LTE;
Evolved Universal Terrestrial Radio Access (E-UTRA);
LTE Positioning Protocol (LPP)
(3GPP TS 36.355 version 11.1.0 Release 11)
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- CNAV-ClockModel
- GLONASS-ClockModel
- SBAS-ClockModel
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Foreword

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y  the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z  the third digit is incremented when editorial only changes have been incorporated in the document.
1 Scope
The present document contains the definition of the LTE Positioning Protocol (LPP).

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

3.1 Definitions

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

**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.

**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).

**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 cells. If a signal from cell 1 is received at the moment $t_1$, and a signal from cell 2 is received at the moment $t_2$, the OTDOA is $t_2 - t_1$.

3.2 Abbreviations

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

ADR Accumulated Delta-Range
A-GNSS Assisted-GNSS
ARFCN Absolute Radio Frequency Channel Number
BTS Base Transceiver Station (GERAN)
CID Cell-ID (positioning method)
CNAV Civil Navigation
CRS Cell-specific Reference Signals
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
FTA Fine Time Assistance
GAGAN GPS Aided Geo Augmented Navigation
GLONASS GLObal'naya NAvigatsionnaya Sputnikovaya Sistema (Engl.: Global Navigation Satellite System)
4 Functionality of Protocol

4.1 General

4.1.1 LPP Configuration

LPP is used point-to-point between a location server (E-SMLC 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 (as defined in [2] and [3]).
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 [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 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, A-GNSS, and E-CID positioning methods.

4.1.4 LPP Messages

Each LPP transaction involves the exchange of one or more LPP messages between the location server and the target device. The general format of an LPP message consists of a set of common fields followed by a body. The body (which may be empty) contains information specific to a particular message type. Each message type contains information specific to one or more positioning methods and/or information common to all positioning methods.

The common fields are as follows:
### Field | Role
--- | ---
Transaction ID | Identify messages belonging to the same transaction
Transaction End Flag | Indicate when a transaction (e.g., one with periodic responses) has ended
Sequence Number | Enable detection of a duplicate LPP message at a receiver
Acknowledgement | Enable an acknowledgement to be requested and/or returned for any LPP message

NOTE: Use of the Transaction ID and Transaction End fields conform to the procedures in clause 5 and are independent of the means used to transport LPP messages (e.g., whether using a NAS MO-LR Request, NAS Generic Transport or user-plane solution).

The following message types are defined:
- Request Capabilities;
- Provide Capabilities;
- Request Assistance Data;
- Provide Assistance Data;
- Request Location Information;
- Provide Location Information;
- Abort;
- Error.

## 4.2 Common LPP Session Procedure

The purpose of this procedure is to support an LPP session comprising a sequence of LPP transactions. The procedure is described in Figure 4.2-1.

1. Endpoint A, which may be either the target or the server, initiates an LPP session by sending an LPP message for an initial LPP transaction $j$ to the other endpoint B (which has an opposite role to A).
2. Endpoints A and B may exchange further messages to continue the transaction started in step 1.
3. Either endpoint may instigate further transactions by sending additional LPP messages.
4. A session is terminated by a final transaction \( N \) in which LPP messages will be exchanged between the two endpoints.

Within each transaction, all constituent messages shall contain the same transaction identifier. The last message sent in each transaction shall have the IE \textit{endTransaction} set to TRUE. Transactions that occur in parallel shall use different transaction IDs; transaction IDs for completed transactions may be reused at any time after the final message of the previous transaction with the same ID is known to have been received.

### 4.3 LPP Transport

#### 4.3.1 Transport Layer Requirements

LPP requires reliable, in-sequence delivery of LPP messages from the underlying transport layers. This section describes the transport capabilities that are available within LPP. A UE implementing LPP for the control-plane solution shall support LPP reliable transport (including all three of duplicate detection, acknowledgement, and retransmission).

LPP reliable transport functionality is not used in the user-plane solution.

The following requirements in subclauses 4.3.2, 4.3.3, and 4.3.4 for LPP reliable transport apply only when the capability is supported.

#### 4.3.2 LPP Duplicate Detection

A sender shall include a sequence number in all LPP messages sent for a particular location session. The sequence number shall be distinct for different LPP messages sent in the same direction in the same location session (e.g., may start at zero in the first LPP message and increase monotonically in each succeeding LPP message). Sequence numbers used in the uplink and downlink are independent (e.g., can be the same).

A receiver shall record the most recent received sequence number for each location session. If a message is received carrying the same sequence number as that last received for the associated location session, it shall be discarded. Otherwise (i.e., if the sequence number is different or if no sequence number was previously received or if no sequence number is included), the message shall be processed.

Sending and receiving sequence numbers shall be deleted in a server when the associated location session is terminated and shall be deleted in a target device when there has been no activity for a particular location session for 10 minutes.

NOTE: For LPP control-plane use, a target device can be aware of a location session from information provided at the NAS level for downlink transport of an LPP message.

#### 4.3.3 LPP Acknowledgement

##### 4.3.3.1 General

Each LPP message may carry an acknowledgement request and/or an acknowledgement indicator. A LPP message including an acknowledgement request (i.e., that include the IE \textit{ackRequested} set to TRUE) shall also include a sequence number. Upon reception of an LPP message which includes the IE \textit{ackRequested} set to TRUE, a receiver returns an LPP message with an acknowledgement response (i.e., that includes the \textit{ackIndicator} IE set to the same sequence number of the message being acknowledged). An acknowledgement response may contain no LPP message body (in which case only the sequence number being acknowledged is significant); alternatively, the acknowledgement may be sent in an LPP message along with an LPP message body. An acknowledgement is returned for each received LPP message that requested an acknowledgement including any duplicate(s). Once a sender receives an acknowledgement for an LPP message, and provided any included sequence number is matching, it is permitted to send the next LPP message. No message reordering is needed at the receiver since this stop-and-wait method of sending ensures that messages normally arrive in the correct order.

When an LPP message is transported via a NAS MO-LR request, the message does not request an acknowledgement.

##### 4.3.3.2 Procedure related to Acknowledgement

Figure 4.3.3.2-1 shows the procedure related to acknowledgement.
1. Endpoint A sends an LPP message $N$ to Endpoint B which includes the IE $ackRequested$ set to TRUE and a sequence number.

2. If LPP message $N$ is received and Endpoint B is able to decode the $ackRequested$ value and sequence number, Endpoint B shall return an acknowledgement for message $N$. The acknowledgement shall contain the IE $ackIndicator$ set to the same sequence number as that in message $N$.

3. When the acknowledgement for LPP message $N$ is received and provided the included $ackIndicator$ IE matches the sequence number sent in message $N$, Endpoint A sends the next LPP message $N+1$ to Endpoint B when this message is available.

### 4.3.4 LPP Retransmission

#### 4.3.4.1 General

This capability builds on the acknowledgement and duplicate detection capabilities. When an LPP message which requires acknowledgement is sent and not acknowledged, it is resent by the sender following a timeout period up to three times. If still unacknowledged after that, the sender aborts all LPP activity for the associated session. The timeout period is determined by the sender implementation but shall not be less than a minimum value of 250ms.

#### 4.3.4.2 Procedure related to Retransmission

Figure 4.3.4.2-1 shows the procedure related to retransmission when combined with acknowledgement and duplicate detection.
Figure 4.3.4.2-1: LPP Retransmission procedure

1. Endpoint A sends an LPP message $N$ to Endpoint B for a particular location session and includes a request for acknowledgement along with a sequence number.

2. If LPP message $N$ is received and Endpoint B is able to decode the $ackRequested$ value and sequence number (regardless of whether the message body can be correctly decoded), Endpoint B shall return an acknowledgement for message $N$. If the acknowledgement is received by Endpoint A (such that the acknowledged message can be identified and sequence numbers are matching), Endpoint A skips steps 3 and 4.

