupport-r15

GNSS-RTK-ObservationsSupport-r15

OPTIONAL, -- Cond RTK-OSR-Sup

glo-RTK-BiasInformationSupport-r15

GLO-RTK-BiasInformationSupport-r15

OPTIONAL, -- Cond GLO-CPB-Sup

gnss-RTK-MAC-CorrectionDifferencesSupport-r15

GNSS-RTK-MAC-CorrectionDifferencesSupport-r15

OPTIONAL, -- Cond MAC-Sup

gnss-RTK-ResidualsSupport-r15 GNSS-RTK-ResidualsSupport-r15

OPTIONAL, -- Cond Res-Sup

gnss-RTK-FKP-GradientsSupport-r15

GNSS-RTK-FKP-GradientsSupport-r15

OPTIONAL, -- Cond FKP-Sup

gnss-SSR-OrbitCorrectionsSupport-r15

GNSS-SSR-OrbitCorrectionsSupport-r15

OPTIONAL, -- Cond OC-Sup

gnss-SSR-ClockCorrectionsSupport-r15

GNSS-SSR-ClockCorrectionsSupport-r15

OPTIONAL, -- Cond CC-Sup

gnss-SSR-CodeBiasSupport-r15 GNSS-SSR-CodeBiasSupport-r15

OPTIONAL -- Cond CB-Sup

]],

[[

gnss-SSR-URA-Support-r16 GNSS-SSR-URA-Support-r16 OPTIONAL, -- Cond URA-Sup

gnss-SSR-PhaseBiasSupport-r16 GNSS-SSR-PhaseBiasSupport-r16

OPTIONAL, -- Cond PB-Sup

gnss-SSR-STEC-CorrectionSupport-r16

GNSS-SSR-STEC-CorrectionSupport-r16

OPTIONAL, -- Cond STEC-Sup

gnss-SSR-GriddedCorrectionSupport-r16

GNSS-SSR-GriddedCorrectionSupport-r16

OPTIONAL -- Cond Grid-Sup

]]

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *GNSS‑ID‑SBAS* | The field is mandatory present if the *GNSS‑ID* = *sbas*; otherwise it is not present. |
| *TimeModSup* | The field is mandatory present if the target device supports *GNSS-TimeModelList*; otherwise it is not present. |
| *DGNSS-Sup* | The field is mandatory present if the target device supports *GNSS-DifferentialCorrections*; otherwise it is not present. |
| *NavModSup* | The field is mandatory present if the target device supports *GNSS-NavigationModel*; otherwise it is not present. |
| *RTISup* | The field is mandatory present if the target device supports *GNSS-RealTimeIntegrity*; otherwise it is not present. |
| *DataBitsSup* | The field is mandatory present if the target device supports *GNSS-DataBitAssistance*; otherwise it is not present. |
| *AcquAssistSup* | The field is mandatory present if the target device supports *GNSS-AcquisitionAssistance*; otherwise it is not present. |
| *AlmanacSup* | The field is mandatory present if the target device supports *GNSS-Almanac*; otherwise it is not present. |
| *UTCModSup* | The field is mandatory present if the target device supports *GNSS-UTC-Model*; otherwise it is not present. |
| *AuxInfoSup* | The field is mandatory present if the target device supports *GNSS-AuxiliaryInformation*; otherwise it is not present. |
| *DBDS-Sup* | The field is mandatory present if the target device supports *BDS-DifferentialCorrections*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *BDS-GridModSup* | The field is mandatory present if the target device supports *BDS-GridModel*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'bds'. |
| *RTK-OSR-Sup* | The field is mandatory present if the target device supports *GNSS-RTK-Observations*; otherwise it is not present. Note, support for *GNSS-RTK-Observations* implies support for *GNSS-RTK-CommonObservationInfo* as well. |
| *GLO-CPB-Sup* | The field is mandatory present if the target device supports *GLO‑RTK‑BiasInformation*; otherwise it is not present. This field may only be present if *gnss-ID* indicates 'glonass'. |
| *MAC-Sup* | The field is mandatory present if the target device supports *GNSS‑RTK‑MAC‑CorrectionDifferences*; otherwise it is not present. |
| *Res-Sup* | The field is mandatory present if the target device supports *GNSS‑RTK‑Residuals*; otherwise it is not present. |
| *FKP-Sup* | The field is mandatory present if the target device supports *GNSS‑RTK‑FKP‑Gradients*; otherwise it is not present. |
| *OC-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑OrbitCorrections*; otherwise it is not present. |
| *CC-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑ClockCorrections*; otherwise it is not present. |
| *CB-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑CodeBias*; otherwise it is not present. |
| *URA-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-URA*; otherwise it is not present. |
| *PB-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-PhaseBias*; otherwise it is not present. |
| *STEC-Sup* | The field is mandatory present if the target device supports *GNSS-SSR-STEC-Correction*; otherwise it is not present. |
| *Grid-Sup* | The field is mandatory present if the target device supports *GNSS‑SSR‑GriddedCorrection*; otherwise it is not present. Note, support for *GNSS‑SSR‑GriddedCorrection* implies support for *GNSS-SSR-CorrectionPoints* as well. |

#### – *GNSS-TimeModelListSupport*

-- ASN1START

GNSS-TimeModelListSupport ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-DifferentialCorrectionSupport*

-- ASN1START

GNSS-DifferentialCorrectionsSupport ::= SEQUENCE {

gnssSignalIDs GNSS-SignalIDs,

dgnss-ValidityTimeSup BOOLEAN,

...

}

-- ASN1STOP

| *GNSS-DifferentialCorrectionsSupport* field descriptions |
| --- |
| ***gnssSignalIDs***  This field specifies the GNSS signal types for which differential corrections are supported by the target device. This is represented by a bit string in *GNSS-SignalIDs*, with a one‑value at the bit position means differential corrections for the particular GNSS signal type is supported; a zero‑value means not supported. |
| ***dgnss-ValidityTimeSup***  This field specifies if the target device supports estimation of UDRE based on growth rate and validity time for differential corrections. TRUE means supported. |