3. If the acknowledgement in step 2 is not received after a timeout period, Endpoint A shall retransmit LPP message $N$ and shall include the same sequence number as in step 1.

4. If LPP message $N$ in step 3 is received and Endpoint B is able to decode the $ackRequested$ value and sequence number (regardless of whether the message body can be correctly decoded and whether or not the message is considered a duplicate), Endpoint B shall return an acknowledgement. Steps 3 may be repeated one or more times if the acknowledgement in step 4 is not received after a timeout period by Endpoint A. If the acknowledgement in step 4 is still not received after sending three retransmissions, Endpoint A shall abort all procedures and activity associated with LPP support for the particular location session.

5. Once an acknowledgement in step 2 or step 4 is received, Endpoint A sends the next LPP message $N+1$ for the location session to Endpoint B when this message is available.

5 LPP Procedures

5.1 Procedures related to capability transfer

The purpose of the procedures that are grouped together in this section 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 3GPP TS 36.305 [2].

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 section 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 3GPP TS 36.305 [2].

5.2.1 Assistance Data Transfer procedure

The Assistance Data Transfer procedure is shown in Figure 5.2.1-1.

1. The target sends a RequestAssistanceData message to the server.

2. The server responds with a ProvideAssistanceData message to the target containing assistance data. The transferred assistance data should match or be a subset of the assistance data requested in step 1. The server may also provide any not requested information that it considers useful to the target. If step 3 does not occur, this message shall set the endTransaction IE to TRUE.

3. The server may transmit one or more additional ProvideAssistanceData messages to the target containing further assistance data. The transferred assistance data should match or be a subset of the assistance data requested in step 1. The server may also provide any not requested information that it considers useful to the target. The last message shall include the endTransaction IE set to TRUE.

5.2.2 Assistance Data Delivery procedure

The Assistance Data Delivery procedure allows the server to provide unsolicited assistance data to the target and is shown in Figure 5.2.2-1.
Figure 5.2.2-1: LPP Assistance data transfer procedure

1. The server sends a ProvideAssistanceData message to the target containing assistance data. If step 2 does not occur, this message shall set the endTransaction IE to TRUE.

2. The server may transmit one or more additional ProvideAssistanceData messages to the target containing additional assistance data. The last message shall include the endTransaction IE set to TRUE.

5.2.3 Transmission of LPP Request Assistance Data

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

1> set the IEs for the positioning-method-specific request for assistance data to request the data indicated by upper layers.

5.2.4 Reception of LPP Provide Assistance Data

Upon receiving a ProvideAssistanceData message, the target device shall:

1> for each positioning method contained in the message:
2> deliver the related assistance data to upper layers.

5.3 Procedures related to Location Information Transfer

The purpose of the procedures in this section 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 3GPP TS 36.305 [2].

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).

5.3.1 Location Information Transfer procedure

The Location Information Transfer procedure is shown in Figure 5.3.1-1.
1. The server sends a `RequestLocationInformation` message to the target to request location information, indicating the type of location information needed and potentially the associated QoS.

2. The target sends a `ProvideLocationInformation` message to the server to transfer location information. The location information transferred should match or be a subset of the location information requested in step 1 unless the server explicitly allows additional location information. If step 3 does not occur, this message shall set the `endTransaction` IE to TRUE.

3. If requested in step 1, the target sends additional `ProvideLocationInformation` messages to the server to transfer location information. The location information transferred should match or be a subset of the location information requested in step 1 unless the server explicitly allows additional location information. The last message shall include the `endTransaction` IE set to TRUE.

5.3.2 Location Information Delivery procedure

The Location Information Delivery allows the target to provide unsolicited location information to the server. The procedure is shown in Figure 5.3.2-1.

1. The target sends a `ProvideLocationInformation` message to the server to transfer location information. If step 2 does not occur, this message shall set the `endTransaction` IE to TRUE.

2. The target may send one or more additional `ProvideLocationInformation` messages to the server containing additional location information data. The last message shall include the `endTransaction` IE set to TRUE.
5.3.3 Reception of Request Location Information

Upon receiving a RequestLocationInformation message, the target device shall:

1. if the requested information is compatible with the target device capabilities and configuration:

   2. include the requested information in a ProvideLocationInformation message;
   3. set the IE LPP-TransactionID in the response to the same value as the IE LPP-TransactionID in the received message;
   4. deliver the ProvideLocationInformation message to lower layers for transmission.

1. otherwise:

   2. if one or more positioning methods are included that the target device does not support:

      3. continue to process the message as if it contained only information for the supported positioning methods;
      4. handle the signaling content of the unsupported positioning methods by LPP error detection as in 5.4.3.

5.3.4 Transmission of Provide Location Information

When triggered to transmit ProvideLocationInformation message, the target device shall:

1. for each positioning method contained in the message:

   2. set the corresponding IE to include the available location information;

1. deliver the response to lower layers for transmission.

5.4 Error Handling Procedures

5.4.1 General

This sub-clause describes how a receiving entity (target device or location server) behaves in cases when it receives erroneous or unexpected data or detects that certain data are missing.

5.4.2 Procedures related to Error Indication

Figure 5.4.2-1 shows the Error indication procedure.

```
<table>
<thead>
<tr>
<th>Endpoint A</th>
<th>Endpoint B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LPP Message</td>
</tr>
<tr>
<td></td>
<td>2. Error</td>
</tr>
</tbody>
</table>
```

**Figure 5.4.2-1: LPP Error Indication procedure**

1. Endpoint A sends an LPP message to Endpoint B.

2. Endpoint B determines that the LPP message in step 1 contains an error. Endpoint B returns an Error message to Endpoint A indicating the error or errors and discards the message in step 1. If Endpoint B is able to determine that the erroneous LPP message in step 1 is an LPP Error or Abort Message, Endpoint B discards the message in step 1 without returning an Error message to Endpoint A.
5.4.3 LPP Error Detection

Upon receiving any LPP message, the receiving entity shall attempt to decode the message and verify the presence of any errors and:

1> if decoding errors are encountered:
   2> if the receiver cannot determine that the received message is an LPP Error or Abort message:
      3> return an LPP Error message to the sender and include the received LPP-TransactionID, if this was decoded, and type of error;
      3> discard the received message and stop the error detection procedure;
1> if the message is a duplicate of a previously received message:
   2> discard the message and stop the error detection procedure;
1> if the LPP-TransactionID matches the LPP-TransactionID for a procedure that is still ongoing for the same session and the message type is invalid for the current state of the procedure:
   2> abort the ongoing procedure;
   2> return an LPP Error message to the sender and include the received transaction ID and type of error;
   2> discard the message and stop the error detection procedure;
1> if the message type is an LPP RequestCapabilities and some of the requested information is not supported:
   2> return any information that can be provided in a normal response.
1> if the message type is an LPP RequestAssistanceData or RequestLocationInformation and some or all of the requested information is not supported:
   2> return any information that can be provided in a normal response, which includes indications on other information that is not supported.

5.4.4 Reception of an LPP Error Message

Upon receiving an Error message, a device shall:

1> abort any ongoing procedure associated with the LPP-TransactionID if included in the received message.

The device may:

1> restart the aborted procedure taking into consideration the returned error information.

5.5 Abort Procedure

5.5.1 General

The purpose of the abort procedure is to allow the target device or location server to abort an ongoing procedure due to some unexpected event (e.g., cancellation of a location request by an LCS client). It can also be used to stop an ongoing procedure (e.g., periodic location reporting from the target device).

5.5.2 Procedures related to Abort

Figure 5.5.2-1 shows the Abort procedure.
5.5.2 LPP Abort procedure

1. A procedure P is ongoing between endpoints A and B.
2. Endpoint A determines that the procedure must be aborted and sends an Abort message to Endpoint B carrying the transaction ID for procedure P. Endpoint B aborts procedure P.

5.5.3 Reception of an LPP Abort Message

Upon receiving an Abort message, a device shall:

1. abort any ongoing procedure associated with the transaction ID indicated in the message.