#### – *GNSS-NavigationModelSupport*

-- ASN1START

GNSS-NavigationModelSupport ::= SEQUENCE {

clockModel BIT STRING { model-1 (0),

model-2 (1),

model-3 (2),

model-4 (3),

model-5 (4),

model-6 (5) } (SIZE (1..8)) OPTIONAL,

orbitModel BIT STRING { model-1 (0),

model-2 (1),

model-3 (2),

model-4 (3),

model-5 (4),

model-6 (5) } (SIZE (1..8)) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-NavigationModelSupport* field descriptions |
| --- |
| ***clockModel***  This field specifies the *gnss-ClockModel* choice(s) in *GNSS-NavigationModel* IE supported by the target device for the GNSS indicated by *GNSS‑ID*. This is represented by a bit string, with a one‑value at the bit position means the particular clock model is supported; a zero‑value means not supported.  If the target device supports GPS and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-2.  If the target device supports SBAS and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-5.  If the target device supports QZSS and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-2.  If the target device supports Galileo and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-1.  If the target device supports GLONASS and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-4.  If the target device supports BDS and *GNSS-NavigationModel* assistance, it shall support *clockModel* Model-6.  If this field is absent, the target device supports the mandatory (native) *clockModel* choice only as listed above for the GNSS indicated by *GNSS‑ID*. |
| ***orbitModel***  This field specifies the *gnss-OrbitModel* choice(s) in *GNSS-NavigationModel* IE supported by the target device for the GNSS indicated by *GNSS‑ID*. This is represented by a bit string, with a one‑value at the bit position means the particular orbit model is supported; a zero‑value means not supported.  If the target device supports GPS and *GNSS-NavigationModel* assistance, it shall support *orbitModel* Model-2.  If the target device supports SBAS and *GNSS-NavigationModel* assistance, it shall support *orbitModel* Model-5.  If the target device supports QZSS and *GNSS-NavigationModel* assistance, it shall support *orbitModel* Model-2.  If the target device supports Galileo and *GNSS-NavigationModel* assistance, it shall support*orbitModel* Model-1.  If the target device supports GLONASS and *GNSS-NavigationModel* assistance, it shall support *orbitModel* Model-4.  If the target device supports BDS and *GNSS-NavigationModel* assistance, it shall support *orbitModel* Model-6.  If this field is absent, the target device supports the mandatory (native) *orbitModel* choice only as listed above for the GNSS indicated by *GNSS‑ID*. |

#### – *GNSS-RealTimeIntegritySupport*

-- ASN1START

GNSS-RealTimeIntegritySupport ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-DataBitAssistanceSupport*

-- ASN1START

GNSS-DataBitAssistanceSupport ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-AcquisitionAssistanceSupport*

-- ASN1START

GNSS-AcquisitionAssistanceSupport ::= SEQUENCE {

...,

confidenceSupport-r10 ENUMERATED { true } OPTIONAL,

dopplerUncertaintyExtSupport-r10 ENUMERATED { true } OPTIONAL

}

-- ASN1STOP

| ***GNSS-AcquisitionAssistanceSupport* field descriptions** |
| --- |
| ***confidenceSupport***  If this field is present, the target device supports the *confidence* field in *GNSS-AcquisitionAssistance*. |
| ***dopplerUncertaintyExtSupport***  If this field is present, the target device supports the *dopplerUncertaintyExt* field in *GNSS-AcquisitionAssistance*. |

#### – *GNSS-AlmanacSupport*

-- ASN1START

GNSS-AlmanacSupport ::= SEQUENCE {

almanacModel BIT STRING { model-1 (0),

model-2 (1),

model-3 (2),

model-4 (3),

model-5 (4),

model-6 (5),

model-7 (6) } (SIZE (1..8)) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-AlmanacSupport* field descriptions |
| --- |
| ***almanacModel***  This field specifies the *almanacModel* choice(s) in *GNSS-Almanac* IE supported by the target device for the GNSS indicated by *GNSS‑ID*. This is represented by a bit string, with a one‑value at the bit position means the particular almanac model is supported; a zero‑value means not supported.  If the target device supports GPS and *GNSS-Almanac* assistance, it shall support Model-2.  If the target device supports SBAS and *GNSS-Almanac* assistance, it shall support Model-6.  If the target device supports QZSS and *GNSS-Almanac* assistance, it shall support Model-2.  If the target device supports Galileo and *GNSS-Almanac* assistance, it shall support Model-1.  If the target device supports GLONASS and *GNSS-Almanac* assistance, it shall support Model-5.  If the target device supports BDS and *GNSS-Almanac* assistance, it shall support Model-7.  If this field is absent, the target device supports the mandatory (native) *almanacModel* choice only as listed above for the GNSS indicated by *GNSS‑ID*. |

#### – *GNSS-UTC-ModelSupport*

-- ASN1START

GNSS-UTC-ModelSupport ::= SEQUENCE {

utc-Model BIT STRING { model-1 (0),

model-2 (1),

model-3 (2),

model-4 (3),

model-5 (4) } (SIZE (1..8)) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-UTC-ModelSupport* field descriptions |
| --- |
| ***utc-Model***  This field specifies the *GNSS-UTC-Model* choice(s) in *GNSS-UTC-Model* IE supported by the target device for the GNSS indicated by *GNSS‑ID*. This is represented by a bit string, with a one‑value at the bit position means the particular UTC model is supported; a zero‑value means not supported.  If the target device supports GPS and *GNSS-UTC-Model* assistance, it shall support Model-1.  If the target device supports SBAS and *GNSS-UTC-Model* assistance, it shall support Model-4.  If the target device supports QZSS and *GNSS-UTC-Model* assistance, it shall support Model-1.  If the target device supports Galileo and *GNSS-UTC-Model* assistance, it shall support Model-1.  If the target device supports GLONASS and *GNSS-UTC-Model* assistance, it shall support Model-3.  If the target device supports BDS and *GNSS-UTC-Model* assistance, it shall support Model-5.  If this field is absent, the target device supports the mandatory (native) *utc-Model* choice only as listed above for the GNSS indicated by *GNSS‑ID*. |

#### – *GNSS-AuxiliaryInformationSupport*

-- ASN1START

GNSS-AuxiliaryInformationSupport ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *BDS-DifferentialCorrectionsSupport*

-- ASN1START

BDS-DifferentialCorrectionsSupport-r12 ::= SEQUENCE {

gnssSignalIDs GNSS-SignalIDs,

...

}

-- ASN1STOP

| *BDS-DifferentialCorrectionsSupport* field descriptions |
| --- |
| ***gnssSignalIDs***  This field specifies the BDS signal types for which differential corrections are supported by the target device. This is represented by a bit string in *GNSS-SignalIDs*, with a one‑value at the bit position means differential corrections for the particular BDS signal type is supported; a zero‑value means not supported. |

#### – *BDS-GridModelSupport*

-- ASN1START

BDS-GridModelSupport-r12 ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-RTK-ObservationsSupport*

-- ASN1START

GNSS-RTK-ObservationsSupport-r15 ::= SEQUENCE {

gnssSignalIDs-r15 GNSS-SignalIDs,

...