6 Information Element Abstract Syntax Definition

6.1 General

The contents of each LPP message is specified in sub-clause 6.2 using ASN.1 to specify the message syntax and using tables when needed to provide further detailed information about the information elements specified in the message syntax.

The ASN.1 in this section uses the same format and coding conventions as described in Annex A of [12].

Transfer syntax for LPP messages is derived 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]. The encoded LPP message always contains a multiple of 8 bits.

The need for information elements to be present in a message or an abstract type, i.e., the ASN.1 fields that are specified as OPTIONAL in the abstract notation (ASN.1), is specified by means of comment text tags attached to the OPTIONAL statement in the abstract syntax. The meaning of each tag is specified in table 6.1-1. These tags are used in the downlink (server to target) direction only.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cond condTag</td>
<td>Conditionally present An information element for which the need is specified by means of conditions. For each conditionTag, the need is specified in a tabular form following the ASN.1 segment. In case, according to the conditions, a field is not present, the target takes no action and where applicable shall continue to use the existing value (and/or the associated functionality) unless explicitly stated otherwise in the description of the field itself.</td>
</tr>
<tr>
<td>Need OP</td>
<td>Optionally present An information element that is optional to signal. For downlink messages, the target is not required to take any special action on absence of the IE beyond what is specified in the procedural text or the field description table following the ASN.1 segment. The target behaviour on absence should be captured either in the procedural text or in the field description.</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Meaning</td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>Need ON</td>
<td>Optionally present, No action. An information element that is optional to signal. If the message is received by the target, and in case the information element is absent, the target takes no action and where applicable shall continue to use the existing value (and/or the associated functionality).</td>
</tr>
<tr>
<td>Need OR</td>
<td>Optionally present, Release. An information element that is optional to signal. If the message is received by the target, and in case the information element is absent, the target shall discontinue/stop using/delete any existing value (and/or the associated functionality).</td>
</tr>
</tbody>
</table>

When specifying information elements which are to be represented by BIT STRINGs, if not otherwise specifically stated in the field description of the concerned IE or elsewhere, the following principle applies with regards to the ordering of bits:

- The first bit (leftmost bit) contains the most significant bit (MSB);
- The last bit (rightmost bit) contains the least significant bit (LSB).

### 6.2 LPP PDU Structure

#### – LPP-PDU-Definitions

This ASN.1 segment is the start of the LPP PDU definitions.

```ASN1START
LPP-PDU-Definitions {
  itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
  eps-Access (21) modules (3) lpp (? version1 (1) lpp-PDU-Definitions (1) }
DEFINITIONS AUTOMATIC TAGS ::= BEGIN
-- ASN1STOP
```

#### – LPP-Message

The **LPP-Message** provides the complete set of information for an invocation or response pertaining to an LPP transaction.

```ASN1START
LPP-Message ::= SEQUENCE {
  transactionID   LPP-TransactionID OPTIONAL, -- Need ON
  endTransaction   BOOLEAN,
  sequenceNumber   SequenceNumber  OPTIONAL, -- Need ON
  acknowledgement   Acknowledgement  OPTIONAL, -- Need ON
  lpp-MessageBody   LPP-MessageBody  OPTIONAL -- Need ON
}
SequenceNumber ::= INTEGER (0..255)
Acknowledgement ::= SEQUENCE {
  ackRequested BOOLEAN,
  ackIndicator SequenceNumber  OPTIONAL
}
-- ASN1STOP
```
**LPP-Message** field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>transactionID</strong></td>
<td>This field is omitted if an <em>lpp-MessageBody</em> is not present (i.e. in an LPP message sent only to acknowledge a previously received message) or if it is not available to the transmitting entity (e.g., in an <em>LPP-Error</em> message triggered by a message that could not be parsed). If present, this field shall be ignored at a receiver in an LPP message for which the <em>lpp-MessageBody</em> is not present.</td>
</tr>
<tr>
<td><strong>endTransaction</strong></td>
<td>This field indicates whether an LPP message is the last message carrying an <em>lpp-MessageBody</em> in a transaction (TRUE) or not last (FALSE).</td>
</tr>
<tr>
<td><strong>sequenceNumber</strong></td>
<td>This field may be included when LPP operates over the control plane and an <em>lpp-MessageBody</em> is included but shall be omitted otherwise.</td>
</tr>
<tr>
<td><strong>acknowledgement</strong></td>
<td>This field is included in an LPP acknowledgement and in any LPP message requesting an acknowledgement when LPP operates over the control plane and is omitted otherwise.</td>
</tr>
<tr>
<td><strong>ackRequested</strong></td>
<td>This field indicates whether an LPP acknowledgement is requested (TRUE) or not (FALSE). A value of TRUE may only be included when an <em>lpp-MessageBody</em> is included.</td>
</tr>
<tr>
<td><strong>ackIndicator</strong></td>
<td>This field indicates the sequence number of the message being acknowledged.</td>
</tr>
<tr>
<td><strong>lpp-MessageBody</strong></td>
<td>This field may be omitted in case the message is sent only to acknowledge a previously received message.</td>
</tr>
</tbody>
</table>

---

**LPP-MessageBody**

The **LPP-MessageBody** identifies the type of an LPP message and contains all LPP information specifically associated with that type.

```ASN1START
LPP-MessageBody ::= CHOICE {
  c1      CHOICE {
    requestCapabilities   RequestCapabilities,
    provideCapabilities   ProvideCapabilities,
    requestAssistanceData RequestAssistanceData,
    provideAssistanceData ProvideAssistanceData,
    requestLocationInformation RequestLocationInformation,
    provideLocationInformation ProvideLocationInformation,
    abort      Abort,
    error      Error,
    spare7 NULL, spare6 NULL, spare5 NULL, spare4 NULL,
    spare3 NULL, spare2 NULL, spare1 NULL, spare0 NULL
  },
  messageClassExtension  SEQUENCE {}
}
```

---

**LPP-TransactionID**

The **LPP-TransactionID** identifies a particular LPP transaction and the initiator of the transaction.

```ASN1START
LPP-TransactionID ::= SEQUENCE {
  initiator    Initiator,
  transactionNumber  TransactionNumber,
  ...
}
```

**Initiator ::= ENUMERATED**

```ASN1
{ locationServer, targetDevice, ...
```

**TransactionNumber ::= INTEGER (0..255)**

```ASN1STOP
```
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
  ...
}
-- ASN1STOP
```

RequestCapabilities field descriptions

**commonIEsRequestCapabilities**
This IE is provided for future extensibility and should not be included in this version of the protocol.

– 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,
  ...
}
-- ASN1STOP
```
**ProvideCapabilities field descriptions**

*commonIEsProvideCapabilities*

This IE is provided for future extensibility and should not be included in this version of the protocol.

---

**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,
  ...
}

-- 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
  ...
}

-- 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                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
  ...
}

--- 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                OPTIONAL,  -- Need ON
  a-gnss-ProvideLocationInformation A-GNSS-ProvideLocationInformation  OPTIONAL,  -- Need ON
  otdoa-ProvideLocationInformation OTDOA-ProvideLocationInformation  OPTIONAL,  -- Need ON
  ecid-ProvideLocationInformation  ECID-ProvideLocationInformation  OPTIONAL,  -- Need ON
  epdu-ProvideLocationInformation EPDU-Sequence      OPTIONAL,  -- Need ON
  ...
}

--- ASN1STOP

---

Abort

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

--- ASN1START

Abort ::= SEQUENCE {
  criticalExtensions  CHOICE {
    c1      CHOICE {
      abort-r9  Abort-r9-IEs,
      spare3 NULL, spare2 NULL, spare1 NULL
    },
  }
}

--- ASN1STOP
criticalExtensionsFuture SEQUENCE {}

Abort-r9-IEs ::= SEQUENCE {
  commonIEsAbort CommonIEsAbort OPTIONAL, -- Need ON
  ..., epdu-Abort EPDU-Sequence OPTIONAL -- Need ON
}

-- ASN1STOP

Error

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

-- ASN1START

Error ::= CHOICE {
  error-r9 Error-r9-IEs,
  criticalExtensionsFuture SEQUENCE {}
}

Error-r9-IEs ::= SEQUENCE {
  commonIEsError CommonIEsError OPTIONAL, -- Need ON
  ..., epdu-Error EPDU-Sequence OPTIONAL -- Need ON
}

-- ASN1STOP

6.4 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} } (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 IE *ARFCN-ValueEUTRA* is used to indicate the ARFCN of the E-UTRA carrier frequency, as defined in [12].