}

-- ASN1STOP

| *GNSS-RTK-ObservationsSupport* field descriptions |
| --- |
| ***gnssSignalIDs***  This field specifies the GNSS signal types for which *GNSS-RTK-Observations* are supported by the target device. This is represented by a bit string in *GNSS-SignalIDs*, with a one‑value at the bit position means *GNSS‑RTK‑Observations* for the particular GNSS signal type is supported; a zero‑value means not supported. |

#### – *GLO-RTK-BiasInformationSupport*

-- ASN1START

GLO-RTK-BiasInformationSupport-r15 ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-RTK-MAC-CorrectionDifferencesSupport*

-- ASN1START

GNSS-RTK-MAC-CorrectionDifferencesSupport-r15 ::= SEQUENCE {

link-combinations-support-r15 GNSS-Link-CombinationsList-r15,

...

}

-- ASN1STOP

| *GNSS-RTK-MAC-CorrectionDifferencesSupport* field descriptions |
| --- |
| ***link-combinations-support***  This field specifies the GNSS link/frequency combinations for which *GNSS-RTK-MAC-CorrectionDifferences* are supported by the target device for the GNSS indicated by *GNSS-ID*. |

#### – *GNSS-RTK-ResidualsSupport*

-- ASN1START

GNSS-RTK-ResidualsSupport-r15 ::= SEQUENCE {

link-combinations-support-r15 GNSS-Link-CombinationsList-r15,

...

}

-- ASN1STOP

| *GNSS-RTK-ResidualsSupport* field descriptions |
| --- |
| ***link-combinations-support***  This field specifies the GNSS link/frequency combinations for which *GNSS-RTK-Residuals* are supported by the target device for the GNSS indicated by *GNSS-ID*. |

#### – *GNSS-RTK-FKP-GradientsSupport*

-- ASN1START

GNSS-RTK-FKP-GradientsSupport-r15 ::= SEQUENCE {

link-combinations-support-r15 GNSS-Link-CombinationsList-r15,

...

}

-- ASN1STOP

| *GNSS-RTK-FKP-GradientsSupport* field descriptions |
| --- |
| ***link-combinations-support***  This field specifies the GNSS link/frequency combinations for which *GNSS-RTK-FKP-Gradients* are supported by the target device for the GNSS indicated by *GNSS-ID*. |

#### – *GNSS-SSR-OrbitCorrectionsSupport*

-- ASN1START

GNSS-SSR-OrbitCorrectionsSupport-r15 ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-SSR-ClockCorrectionsSupport*

-- ASN1START

GNSS-SSR-ClockCorrectionsSupport-r15 ::= SEQUENCE {

...

}

-- ASN1STOP

– *GNSS-SSR-CodeBiasSupport*

-- ASN1START

GNSS-SSR-CodeBiasSupport-r15 ::= SEQUENCE {

signal-and-tracking-mode-ID-Sup-r15 GNSS-SignalIDs,

...

}

-- ASN1STOP

| GNSS-SSR-CodeBiasSupport field descriptions |
| --- |
| ***signal-and-tracking-mode-ID-Sup***  This field specifies the GNSS signal(s) for which the *GNSS-SSR-CodeBias* is supported by the target device. |

#### – *GNSS-SSR-URA-Support*

-- ASN1START

GNSS-SSR-URA-Support-r16 ::= SEQUENCE {

...

}

-- ASN1STOP

– *GNSS-SSR-PhaseBiasSupport*

-- ASN1START

GNSS-SSR-PhaseBiasSupport-r16 ::= SEQUENCE {

signal-and-tracking-mode-ID-Sup-r15 GNSS-SignalIDs,

...

}

-- ASN1STOP

| *GNSS-SSR-PhaseBiasSupport* field descriptions |
| --- |
| ***signal-and-tracking-mode-ID-Sup***  This field specifies the GNSS signal(s) for which the *GNSS-SSR-PhaseBias* is supported by the target device. |

#### – *GNSS-SSR-STEC-CorrectionSupport*

-- ASN1START

GNSS-SSR-STEC-CorrectionSupport-r16 ::= SEQUENCE {

...

}

-- ASN1STOP

#### – *GNSS-SSR-GriddedCorrectionSupport*

-- ASN1START

GNSS-SSR-GriddedCorrectionSupport-r16 ::= SEQUENCE {

...

}

-- ASN1STOP

#### 6.5.2.11 GNSS Capability Information Request

#### – *A-GNSS-RequestCapabilities*

The IE *A-GNSS-Request-Capabilities* is used by the location server to request A-GNSS location capabilities (e.g., GNSSs and assistance data supported) from the target device.

-- ASN1START

A-GNSS-RequestCapabilities ::= SEQUENCE {

gnss-SupportListReq BOOLEAN,

assistanceDataSupportListReq BOOLEAN,

locationVelocityTypesReq BOOLEAN,

...

}

-- ASN1STOP

| *A-GNSS-RequestCapabilities* field descriptions |
| --- |
| ***gnss-SupportListReq***  This field specifies whether the target device is requested to include the *gnss-SupportList* field in the *A-GNSS-ProvideCapabilities* IE or not. TRUE means requested. |
| ***assistanceDataSupportListReq***  This field specifies whether the target device is requested to include the *assistanceDataSupportList* field in the *A‑GNSS‑ProvideCapabilities* IE or not. TRUE means requested. |
| ***locationVelocityTypesReq***  This field specifies whether the target device is requested to include the *locationCoordinateTypes* field and *velocityTypes* field in the *A-GNSS-ProvideCapabilities* IE or not. TRUE means requested. |

#### 6.5.2.12 GNSS Error Elements

#### – *A-GNSS-Error*

The IE *A-GNSS-Error* is used by the location server or target device to provide GNSS error reasons.

-- ASN1START

A-GNSS-Error ::= CHOICE {

locationServerErrorCauses GNSS-LocationServerErrorCauses,

targetDeviceErrorCauses GNSS-TargetDeviceErrorCauses,

...

}

-- ASN1STOP

#### – *GNSS-LocationServerErrorCauses*

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

-- ASN1START

GNSS-LocationServerErrorCauses ::= SEQUENCE {

cause ENUMERATED {

undefined,

undeliveredAssistanceDataIsNotSupportedByServer,

undeliveredAssistanceDataIsSupportedButCurrentlyNotAvailableByServer, undeliveredAssistanceDataIsPartlyNotSupportedAndPartlyNotAvailableByServer,

...,

unconfirmedPeriodicAssistanceDataIsNotSupported-v1510,

unconfirmedPeriodicAssistanceDataIsSupportedButCurrentlyNotAvailable-v1510,

unconfirmedPeriodicAssistanceDataIsPartlyNotSupportedAndPartlyNotAvailable-v1510,

undeliveredPeriodicAssistanceDataIsCurrentlyNotAvailable-v1510

},

...

}

-- ASN1STOP

| *GNSS-LocationServerErrorCauses* field descriptions |
| --- |
| ***cause***  This field provides a GNSS specific error cause. The cause values '*unconfirmedPeriodicAssistanceDataIsNotSupported'*, '*unconfirmedPeriodicAssistanceDataIsSupportedButCurrentlyNotAvailable*' and '*unconfirmedPeriodicAssistanceDataIsPartlyNotSupportedAndPartlyNotAvailable*' may only be included in the control transaction of a periodic assistance data transfer procedure, as described in clause 5.2.1a.  The cause value '*undeliveredPeriodicAssistanceDataIsCurrentlyNotAvailable*' may only be included in the data transaction of a periodic assistance data transfer procedure when periodic assistance data are not available when the periodicity condition occurs, as described in clauses 5.2.1a and 5.2.2a. |

#### – *GNSS-TargetDeviceErrorCauses*

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

-- ASN1START

GNSS-TargetDeviceErrorCauses ::= SEQUENCE {

cause ENUMERATED { undefined,

thereWereNotEnoughSatellitesReceived,

assistanceDataMissing,

notAllRequestedMeasurementsPossible,

...

},

fineTimeAssistanceMeasurementsNotPossible NULL OPTIONAL,

adrMeasurementsNotPossible NULL OPTIONAL,

multiFrequencyMeasurementsNotPossible NULL OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-TargetDeviceErrorCauses* field descriptions |
| --- |
| ***cause***  This field provides a GNSS specific error cause. If the cause value is '*notAllRequestedMeasurementsPossible*', the target device was not able to provide all requested GNSS measurements (but may be able to report a location estimate or location measurements). In this case, the target device should include any of the *fineTimeAssistanceMeasurementsNotPossible*, *adrMeasurementsNotPossible*, or *multiFrequenceMeasurementsNotPossible* fields, as applicable. |

#### 6.5.2.13 Common GNSS Information Elements

#### – *GNSS-FrequencyID*

The IE *GNSS-FrequencyID* is used to indicate a specific GNSS link/frequency. The interpretation of *GNSS‑FrequencyID* depends on the *GNSS‑ID.*

-- ASN1START

GNSS-FrequencyID-r15 ::= SEQUENCE {

gnss-FrequencyID-r15 INTEGER (0 .. 7),

...

}

-- ASN1STOP

| *GNSS-FrequencyID* field descriptions |
| --- |
| ***gnss-FrequencyID***  This field specifies a particular GNSS link/frequency. The interpretation of *gnss-FrequencyID* depends on the *GNSS‑ID* and is as shown in the table Value & Explanation relation below. |

Value & Explanation relation

|  |  |  |  |
| --- | --- | --- | --- |
| System | Value | Explanation | |
| Link | Centre Frequency  [MHz] |
| GPS | 0 | L1 | 1575.42 |
| 1 | L2 | 1227.60 |
| 2 | L5 | 1176.45 |
| 3-7 | reserved | |
| SBAS | 0 | L1 | 1575.42 |
| 1 | L5 | 1176.45 |
| 2-7 | reserved | |
| QZSS | 0 | L1 | 1575.42 |
| 1 | L2 | 1227.60 |
| 2 | L5 | 1176.45 |
| 3-7 | reserved | |
| GLONASS  k = -7..13 | 0 | G1 | 1602+k×0.5625 |
| 1 | G2 | 1246+k×0.4375 |
| 2 | G3 | 1202.025 |
| 3-7 | reserved | |
| Galileo | 0 | E1 | 1575.420 |
| 1 | E6 | 1278.750 |
| 2 | E5a | 1176.450 |
| 3 | E5b | 1207.140 |
| 4 | E5 | 1191.795 |
|  | 5-7 | reserved | |
| BDS | 0 | B1 (Phase II) | 1561.098 |
| 1 | B1 (Phase III) | 1575.420 |
| 2 | B2 | 1207.140 |
|  | 3 | B3 | 1268.520 |
|  | 4-7 | reserved | |

#### – *GNSS-ID*

The IE *GNSS-ID* is used to indicate a specific GNSS.

-- ASN1START

GNSS-ID ::= SEQUENCE {

gnss-id ENUMERATED{ gps, sbas, qzss, galileo, glonass, ..., bds },

...

}

-- ASN1STOP

#### – *GNSS-ID-Bitmap*

The IE *GNSS-ID-Bitmap* is used to indicate several GNSSs using a bit map.

-- ASN1START

GNSS-ID-Bitmap ::= SEQUENCE {

gnss-ids BIT STRING { gps (0),

sbas (1),

qzss (2),

galileo (3),

glonass (4),

bds (5) } (SIZE (1..16)),

...

}

-- ASN1STOP

| *GNSS-ID-Bitmap* field descriptions |
| --- |
| ***gnss‑ids***  This field specifies the GNSS(s). This is represented by a bit string, with a one‑value at the bit position means the particular GNSS is addressed; a zero‑value means not addressed. |

#### – *GNSS-Link-CombinationsList*

-- ASN1START

GNSS-Link-CombinationsList-r15 ::= SEQUENCE (SIZE(1..8)) OF GNSS-Link-Combinations-r15

GNSS-Link-Combinations-r15 ::= SEQUENCE {

l1-r15 GNSS-FrequencyID-r15,

l2-r15 GNSS-FrequencyID-r15,

...

}

-- ASN1STOP

#### – *GNSS-NavListInfo*

-- ASN1START

GNSS-NavListInfo-r15 ::= SEQUENCE (SIZE (1..64)) OF SatListElement-r15

SatListElement-r15 ::= SEQUENCE {

svID-r15 SV-ID,

iod-r15 BIT STRING (SIZE(11)),

...

}

-- ASN1STOP

#### – *GNSS-NetworkID*

The IE *GNSS-NetworkID* defines the reference network and the source of the particular set of reference stations and their observation information. This IE is used for MAC Network RTK as described in [30].