-- ASN1START
ARFCN-ValueEUTRA ::= INTEGER (0..65535)
-- ASN1STOP

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

-- ASN1START
ARFCN-ValueUTRA ::= INTEGER (0..16383)
-- ASN1STOP

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 [12].

cellIdentity
This field defines the identity of the cell within the context of the PLMN as defined in [12] and [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

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>plmn-Identity</strong></td>
<td>This field identifies the PLMN of the cell.</td>
</tr>
<tr>
<td><strong>locationAreaCode</strong></td>
<td>This field is a fixed length code identifying the location area within a PLMN.</td>
</tr>
<tr>
<td><strong>cellIdentity</strong></td>
<td>This field specifies the cell Identifier which is unique within the context of the GERAN location area.</td>
</tr>
</tbody>
</table>

### ECGI

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

--- ASN1START

```asn1
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 3GPP TS 23.032 [15].

--- ASN1START

```asn1
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 3GPP TS 23.032 [15].

--- ASN1START

```asn1
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 3GPP TS 23.032 [15].

--- ASN1START

```asn1
EllipsoidPointWithUncertaintyEllipse ::= SEQUENCE {
    latitudeSign    ENUMERATED {north, south},
    degreesLatitude    INTEGER (0..8388607),   -- 23 bit field
    degreesLongitude   INTEGER (-8388608..8388607), -- 24 bit field
    uncertaintySemiMajor  INTEGER (0..127),
}
```

--- ASN1STOP
EllipsoidPointWithAltitude

The IE EllipsoidPointWithAltitude is used to describe a geographic shape as defined in 3GPP TS 23.032 [15].

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
}

EllipsoidPointWithAltitudeAndUncertaintyEllipsoid

The IE EllipsoidPointWithAltitudeAndUncertaintyEllipsoid is used to describe a geographic shape as defined in 3GPP TS 23.032 [15].

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)
}

EllipsoidArc

The IE EllipsoidArc is used to describe a geographic shape as defined in 3GPP TS 23.032 [15].

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,
  outerRadius INTEGER (0..127),
  offsetAngle INTEGER (0..179),
  includedAngle INTEGER (0..179),
  confidence INTEGER (0..100)
}

EPDU-Sequence

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

<table>
<thead>
<tr>
<th>EPDU-ID</th>
<th>EPDU Defining entity</th>
<th>Method name</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OMA LOC</td>
<td>OMA LPP extensions (LPPe)</td>
<td>OMA-TS-LPPe-V1_0 [20]</td>
</tr>
</tbody>
</table>

---

**HorizontalVelocity**

The IE *HorizontalVelocity* is used to describe a velocity shape as defined in 3GPP TS 23.032 [15].

---

**HorizontalWithVerticalVelocity**

The IE *HorizontalWithVerticalVelocity* is used to describe a velocity shape as defined in 3GPP TS 23.032 [15].
The IE `HorizontalVelocityWithUncertainty` is used to describe a velocity shape as defined in 3GPP TS 23.032 [15].

```
-- ASN1START
HorizontalVelocityWithUncertainty ::= SEQUENCE {
  bearing      INTEGER(0..359),
  horizontalSpeed    INTEGER(0..2047),
  uncertaintySpeed   INTEGER(0..255)
}
-- ASN1STOP
```

The IE `HorizontalWithVerticalVelocityAndUncertainty` is used to describe a velocity shape as defined in 3GPP 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
```

The IE `LocationCoordinateTypes` defines a list of possible geographic shapes as defined in 3GPP TS 23.032 [15].

```
-- ASN1START
LocationCoordinateTypes ::= SEQUENCE {
  ellipsoidPoint           BOOLEAN,
  ellipsoidPointWithUncertaintyCircle      BOOLEAN,
  ellipsoidPointWithUncertaintyEllipse     BOOLEAN,
  polygon             BOOLEAN,
  ellipsoidPointWithAltitude        BOOLEAN,
  ellipsoidPointWithAltitudeAndUncertaintyEllipsoid  BOOLEAN,
  ellipsoidArc           BOOLEAN,
  ...                     
}
-- ASN1STOP
```

The IE `Polygon` is used to describe a geographic shape as defined in 3GPP 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
```
The IE `PositioningModes` is used to indicate several positioning modes using a bit map.

**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.

The IE `VelocityTypes` defines a list of possible velocity shapes as defined in 3GPP TS 23.032 [15].

### 6.4.2 Common Positioning

- **CommonIEsRequestCapabilities**

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

- **CommonIEsProvideCapabilities**

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

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

```
CommonIEsRequestAssistanceData ::= SEQUENCE {
  primaryCellID  ECGI  OPTIONAL,  -- Cond EUTRA
  ...
}
```

<table>
<thead>
<tr>
<th>Conditional presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUTRA</td>
<td>The field is mandatory present for E-UTRA access. The field shall be omitted for non-EUTRA user plane support.</td>
</tr>
</tbody>
</table>

**CommonIEsRequestAssistanceData** field descriptions

**primaryCellID**
This parameter identifies the current primary cell for the target device.

CommonIEsProvideAssistanceData

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

```
CommonIEsProvideAssistanceData ::= SEQUENCE {
  ...
}
```

CommonIEsRequestLocationInformation

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

```
CommonIEsRequestLocationInformation ::= SEQUENCE {
  locationInformationType  LocationInformationType,
  triggeredReporting        TriggeredReportingCriteria OPTIONAL,  -- Cond BCID
  periodicalReporting       PeriodicalReportingCriteria OPTIONAL,  -- Need ON
  additionalInformation     AdditionalInformation  OPTIONAL,  -- Need ON
  qos                      QoS  OPTIONAL,  -- Need ON
  environment              Environment     OPTIONAL,  -- Need ON
  locationCoordinateTypes   LocationCoordinateTypes  OPTIONAL,  -- Need ON
  velocityTypes            VelocityTypes    OPTIONAL,  -- Need ON
  ...
}
```

```
LocationInformationType ::= ENUMERATED {
  locationEstimateRequired,
  locationMeasurementsRequired,
  locationEstimatePreferred,
  locationMeasurementsPreferred,
  ...
}
```

```
PeriodicalReportingCriteria ::= SEQUENCE {
  reportingAmount ENUMERATED {
    ra1, ra2, ra4, ra8, ra16, ra32,
    ra64, ra-Infinity
  }
}``
TriggedReportingCriteria ::= SEQUENCE {
cellChange BOOLEAN,
reportingDuration ReportingDuration,
... }

ReportingDuration ::= INTEGER (0..255)

AdditionalInformation ::= ENUMERATED {
  onlyReturnInformationRequested,
  mayReturnAdditionalInformation,
  ... }

QoS ::= SEQUENCE {
  horizontalAccuracy HorizontalAccuracy OPTIONAL, -- Need ON
  verticalCoordinateRequest BOOLEAN,
  verticalAccuracy VerticalAccuracy OPTIONAL, -- Need ON
  responseTime ResponseTime OPTIONAL, -- Need ON
  velocityRequest BOOLEAN,
  ... }

HorizontalAccuracy ::= SEQUENCE {
  accuracy INTEGER (0..127),
  confidence INTEGER (0..100),
  ... }