-- ASN1START

GNSS-NetworkID-r15 ::= SEQUENCE {

networkID-r15 INTEGER (0..255),

...

}

-- ASN1STOP

#### – *GNSS-PeriodicControlParam*

The IE *GNSS-PeriodicControlParam* is used to specify control parameters for a periodic assistance data delivery.

-- ASN1START

GNSS-PeriodicControlParam-r15 ::= SEQUENCE {

deliveryAmount-r15 INTEGER (1..32),

deliveryInterval-r15 INTEGER (1..64),

...

}

-- ASN1STOP

| *GNSS-PeriodicControlParam* field descriptions |
| --- |
| ***deliveryAmount***  This field specifies the number of periodic assistance data deliveries. Integer values *N*=1…31 correspond to an amount of 2*N*. Integer value *N*=32 indicates an 'infinite/indefinite' amount, which means that the assistance data delivery should continue until a LPP *Abort* message is received. |
| ***deliveryInterval***  This field specifies the interval between assistance data deliveries in seconds. |

#### – *GNSS-ReferenceStationID*

The IE *GNSS-ReferenceStationID* is used to identify a specific GNSS Reference Station.

-- ASN1START

GNSS-ReferenceStationID-r15 ::= SEQUENCE {

referenceStationID-r15 INTEGER (0..65535),

providerName-r15 VisibleString (SIZE (1..32)) OPTIONAL,

...

}

-- ASN1STOP

| *GNSS-ReferenceStationID* field descriptions |
| --- |
| ***referenceStationID***  This field provides the reference station identity. |
| ***providerName***  This field is associated to a GNSS correction data provider to ensure that the *referenceStationID*'s are unique from a target device perspective. |

#### – *GNSS-SignalID*

The IE *GNSS-SignalID* is used to indicate a specific GNSS signal type. The interpretation of *GNSS-SignalID* depends on the *GNSS‑ID.*

-- ASN1START

GNSS-SignalID ::= SEQUENCE {

gnss-SignalID INTEGER (0 .. 7),

...,

[[

gnss-SignalID-Ext-r15 INTEGER (8..23) OPTIONAL

]]

}

-- ASN1STOP

| *GNSS-SignalID* field descriptions |
| --- |
| ***gnss-SignalID, gnss-SignalID-Ext***  This field specifies a particular GNSS signal. The interpretation of *gnss-SignalID* and *gnss-SignalID-Ext* depends on the *GNSS‑ID* and is as shown in the table System to Value & Explanation relation below.  If the field *gnss-SignalID-Ext* is present, the *gnss-SignalID* should be set to value 7 and shall be ignored by the receiver. |

System to Value & Explanation relation

|  |  |  |
| --- | --- | --- |
| System | Value | Explanation |
| GPS | 0 | GPS L1 C/A |
| 1 | GPS L1C |
| 2 | GPS L2C |
| 3 | GPS L5 |
| 4 | GPS L1 P |
| 5 | GPS L1 Z-tracking |
| 6 | GPS L2 C/A |
| 7 | GPS L2 P |
| 8 | GPS L2 Z-tracking |
| 9 | GPS L2 L2C(M) |
| 10 | GPS L2 L2C(L) |
| 11 | GPS L2 L2C(M+L) |
| 12 | GPS L5 I |
| 13 | GPS L5 Q |
| 14 | GPS L5 I+Q |
| 15 | GPS L1 L1C(D) |
| 16 | GPS L1 L1C(P) |
| 17 | GPS L1 L1C(D+P) |
| 18-23 | Reserved |
| SBAS | 0 | L1 C/A |
| 1 | L5 I |
| 2 | L5 Q |
| 3 | L5 I+Q |
| 4-7 | Reserved |
| QZSS | 0 | QZS-L1 C/A |
| 1 | QZS-L1C |
| 2 | QZS-L2C |
| 3 | QZS-L5 |
| 4 | QZS-LEX S |
| 5 | QZS-LEX L |
| 6 | QZS-LEX S+L |
| 7 | QZS-L2 L2C(M) |
| 8 | QZS-L2 L2C(L) |
| 9 | QZS-L2 L2C(M+L) |
| 10 | QZS-L5 I |
| 11 | QZS-L5 Q |
| 12 | QZS-L5 I+Q |
| 13 | QZS L1 L1C(D) |
| 14 | QZS L1 L1C(P) |
| 15 | QZS L1 L1C(D+P) |
| 16-23 | Reserved |
| GLONASS | 0 | GLONASS G1 C/A |
| 1 | GLONASS G2 C/A |
| 2 | GLONASS G3 |
| 3 | GLONASS G1 P |
| 4 | GLONASS G2 P |
| 5 | GLONASS G1a(D) |
| 6 | GLONASS G1a(P) |
| 7 | GLONASS G1a (D+P) |
| 8 | GLONASS G2a(I) |
| 9 | GLONASS G2a(P) |
| 10 | GLONASS G2a(I+P) |
| 11 | GLONASS G3 I |
| 12 | GLONASS G3 Q |
| 13 | GLONASS G3 I+Q |
| 14-23 | Reserved |
| Galileo | 0 | Galileo E1 |
| 1 | Galileo E5A |
| 2 | Galileo E5B |
| 3 | Galileo E6 |
| 4 | Galileo E5A + E5B |
| 5 | Galileo E1 C No data |
| 6 | Galileo E1 A |
| 7 | Galileo E1 B I/NAV OS/CS/SoL |
| 8 | Galileo E1 B+C |
| 9 | Galileo E1 A+B+C |
| 10 | Galileo E6 C |
| 11 | Galileo E6 A |
| 12 | Galileo E6 B |
| 13 | Galileo E6 B+C |
| 14 | Galileo E6 A+B+C |
| 15 | Galileo E5B I |
| 16 | Galileo E5B Q |
| 17 | Galileo E5B I+Q |
| 18 | Galileo E5(A+B) I |
| 19 | Galileo E5(A+B) Q |
| 20 | Galileo E5(A+B) I+Q |
| 21 | Galileo E5A I |
| 22 | Galileo E5A Q |
| 23 | Galileo E5A I+Q |
| BDS | 0 | B1 I |
| 1 | B1 Q |
| 2 | B1 I+Q |
| 3 | B3 I |
| 4 | B3 Q |
| 5 | B3 I+Q |
| 6 | B2 I |
| 7 | B2 Q |
| 8 | B2 I+Q |
| 9-23 | Reserved |

#### – *GNSS-SignalIDs*

The IE *GNSSSignal‑IDs* is used to indicate several GNSS signals using a bit map. The interpretation of *GNSSSignal‑IDs* depends on the *GNSS‑ID.*

-- ASN1START

GNSS-SignalIDs ::= SEQUENCE {

gnss-SignalIDs BIT STRING (SIZE(8)),

...,

[[

gnss-SignalIDs-Ext-r15 BIT STRING (SIZE(16)) OPTIONAL

]]

}

-- ASN1STOP

| *GNSS-SignalIDs* field descriptions |
| --- |
| ***gnss-SignalIDs, gnss-SignalIDs-Ext***  This field specifies one or several GNSS signals using a bit map. A one‑value at the bit position means the particular signal is addressed; a zero‑value at the particular bit position means the signal is not addressed. The interpretation of the bit map in *gnssSignalIDs* and *gnss-SignalIDs-Ext* depends on the *GNSS‑ID* and is shown in the table below.  Unfilled table entries indicate no assignment and shall be set to zero. |

interpretation of the bit map in *gnssSignalIDs*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| GNSS | Bit 1  (MSB) | Bit 2 | Bit 3 | Bit 4 | Bit 5 | Bit 6 | Bit 7 | Bit 8  (LSB) |
| GPS | L1 C/A | L1C | L2C | L5 | L1P | L1 Z | L2 C/A | L2 P |
| SBAS | L1 C/A | L5 I | L5 Q | L5 I+Q |  |  |  |  |
| QZSS | QZS-L1 C/A | QZS-L1C | QZS-L2C | QZS-L5 | LEX S | LEX L | LEX S+L | L2C(M) |
| GLONASS | G1 C/A | G2 C/A | G3 | G1 P | G2 P | G1a(D) | G1a(P) | G1a(D+P) |
| Galileo | E1 | E5a | E5b | E6 | E5a+E5b | E1 C No Data | E1 A | E1 B I/NAV OS/CS/SoL |
| BDS | B1 I | B1 Q | B1 I+Q | B3 I | B3 Q | B3 I+Q | B2 I | B2 Q |

interpretation of the bit map in *gnssSignalIDs-Ext*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| GNSS | Bit 1  (MSB) | Bit 2 | Bit 3 | Bit 4 | Bit 5 | Bit 6 | Bit 7 | Bit 8 |
| GPS | L2 Z | L2C(M) | L2C(L) | L2C(M+L) | L5 I | L5 Q | L5 I+Q | L1C(D) |
| SBAS |  |  |  |  |  |  |  |  |
| QZSS | L2C(L) | L2C(M+L) | L5 I | L5 Q | L5 I+Q | L1C(D) | L1C(P) | L1C(D+P) |
| GLONASS | G2a(I) | G2a(P) | G2a(I+P) | G3 I | G3 Q | G3(I+Q) |  |  |
| Galileo | E1 B+C | E1 A+B+C | E6C | E6A | E6B | E6 B+C | E6 A+B+C | E5B I |
| BDS | B2 I+Q |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| GNSS | Bit 9 | Bit 10 | Bit 11 | Bit 12 | Bit 13 | Bit 14 | Bit 15 | Bit 16  (LSB) |
| GPS | L1C(P) | L1C(D+P) |  |  |  |  |  |  |
| SBAS |  |  |  |  |  |  |  |  |
| QZSS |  |  |  |  |  |  |  |  |
| GLONASS |  |  |  |  |  |  |  |  |
| Galileo | E5B Q | E5B I+Q | E5(A+B) I | E5(A+B) Q | E5(A+B) I+Q | E5A I | E5A Q | E5A I+Q |
| BDS |  |  |  |  |  |  |  |  |

#### – *GNSS-SubNetworkID*

The IE *GNSS-SubNetworkID* defines the subnetwork of a network identified by *GNSS-NetworkID*. This IE is used for MAC Network RTK as described in [30].

-- ASN1START

GNSS-SubNetworkID-r15 ::= SEQUENCE {

subNetworkID-r15 INTEGER (0..15),

...

}

-- ASN1STOP

#### – *SBAS-ID*

The IE *SBAS‑ID* is used to indicate a specific SBAS.

-- ASN1START

SBAS-ID ::= SEQUENCE {

sbas-id ENUMERATED { waas, egnos, msas, gagan, ...},

...

}

-- ASN1STOP

#### – *SBAS-IDs*

The IE *SBAS‑IDs* is used to indicate several SBASs using a bit map.

-- ASN1START

SBAS-IDs ::= SEQUENCE {

sbas-IDs BIT STRING { waas (0),

egnos (1),

msas (2),

gagan (3) } (SIZE (1..8)),

...

}

-- ASN1STOP

| *SBAS‑IDs* field descriptions |
| --- |
| ***sbas-IDs***  This field specifies one or several SBAS(s) using a bit map. A one‑value at the bit position means the particular SBAS is addressed; a zero‑value at the particular bit position means the SBAS is not addressed. |

#### – *SV-ID*

The IE *SV‑ID* is used to indicate a specific GNSS satellite. The interpretation of *SV‑ID* depends on the *GNSS‑ID.*

-- ASN1START

SV-ID ::= SEQUENCE {

satellite-id INTEGER(0..63),

...

}

-- ASN1STOP

| *SV‑ID* field descriptions |
| --- |
| ***satellite‑id***  This field specifies a particular satellite within a specific GNSS. The interpretation of *satellite‑id* depends on the *GNSS‑ID* see the table below. |

interpretation of *satellite‑id*

|  |  |  |
| --- | --- | --- |
| System | Value of *satellite‑id* | Interpretation of *satellite‑id* |
| GPS | '0' – '62'  '63' | Satellite PRN Signal No. 1 to 63  Reserved |
| SBAS | '0' – '38'  '39' – '63' | Satellite PRN Signal No. 120 to 158  Reserved |
| QZSS | '0' – '9'  '10 – '63' | Satellite PRN Signal No. 193 to 202  Reserved |
| GLONASS | '0' – '23'  '24 – '63' | Slot Number 1 to 24  Reserved |
| Galileo | '0' – '35' '36' – '63' | Code No. 1 to 36 Reserved |
| BDS | '0' – '36'  '37' – '63' | Satellite ranging code number signal No.1 to 37 [23]  Reserved |