VerticalAccuracy ::= SEQUENCE {
  accuracy INTEGER (0..127),
  confidence INTEGER (0..100),
  ... }

ResponseTime ::= SEQUENCE {
  time INTEGER (1..128),
  ... }

Environment ::= ENUMERATED {
  badArea,
  notBadArea,
  mixedArea,
  ... }

-- ASN1STOP

<table>
<thead>
<tr>
<th>Conditional presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECID</td>
<td>The field is optionally present, need ON, if ECID is requested. Otherwise it is not present.</td>
</tr>
</tbody>
</table>

**CommonIEsRequestLocationInformation field descriptions**

**locationInformationType**

This IE indicates whether the server requires a location estimate or measurements. For "locationEstimateRequired", the target device shall return a location estimate if possible, or indicate a location error if not possible. For "locationMeasurementsRequired", the target device shall return measurements if possible, or indicate a location error if not possible. For "locationEstimatePreferred", the target device shall return a location estimate if possible, but may also or instead return measurements for any requested position methods for which a location estimate is not possible. For "locationMeasurementsPreferred", the target device shall return location measurements if possible, but may also or instead return a location estimate for any requested position methods for which return of location measurements is not possible.
CommonIEsRequestLocationInformation field descriptions

triggeredReporting
This IE indicates that triggered reporting is requested and comprises the following subfields:
- **cellChange**: If this field is set to TRUE, the target device provides requested location information each time the primary cell has changed.
- **reportingDuration**: Maximum duration of triggered reporting in seconds. A value of zero is interpreted to mean an unlimited (i.e. "infinite") duration. The target device should continue triggered reporting for the reportingDuration or until an LPP Abort or LPP Error message is received.

periodicalReporting
This IE indicates that periodic reporting is requested and comprises the following subfields:
- **reportingAmount** indicates the number of periodic location information reports requested. Enumerated values correspond to 1, 2, 4, 8, 16, 32, 64, or infinite/indefinite number of reports. If the reportingAmount is "infinite/ indefinite", the target device should continue periodic reporting until an LPP Abort message is received. The value "ra?" shall not be used by a sender.
- **reportingInterval** indicates the interval between location information reports and the response time requirement for the first location information report. Enumerated values ri0-25, ri0-5, ri1, ri2, ri4, ri8, ri16, ri32, ri64 correspond to reporting intervals of 1, 2, 4, 8, 10, 16, 20, 32, and 64 seconds, respectively. Measurement reports containing no measurements or no location estimate are required when a reportingInterval expires before a target device is able to obtain new measurements or obtain a new location estimate. The value "noPeriodicalReporting" shall not be used by a sender.

additionalInformation
This IE indicates whether a target device is allowed to return additional information to that requested. If this IE indicates "onlyReturnInformationRequested" then the target device shall not return any additional information to that requested by the server. If this IE indicates "mayReturnAdditionalInformation" then the target device may return additional information to that requested by the server. If a location estimate is returned, any additional information is restricted to that associated with a location estimate (e.g. might include velocity if velocity was not requested but cannot include measurements). If measurements are returned, any additional information is restricted to additional information to that requested by the server. If measurements are returned, any additional information is restricted to additional measurements (e.g. might include E-CID measurements if A-GNSS measurements were requested but not E-CID measurements).

qos
This IE indicates the quality of service and comprises a number of sub-fields. In the case of measurements, some of the sub-fields apply to the location estimate that could be obtained by the server from the measurements provided by the target device assuming that the measurements are the only sources of error. Fields are as follows:
- **horizontalAccuracy** indicates the maximum horizontal error in the location estimate at an indicated confidence level. The "accuracy" corresponds to the encoded uncertainty as defined in 3GPP TS 23.032 [15] and "confidence" corresponds to confidence as defined in 3GPP TS 23.032 [15].
- **verticalCoordinateRequest** indicates whether a vertical coordinate is required (TRUE) or not (FALSE)
- **verticalAccuracy** indicates the maximum vertical error in the location estimate at an indicated confidence level and is only applicable when a vertical coordinate is requested. The "accuracy" corresponds to the encoded uncertainty altitude as defined in 3GPP TS 23.032 [15] and "confidence" corresponds to confidence as defined in 3GPP TS 23.032 [15].
- **responseTime** indicates the maximum response time as measured between receipt of the RequestLocationInformation and transmission of a ProvideLocationInformation. This is given as an integer number of seconds between 1 and 128. If the periodicalReporting IE is included in CommonIEsRequestLocationInformation, this field should not be included by the location server and shall be ignored by the target device (if included).
- **velocityRequest** indicates whether velocity (or measurements related to velocity) is requested (TRUE) or not (FALSE).

All QoS requirements shall be obtained by the target device to the degree possible but it is permitted to return a response that does not fulfill all QoS requirements if some were not attainable. The single exception is response-time which shall always be fulfilled – even if that means not fulfilling other QoS requirements.

environment
This field provides the target device with information about expected multipath and non line of sight (NLOS) in the current area. The following values are defined:
- **badArea**: possibly heavy multipath and NLOS conditions (e.g. bad urban or urban).
- **notBadArea**: no or light multipath and usually LOS conditions (e.g. suburban or rural).
- **mixedArea**: environment that is mixed or not defined.

If this field is absent, a default value of "mixedArea" applies.

locationCoordinateTypes
This field provides a list of the types of location estimate that the target device may return when a location estimate is obtained by the target.

velocityTypes
This fields provides a list of the types of velocity estimate that the target device may return when a velocity estimate is obtained by the target.
The CommonIEsProvideLocationInformation carries common IEs for a Provide Location Information LPP message Type.

```asn1
CommonIEsProvideLocationInformation ::= SEQUENCE {
  locationEstimate   LocationCoordinates  OPTIONAL,
  velocityEstimate   Velocity    OPTIONAL,
  locationError    LocationError   OPTIONAL,
  ...
}
```

```asn1
LocationCoordinates ::= CHOICE {
  ellipsoidPoint        Ellipsoid-Point,
  ellipsoidPointWithUncertaintyCircle   Ellipsoid-PointWithUncertaintyCircle,
  ellipsoidPointWithUncertaintyEllipse  EllipsoidPointWithUncertaintyEllipse,
  polygon          Polygon,
  ellipsoidPointWithAltitude     EllipsoidPointWithAltitude,
  ellipsoidPointWithAltitudeAndUncertaintyEllipsoid
  EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,
  ellipsoidArc        EllipsoidArc,
  ...
}
```

```asn1
Velocity ::= CHOICE {
  horizontalVelocity       HorizontalVelocity,
  horizontalWithVerticalVelocity    HorizontalWithVerticalVelocity,
  horizontalVelocityWithUncertainty   HorizontalVelocityWithUncertainty,
  horizontalWithVerticalVelocityAndUncertainty
  HorizontalWithVerticalVelocityAndUncertainty,
  ...
}
```

```asn1
LocationError ::= SEQUENCE {
  locationfailurecause   LocationFailureCause,
  ...
}
```

```asn1
LocationFailureCause ::= ENUMERATED {
  undefined,
  requestedMethodNotSupported,
  positionMethodFailure,
  periodicLocationMeasurementsNotAvailable,
  ...
}
```

The CommonIEsProvideLocationInformation field descriptions

**locationEstimate**
This field provides a location estimate using one of the geographic shapes defined in 3GPP TS 23.032 [15]. Coding of the values of the various fields internal to each geographic shape follow the rules in [15]. The conditions for including this field are defined for the locationInformationType field in a Request Location Information message.

**velocityEstimate**
This field provides a velocity estimate using one of the velocity shapes defined in 3GPP TS 23.032 [15]. Coding of the values of the various fields internal to each velocity shape follow the rules in [15].

**locationError**
This field shall be included if and only if a location estimate and measurements are not included in the LPP PDU. The field includes information concerning the reason for the lack of location information. The LocationFailureCause "periodicLocationMeasurementsNotAvailable" shall be used by the target device if periodic location reporting was requested, but no measurements or location estimate are available when the reportingInterval expired.