|  |
| --- |
| 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. |
| ***resultsSSB-Cell***  This attribute specifies the SS reference signal received power (SS-RSRP) and quality (SS-RSRQ) measurement aggregated at cell level, as defined in TS 38.331 [35]. |
| ***resultsCSI-RS-Cell***  This attribute specifies the CSI-RS reference signal received power (CSI-RSRP) and quality (CSI-RSRQ) measurement aggregated at cell level, as defined in TS 38.331 [35]. |
| ***ssb-Results***  This attribute specifies the SS reference signal received power (SS-RSRP) and quality (SS-RSRQ) measurement per SSB resource, as defined in TS 38.331 [35]. |
| ***csi-RS-Results***  This attribute specifies the CSI-RS reference signal received power (CSI-RSRP) and quality (CSI-RSRQ) per CSI-RS resource, as defined in TS 38.331 [35]. |
| ***primaryCellMeasuredResults***  This field contains measurements for the primary cell when the target device reports measurements for both primary cell and neighbour cells. This field shall be omitted when the target device reports measurements for the primary cell only, in which case the measurements for the primary cell is reported in the *measuredResultsList*. |

#### 6.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-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

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

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

...

}

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

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

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

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

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

...

}

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

-- ASN1STOP

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

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

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

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

...

}

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

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

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

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

}

-- ASN1STOP

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

#### 6.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)),

additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-TDOA-ProvideCapabilities* field descriptions |
| --- |
| ***nr-DL-TDOA-Mode***  This field specifies the 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-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

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

...

}

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

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

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

...

}

nrMaxTRPs INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

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

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

The IE *NR-DL-AoD-LocationInformation* is included by the target device when location information derived using 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. |
| ***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 to be decided in RAN4

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

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

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

...

}

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

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

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

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

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

...

}

nrMaxTRPs INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

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

#### 6.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,

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

...

}

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

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

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

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

}

-- ASN1STOP

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

#### 6.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)),

additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

#### 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

#### 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

|  |
| --- |
| Next change |

# 7 Broadcast of assistance data

## 7.1 General

Broadcast of positioning assistance data is supported via Positioning System Information Blocks (posSIBs) as specified in TS 36.331 [12] or TS 38.331 [35]. The posSIBs are carried in RRC System Information (SI) messages (TS 36.331 [12] or TS 38.331 [35]).

A single *SystemInformationBlockPos* IE is defined in TS 36.331 [12] or TS 38.331 [35] which is carried in IE *PosSystemInformation-r15-IEs* specified in TS 36.331 [12] or TS 38.331 [35]. The mapping of positioning SIB type (*posSibType*) to assistance data carried in *SystemInformationBlockPos* is specified in clause 7.2.

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

The supported *posSibType*'s are specified in Table 7.2-1. The GNSS Common and Generic Assistance Data IEs are defined in clause 6.5.2.2. The OTDOA Assistance Data IEs and NR DL-TDOA/DL-AoD Assistance Data IEs are defined in clause 7.4.2.

Table 7.2-1: Mapping of posSibType to assistanceDataElement

|  |  |  |
| --- | --- | --- |
|  | *posSibType* [12] | *assistanceDataElement* |
| GNSS Common Assistance Data (clause 6.5.2.2) | *posSibType1-1* | *GNSS-ReferenceTime* |
| *posSibType1-2* | *GNSS-ReferenceLocation* |
| *posSibType1-3* | *GNSS-IonosphericModel* |
| *posSibType1-4* | *GNSS-EarthOrientationParameters* |
| *posSibType1-5* | *GNSS-RTK-ReferenceStationInfo* |
| *posSibType1-6* | *GNSS-RTK-CommonObservationInfo* |
| *posSibType1-7* | *GNSS-RTK-AuxiliaryStationData* |
| *posSibType1-8* | *GNSS-SSR-CorrectionPoints* |
| GNSS Generic Assistance Data (clause 6.5.2.2) | *posSibType2-1* | *GNSS-TimeModelList* |
| *posSibType2-2* | *GNSS-DifferentialCorrections* |
| *posSibType2-3* | *GNSS-NavigationModel* |
| *posSibType2-4* | *GNSS-RealTimeIntegrity* |
| *posSibType2-5* | *GNSS-DataBitAssistance* |
| *posSibType2-6* | *GNSS-AcquisitionAssistance* |
| *posSibType2-7* | *GNSS-Almanac* |
| *posSibType2-8* | *GNSS-UTC-Model* |
| *posSibType2-9* | *GNSS-AuxiliaryInformation* |
| *posSibType2-10* | *BDS-DifferentialCorrections* |
| *posSibType2-11* | *BDS-GridModelParameter* |
| *posSibType2-12* | *GNSS-RTK-Observations* |
| *posSibType2-13* | *GLO-RTK-BiasInformation* |
| *posSibType2-14* | *GNSS-RTK-MAC-CorrectionDifferences* |
| *posSibType2-15* | *GNSS-RTK-Residuals* |
| *posSibType2-16* | *GNSS-RTK-FKP-Gradients* |
| *posSibType2-17* | *GNSS-SSR-OrbitCorrections* |
| *posSibType2-18* | *GNSS-SSR-ClockCorrections* |
| *posSibType2-19* | *GNSS-SSR-CodeBias* |
| *posSibType2-20* | *GNSS-SSR-URA* |
| *posSibType2-21* | *GNSS-SSR-PhaseBias* |
| *posSibType2-22* | *GNSS-SSR-STEC-Correction* |
| *posSibType2-23* | *GNSS-SSR-GriddedCorrection* |
| OTDOA Assistance Data (clause 7.4.2) | *posSibType3-1* | *OTDOA-UE-Assisted* |
| NR DL-TDOA/DL-AoD Assistance Data (clause 7.4.2) | *posSibType6-1* | *NR-DL-Measurement-AD* |
| *posSibType6-2* | *NR-UEB-TRP-LocationData* |
| *posSibType6-3* | *NR-UEB-TRP-RTD-Info* |

|  |
| --- |
| Next change |

## 7.4 Broadcast information elements

### 7.4.1 Basic production

This clause defines the broadcast information elements which are encoded as 'basic production' for other purposes than encoding the IE within an LPP message.

The 'basic production' is obtained from their ASN.1 definitions by use of Basic Packed Encoding Rules (BASIC-PER), Unaligned Variant, as specified in ITU-T Rec. X.691 [22]. It always contains a multiple of 8 bits.

### 7.4.2 Element definitions

#### – *AssistanceDataSIBelement*

The IE *AssistanceDataSIBelement* is used in the IE *SystemInformationBlockPos* as specified in TS 36.331 [12].