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

```asn1
CommonIEsAbort ::= SEQUENCE {
  ...
}
```
abortCause ENUMERATED {
  undefined,
  stopPeriodicReporting,
  targetDeviceAbort,
  networkAbort,
  ...
}

-- ASN1STOP

<table>
<thead>
<tr>
<th>CommonEsAbort field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>abortCause</strong></td>
</tr>
<tr>
<td>This IE defines the request to abort an ongoing procedure. The abort cause “stopPeriodicReporting” should be used by the location server to stop any ongoing location reporting configured as <em>periodicalReporting</em> or <em>triggeredReporting</em> in the CommonEsRequestLocationInformation.</td>
</tr>
</tbody>
</table>

---

CommonEsAbort

field descriptions

<table>
<thead>
<tr>
<th><strong>abortCause</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>This IE defines the request to abort an ongoing procedure. The abort cause “stopPeriodicReporting” should be used by the location server to stop any ongoing location reporting configured as <em>periodicalReporting</em> or <em>triggeredReporting</em> in the CommonEsRequestLocationInformation.</td>
</tr>
</tbody>
</table>

---

CommonEsError

The CommonEsError carries common IEs for an Error LPP message Type.

---

<table>
<thead>
<tr>
<th>CommonEsError field descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>errorCause</strong></td>
</tr>
<tr>
<td>This IE defines the cause for an error. &quot;lppMessageHeaderError&quot;, &quot;lppMessageBodyError&quot; and &quot;epduError&quot; is used if a receiver is able to detect a coding error in the LPP header (i.e., in the common fields), LPP message body or in an EPDU, respectively.</td>
</tr>
</tbody>
</table>

---

6.5 Positioning Method IEs

6.5.1 OTDOA Positioning

6.5.1.1 OTDOA Assistance Data

---

| **OTDOA-ProvideAssistanceData** |
| The IE OTDOA-ProvideAssistanceData is used by the location server to provide assistance data to enable UE-assisted downlink OTDOA. It may also be used to provide OTDOA positioning specific error reason. |

Throughout Section 6.5.1, "assistance data reference cell" refers to the cell defined by the IE OTDOA-ReferenceCellInfo (see section 6.5.1.2). "RSTD reference cell" applies only in Section 6.5.1.5.

**NOTE:** The location server should include at least one cell for which the SFN can be obtained by the target device, e.g. the serving cell, in the assistance data, either as the assistance data reference cell or in the neighbor cell list. Otherwise the target device will be unable to perform the OTDOA measurement and the positioning operation will fail.
6.5.1.2 OTDOA Assistance Data Elements

– OTDOA-ReferenceCellInfo

The IE OTDOA-ReferenceCellInfo is used by the location server to provide assistance data reference cell information for OTDOA assistance data. The slot number offsets and expected RSTDs in OTDOA-NeighbourCellInfoList are provided relative to the cell defined by this IE. If earfcnRef of this assistance data reference cell is different from that of the serving cell, the LPP layer shall inform lower layers to start performing inter-frequency RSTD measurements with this cell and provide to lower layers the information about this assistance data reference cell, e.g. EARFCN and PRS positioning occasion information.

NOTE: The location server should always include the PRS configuration of the assistance data reference and neighbour cells. Otherwise the UE may not meet the accuracy requirements as defined in [18].

--- ASN1START

OTDOA-ReferenceCellInfo ::= SEQUENCE {
  physCellId     INTEGER (0..503),
  cellGlobalId    ECGI OPTIONAL, -- Need ON
  earfcnRef     ARFCN-ValueEUTRA OPTIONAL, -- Cond NotSameAsServ0
  antennaPortConfig   ENUMERATED {ports1-or-2, ports4, ... } OPTIONAL, -- Cond NotSameAsServ1
  cpLength     ENUMERATED { normal, extended, ... },
  prsInfo      PRS-Info     OPTIONAL, -- Cond PRS
  ...}

--- ASN1STOP

<table>
<thead>
<tr>
<th>Conditional presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NotSameAsServ0</td>
<td>The field is mandatory present if the EARFCN of the OTDOA assistance data reference cell is not the same as the EARFCN of the target devices’s current primary cell.</td>
</tr>
<tr>
<td>NotSameAsServ1</td>
<td>The field is mandatory present if the antenna port configuration of the OTDOA assistance data reference cell is not the same as the antenna port configuration of the target devices’s current primary cell.</td>
</tr>
<tr>
<td>PRS</td>
<td>The field is mandatory present if positioning reference signals are available in the assistance data reference cell [16]; otherwise it is not present.</td>
</tr>
</tbody>
</table>

--- OTDOA-ReferenceCellInfo field descriptions ---

physCellId
This field specifies the physical cell identity of the assistance data reference cell, as defined in [12].

cellGlobalId
This field specifies the ECGI, the globally unique identity of a cell in E-UTRA, of the assistance data reference cell, as defined in [12]. The server should include this field if it considers that it is needed to resolve ambiguity in the cell indicated by physCellId.

tcpLength
This field specifies the cycle prefix length of the assistance data reference cell PRS if the prsInfo field is present, otherwise this field specifies the cycle prefix length of the assistance data reference cell CRS.

prsInfo
This field specifies the PRS configuration of the assistance data reference cell.
The IE PRS-Info provides the information related to the configuration of PRS in a cell.

**PRS-Info field descriptions**

- **prs-Bandwidth**
  This field specifies the bandwidth that is used to configure the positioning reference signals on. Enumerated values are specified in number of resource blocks (n6 corresponds to 6 resource blocks, n15 to 15 resource blocks and so on) and define 1.4, 3, 5, 10, 15 and 20 MHz bandwidth.

- **prs-ConfigurationIndex**
  This field specifies the positioning reference signals configuration index IPRS as defined in [16].

- **numDL-Frames**
  This field specifies the number of consecutive downlink subframes NPRS with positioning reference signals, as defined in [16]. Enumerated values define 1, 2, 4, or 6 consecutive subframes.

- **prs-MutingInfo**
  This field specifies the PRS muting configuration of the cell. The PRS muting configuration is defined by a periodic PRS muting sequence with periodicity TREP where TREP, counted in the number of PRS positioning occasions [18], can be 2, 4, 8, or 16 which is also the length of the selected bit string that represents this PRS muting sequence. If a bit in the PRS muting sequence is set to “0”, then the PRS is muted in the corresponding PRS positioning occasion. A PRS positioning occasion comprises of Nprs downlink positioning subframes as defined in [16]. The first bit of the PRS muting sequence corresponds to the first PRS positioning occasion that starts after the beginning of the assistance data reference cell SFN=0. The sequence is valid for all subframes after the target device has received the prs-MutingInfo. If this field is not present the target device may assume that the PRS muting is not in use for the cell.

When the SFN of the assistance data reference cell is not known to the UE and prs-MutingInfo is provided for a cell in the OTDOA-NeighbourCellInfoList IE, the UE may assume no PRS is transmitted by that cell.