-- ASN1START

AssistanceDataSIBelement-r15 ::= SEQUENCE {

valueTag-r15 INTEGER (0..63) OPTIONAL,

expirationTime-r15 UTCTime OPTIONAL,

cipheringKeyData-r15 CipheringKeyData-r15 OPTIONAL,

segmentationInfo-r15 SegmentationInfo-r15 OPTIONAL,

assistanceDataElement-r15 OCTET STRING,

...

}

CipheringKeyData-r15 ::= SEQUENCE {

cipherSetID-r15 INTEGER (0..65535),

d0-r15 BIT STRING (SIZE (1..128)),

...

}

SegmentationInfo-r15 ::= SEQUENCE {

segmentationOption-r15 ENUMERATED {pseudo-seg, octet-string-seg},

assistanceDataSegmentType-r15 ENUMERATED {notLastSegment, lastSegment},

assistanceDataSegmentNumber-r15 INTEGER (0..63),

...

}

-- ASN1STOP

| *AssistanceDataSIBelement* field descriptions |
| --- |
| ***valueTag***  This field is used to indicate to the target device any changes in the broadcast assistance data content. The *valueTag* is incremented by one, by the location server, every time a modified assistance data content is provided. This field is not included if the broadcast assistance data changes too frequently. If *valueTag* and *expirationTime* are absent, the UE assumes that the broadcast assistance data content changes at every broadcast interval. |
| ***expirationTime***  This field indicates how long the broadcast assistance data content is valid. It is specified as UTC time and indicates when the broadcast assistance data content will expire. |
| ***cipheringKeyData***  If present, indicates that the *assistanceDataElement* octet string is ciphered. |
| ***segmentationInfo***  If present, indicates that the *assistanceDataElement* is one of many segments. |
| ***assistanceDataElement***  The *assistanceDataElement* OCTET STRING depends on the *posSibType* and is specified in Table 7.2-1. NOTE. |
| ***cipherSetID***  This field identifies a cipher set comprising a cipher key value and the first component C0 of the initial counter C1. |
| ***d0***  This field provides the second component for the initial ciphering counter C1. This field is defined as a bit string with a length of 1 to 128 bits. A target device first pads out the bit string if less than 128 bits with zeroes in least significant bit positions to achieve 128 bits. C1 is then obtained from D0 and C0 (defined by the *cipherSetID*) as:  C1 = (D0 + C0) mod 2128 (with all values treated as non-negative integers). |
| ***segmentationOption***  Indicates the used segmentation option. |
| ***assistanceDataSegmentType***  Indicates whether the included *assistanceDataElement* segment is the last segment or not. |
| ***assistanceDataSegmentNumber***  Segment number of the *assistanceDataElement* segment. A segment number of zero corresponds to the first segment, one corresponds to the second segment, and so on. Segments numbers wraparound should there be more than 64 segments |

NOTE: For example, if the *posSibType* in IE *PosSIB-Type* defined in TS 36.331 [12] indicates '*posSibType1-7*', the *assistanceDataElement* OCTET STRING includes the LPP IE *GNSS‑RTK‑AuxiliaryStationData*.

#### – *OTDOA-UE-Assisted*

The IE *OTDOA-UE-Assisted* is used in the *assistanceDataElement* if the *posSibType* in IE *PosSIB-Type* defined in TS 36.331 [12] indicates '*posSibType3-1*'.

-- ASN1START

OTDOA-UE-Assisted-r15 ::= SEQUENCE {

otdoa-ReferenceCellInfo-r15 OTDOA-ReferenceCellInfo,

otdoa-NeighbourCellInfo-r15 OTDOA-NeighbourCellInfoList,

...

}

-- ASN1STOP

| *OTDOA-UE-Assisted* field descriptions |
| --- |
| ***otdoa-ReferenceCellInfo***  LPP IE *OTDOA-ReferenceCellInfo* as defined in clause 6.5.1.2. |
| ***otdoa-NeighbourCellInfo***  LPP IE *OTDOA-NeighbourCellInfoList* as defined in clause 6.5.1.2. |

#### – *NR-DL-Measurement-AD*

The IE *NR-DL-Measurement-AD* is used in the *assistanceDataElement* if the *posSibType* in IE *PosSIB-Type* defined in TS 38.331 [35] indicates '*posSibType6-1*'.

-- ASN1START

NR-DL-Measurement-AD-r16 ::= SEQUENCE {

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

nr-PositionCalculationAssistanceData-r16

NR-PositionCalculationAssistanceData-r16 ...

}

-- ASN1STOP

| *NR-DL-Measurement-AD* field descriptions |
| --- |
| ***nr-DL-PRS-AssistanceData***  LPP IE *NR-DL-PRS-AssistanceData* as defined in sub-clause 6.4.2.1. |
| ***nr-PositionCalculationAssistanceData***  LPP IE *NR-PositionCalculationAssistanceData* as defined in sub-clause 6.4.2.1. |

#### – *NR-UEB-TRP-LocationData*

The IE *NR-UEB-TRP-LocationData* is used in the *assistanceDataElement* if the *posSibType* in IE *PosSIB-Type* defined in TS 38.331 [35] indicates '*posSibType6-2*'.

-- ASN1START

NR-UEB-TRP-LocationData-r16 ::= SEQUENCE {

nr-trp-LocationInfo-r16 NR-TRP-LocationInfo-r16,

nr-dl-prs-BeamInfo-r16 NR-DL-PRS-Beam-Info-r16 OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| *NR-UEB-TRP-LocationData* field descriptions |
| --- |
| ***nr-trp-LocationInfo***  LPP IE *NR-TRP-LocationInfo* as defined in sub-clause 6.4.2.1. |
| ***nr-dl-prs-BeamInfo***  LPP IE *NR-DL-PRS-Beam-Info* as defined in sub-clause 6.4.2.1. |

#### – *NR-UEB-TRP-RTD-Info*

The IE *NR-UEB-TRP-RTD-Info* is used in the *assistanceDataElement* if the *posSibType* in IE *PosSIB-Type* defined in TS 38.331 [35] indicates '*posSibType6-3*'.

-- ASN1START

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

nr-rtd-Info-r16 NR-RTD-Info-r16,

...

}

-- ASN1STOP

| *NR-UEB-TRP-RTD-Info* field descriptions |
| --- |
| ***nr-rtd-Info***  LPP IE *NR-RTD-Info* as defined in sub-clause 6.4.2.1. |

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