**OTDOA-NeighbourCellInfoList**

The IE OTDOA-NeighbourCellInfoList is used by the location server to provide neighbour cell information for OTDOA assistance data. The OTDOA-NeighbourCellInfoList is sorted in the decreasing order of priority for measurement to be performed by the target device, with the first cell in the list being the highest priority for measurement. The exact sorting of the list is left to server implementation. The target device should provide the available measurements in the same order as provided by the server. If inter-frequency neighbour cells are included in OTDOA-NeighbourCellInfoList, where an inter-frequency is a E-UTRA frequency which is different from the E-UTRA serving cell frequency, the LPP layer shall inform lower layers to start performing inter-frequency RSTD measurements for these neighbour cells and also provide to lower layers the information about these neighbour cells, e.g. EARFCN and PRS positioning occasion information.
<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>earfcn</td>
<td>ARFCN-ValueEUTRA OPTIONAL, -- Cond NotSameAsRef0</td>
</tr>
<tr>
<td>cpLength</td>
<td>ENUMERATED {normal, extended, ...} OPTIONAL, -- Cond NotSameAsRef1</td>
</tr>
<tr>
<td>prsInfo</td>
<td>PRS-Info OPTIONAL, -- Cond NotSameAsRef2</td>
</tr>
<tr>
<td>antennaPortConfig</td>
<td>ENUMERATED {ports-1-or-2, ports-4, ...} OPTIONAL, -- Cond NotSameAsRef3</td>
</tr>
<tr>
<td>slotNumberOffset</td>
<td>INTEGER (0..19) OPTIONAL, -- Cond NotSameAsRef4</td>
</tr>
<tr>
<td>prs-SubframeOffset</td>
<td>INTEGER (0..1279) OPTIONAL, -- Cond InterFreq</td>
</tr>
<tr>
<td>expectedRSTD</td>
<td>INTEGER (0..16383), expectedRSTD-Uncertainty INTEGER (0..1023), ...</td>
</tr>
<tr>
<td>maxFreqLayers</td>
<td>INTEGER ::= 3</td>
</tr>
</tbody>
</table>

**Conditional presence**

| NotsameAsRef0                  | The field is mandatory present if the EARFCN is not the same as for the assistance data reference cell; otherwise it is not present.          |
| NotsameAsRef1                  | The field is mandatory present if the cyclic prefix length is not the same as for the assistance data reference cell; otherwise it is not present. |
| NotsameAsRef2                  | The field is mandatory present if the PRS configuration is not the same as for the assistance data reference cell; otherwise it is not present. |
| NotsameAsRef3                  | The field is mandatory present if the antenna port configuration is not the same as for the assistance data reference cell; otherwise it is not present. |
| NotsameAsRef4                  | The field is mandatory present if the slot timing is not the same as for the assistance data reference cell; otherwise it is not present.      |
| InterFreq                     | The field is optionally present, need OP, if the EARFCN is not the same as for the assistance data reference cell; otherwise it is not present. |

**OTDOA-NeighbourCellInfoList field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>physCellId</td>
<td>This field specifies the physical cell identity of the neighbour cell, as defined in [12].</td>
</tr>
<tr>
<td>cellGlobalId</td>
<td>This field specifies the ECGI, the globally unique identity of a cell in E-UTRA, of the neighbour cell, as defined in [12].</td>
</tr>
<tr>
<td>earfcn</td>
<td>This field specifies the EARFCN of the neighbour cell.</td>
</tr>
<tr>
<td>cpLength</td>
<td>This field specifies the cyclic prefix length of the neighbour cell PRS if PRS are present in this neighbour cell, otherwise this field specifies the cyclic prefix length of CRS in this neighbor cell.</td>
</tr>
<tr>
<td>prsInfo</td>
<td>This field specifies the PRS configuration of the neighbour cell. When the EARFCN of the neighbour cell is the same as for the assistance data reference cell, the target device may assume that each PRS positioning occasion in the neighbour cell at least partially overlaps with a PRS positioning occasion in the assistance data reference cell where the maximum offset between the transmitted PRS positioning occasions may be assumed to not exceed half a subframe. When the EARFCN of the neighbour cell is the same as for the assistance data reference cell, the target may assume that this cell has the same PRS periodicity (Tprs) as the assistance data reference cell.</td>
</tr>
<tr>
<td>slotNumberOffset</td>
<td>This field specifies whether 1 (or 2) antenna port(s) or 4 antenna ports for cell specific reference signals are used.</td>
</tr>
<tr>
<td>prs-SubframeOffset</td>
<td>This field specifies the slot number offset at the transmitter between this cell and the assistance data reference cell. The slotNumberOffset together with the current slot number of the assistance data reference cell may be used to calculate the current slot number of this cell which may further be used to generate the CRS sequence by the target device. The offset corresponds to the number of full slots counted from the beginning of a radio frame of the assistance data reference cell to the beginning of the closest subsequent radio frame of this cell. If this field is absent, the slot timing is the same as for the assistance data reference cell.</td>
</tr>
<tr>
<td>expectedRSTD</td>
<td>This field specifies the offset between the first PRS subframe in the assistance data reference cell on the reference carrier frequency layer and the first PRS subframe in the closest subsequent PRS positioning occasion of this cell on the other carrier frequency layer. The value is given in number of full sub-frames. If the ARFCN is not the same as for the assistance data reference cell and the field is not present but PRS are available on this cell, the receiver shall consider the PRS subframe offset for this cell to be 0.</td>
</tr>
</tbody>
</table>
OTDOA-NeighbourCellInfoList field descriptions

expectedRSTD
If PRS is transmitted:

This field indicates the RSTD value that the target device is expected to measure between this cell and the assistance data reference cell. The expectedRSTD field takes into account the expected propagation time difference as well as transmit time difference of PRS positioning occasions between the two cells. The RSTD value can be negative and is calculated as (expectedRSTD-8192). The resolution is 3×Ts, with Ts=1/(15000×2048) seconds.

If PRS is not transmitted:

This field indicates the RSTD value that the target device is expected to measure between this cell and the assistance data reference cell. The expectedRSTD field takes into account the expected propagation time difference as well as transmit time difference between the two cells. The RSTD value can be negative and is calculated as (expectedRSTD-8192). The resolution is 3×Ts, with Ts=1/(15000×2048) seconds.

expectedRSTD-Uncertainty
If PRS is transmitted:

This field indicates the uncertainty in expectedRSTD value. The uncertainty is related to the location server’s a-priori estimation of the target device location. The expectedRSTD and expectedRSTD-Uncertainty together define the search window for the target device. The scale factor of the expectedRSTD-Uncertainty field is 3×Ts, with Ts=1/(15000×2048) seconds.

The target device may assume that the beginning of the PRS positioning occasion of the neighbour cell is received within the search window of size [−expectedRSTD-Uncertainty×3×Ts, expectedRSTD-Uncertainty×3×Ts] centered at TREF+1 millisecond×N+(expectedRSTD-8192)×3×Ts, where TREF is the reception time of the beginning of the PRS positioning occasion of the assistance data reference cell at the target device antenna connector. N = 0 when the EArFCN of the neighbour cell is equal to that of the assistance data reference cell, and N = prs-SubframeOffset otherwise.

If PRS is not transmitted:

This field indicates the uncertainty in expectedRSTD value. The uncertainty is related to the location server’s a-priori estimation of the target device location. The expectedRSTD and expectedRSTD-Uncertainty together define the search window for the target device. The scale factor of the expectedRSTD-Uncertainty field is 3×Ts, with Ts=1/(15000×2048) seconds.

If T is the reception time of the beginning of the subframe X of the assistance data reference cell at the target device antenna connector, the target device may assume that the beginning of the closest subframe of this neighbour cell to subframe X is received within the search window of size [−expectedRSTD-Uncertainty×3×Ts, expectedRSTD-Uncertainty×3×Ts] centered at Tx+(expectedRSTD-8192)×3×Ts.

6.5.1.3 OTDOA Assistance Data Request

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

```
-- ASN1START

OTDOA-RequestAssistanceData ::= SEQUENCE {
  physCellId       INTEGER (0..503),
  ...
}

-- ASN1STOP

```

OTDOA-RequestAssistanceData field descriptions

physCellId
This field specifies the physical cell identity of the current primary cell of the target device.
6.5.1.4 OTDOA Location Information

– OTDOA-ProvideLocationInformation

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

```asn1
OTDOA-ProvideLocationInformation ::= SEQUENCE {
  otdoaSignalMeasurementInformation OTDOA-SignalMeasurementInformation OPTIONAL,
  otdoa-Error OTDOA-Error OPTIONAL,
  ...
}
```

6.5.1.5 OTDOA Location Information Elements

– OTDOA-SignalMeasurementInformation

The IE **OTDOA-SignalMeasurementInformation** is used by the target device to provide RSTD measurements to the location server. The RSTD measurements are provided for a neighbour cell and the RSTD reference cell, both of which are provided in the IE **OTDOA-ProvideAssistanceData**. The RSTD reference cell may or may not be the same as the assistance data reference cell provided in **OTDOA-ReferenceCellInfo**. If the target device stops reporting inter-frequency RSTD measurements, where the inter-frequency RSTD measurement is an OTDOA RSTD measurement with at least one cell on a frequency different from the serving cell frequency, the LPP layer shall inform lower layers that inter-frequency RSTD measurements are stopped.

```asn1
OTDOA-SignalMeasurementInformation ::= SEQUENCE {
  systemFrameNumber BIT STRING (SIZE (10)),
  physCellIdRef INTEGER {0..503},
  cellGlobalIdRef ECGI OPTIONAL,
  earfcnRef ARFCN-ValueEUTRA OPTIONAL,
  referenceQuality OTDOA-MeasQuality OPTIONAL,
  neighbourMeasurementList NeighbourMeasurementList, ...
}
```

**OTDOA-SignalMeasurementInformation field descriptions**

- **systemFrameNumber**
  This field specifies the SFN of the RSTD reference cell containing the starting subframe of the PRS positioning occasion if PRS are available on the RSTD reference cell, or subframe of the CRS for RSTD measurements if PRS are not available on the RSTD reference cell during which the most recent neighbour cell RSTD measurement was performed.

- **physCellIdRef**
  This field specifies the physical cell identity of the RSTD reference cell.

- **cellGlobalIdRef**
  This field specifies the ECGI, the globally unique identity of a cell in E-UTRA, of the RSTD reference cell. The target shall provide this IE if it knows the ECGI of the RSTD reference cell.
**OTDOA-SignalMeasurementInformation field descriptions**

**earfcnRef**
This field specifies the E-UTRA carrier frequency of the RSTD reference cell. The target device shall include this field if the ARFCN of the RSTD reference cell is not the same as the ARFCN of the assistance data reference cell provided in the OTDOA assistance data.

**referenceQuality**
This field specifies the target device’s best estimate of the quality of the TOA measurement from the RSTD reference cell, \( T_{\text{SubframeRxRef}} \), where \( T_{\text{SubframeRxRef}} \) is the time of arrival of the signal from the RSTD reference cell.

**neighbourMeasurementList**
This list contains the measured RSTD values for neighbour cells together with the RSTD reference cell, along with quality for each measurement.

**physCellIdNeighbor**
This field specifies the physical cell identity of the neighbour cell for which the RSTDs are provided.

**cellGlobalIdNeighbor**
This field specifies the ECGI, the globally unique identity of a cell in E-UTRA, of the neighbour cell for which the RSTDs are provided. The target device shall provide this IE if it was able to determine the ECGI of the neighbour cell at the time of measurement.

**earfcnNeighbour**
This field specifies the E-UTRA carrier frequency of the neighbour cell used for the RSTD measurements. The target device shall include this field if the ARFCN of this neighbor cell is not the same as the `earfcnRef` for the RSTD reference cell.

**rstd**
This field specifies the relative timing difference between this neighbour cell and the RSTD reference cell, as defined in [17]. Mapping of the measured quantity is defined as in [18] subclause 9.1.10.3.

**rstd-Quality**
This field specifies the target device’s best estimate of the quality of the measured `rstd`.

---

**OTDOA-MeasQuality**

```asn1
OTDOA-MeasQuality ::= SEQUENCE {
  error-Resolution  BIT STRING (SIZE (2)) ,
  error-Value    BIT STRING (SIZE (5)) ,
  error-NumSamples  BIT STRING (SIZE (3))    OPTIONAL,
  ... 
}
```

---

**OTDOA-MeasQuality field descriptions**

**error-Resolution**
This field specifies the resolution \( R \) used in `error-Value` field. The encoding on two bits is as follows:

- '00' 5 meters
- '01' 10 meters
- '10' 20 meters
- '11' 30 meters

**error-Value**
This field specifies the target device’s best estimate of the uncertainty of the OTDOA (or TOA) measurement. The encoding on five bits is as follows:

- '00000' 0 to \( (R^1\cdot1) \) meters
- '00001' \( R^1 \) to \( (R^2\cdot1) \) meters
- '00010' \( R^2 \) to \( (R^3\cdot1) \) meters
- '00100' \( R^3 \) to \( (R^4\cdot1) \) meters
- '01000' \( R^4 \) to \( (R^5\cdot1) \) meters
- '10000' \( R^5 \) to \( (R^6\cdot1) \) meters
- '11000' \( R^6 \) to \( (R^7\cdot1) \) meters
- '11100' \( R^7 \) to \( (R^8\cdot1) \) meters
- '11110' \( R^8 \) to \( (R^9\cdot1) \) meters
- '11111' \( R^9 \) meters or more;

where \( R \) is the resolution defined by `error-Resolution` field.

E.g., \( R=20 \) m corresponds to 0-19 m, 20-39 m, ..., 620+ m.
### OTDOA-MeasQuality field descriptions

**error-NumSamples**

If the error-Value field provides the sample uncertainty of the OTDOA (or TOA) measurement, this field specifies how many measurements have been used by the target device to determine this (i.e., sample size). Following 3 bit encoding is used:

- "000" Not the baseline metric
- '001' 5-9
- '010' 10-14
- '011' 15-24
- '100' 25-34
- '101' 35-44
- '110' 45-54
- '111' 55 or more.

In case of the value "000", the error-Value field contains the target device’s best estimate of the uncertainty of the OTDOA (or TOA) measurement not based on the baseline metric. E.g., other measurements such as signal-to-noise-ratio or signal strength can be utilized to estimate the error-Value.

If this field is absent, the value of this field is "000".

### 6.5.1.6 OTDOA Location Information Request

**– OTDOA-RequestLocationInformation**

The IE OTDOA-RequestLocationInformation is used by the location server to request OTDOA location measurements from a target device. Details of the required measurements (e.g. details of assistance data reference cell and neighbour cells) are conveyed in the OTDOA-ProvideAssistanceData IE in a separate Provide Assistance Data message.

```asn1
OTDOA-RequestLocationInformation ::= SEQUENCE {
  assistanceAvailability  BOOLEAN, ...
}
```

### 6.5.1.7 OTDOA Capability Information

**– OTDOA-ProvideCapabilities**

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

```asn1
OTDOA-ProvideCapabilities ::= SEQUENCE {
  otdoa-Mode  BIT STRING {  ue-assisted (0) } (SIZE (1..8)), ...
  supportedBandListEUTRA   SEQUENCE (SIZE (1..maxBands)) OF SupportedBandEUTRA  OPTIONAL
} maxBands INTEGER ::= 64
SupportedBandEUTRA ::= SEQUENCE {
  bandEUTRA       INTEGER (1..64)
}
```

### OTDOA-RequestLocationInformation field descriptions

**assistanceAvailability**

This field indicates whether the target device may request additional OTDOA assistance data from the server. TRUE means allowed and FALSE means not allowed.
**OTDOA-ProvideCapabilities field descriptions**

**otdoa-Mode**
This field specifies the OTDOA mode(s) supported by the target device. This is represented by a bit string, with a one-value at the bit position means the particular OTDOA mode is supported; a zero-value means not supported. A zero-value in all bit positions in the bit string means OTDOA positioning method is not supported by the target device.

**SupportedBandEUTRA**
One entry corresponding to each supported E-UTRA band as defined in TS 36.101 [21].

### 6.5.1.8 OTDOA Capability Information Request

- **OTDOA-RequestCapabilities**

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

```asn1
OTDOA-RequestCapabilities ::= SEQUENCE {
   ...
}
```

---

### 6.5.1.9 OTDOA Error Elements

- **OTDOA-Error**

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

```asn1
OTDOA-Error ::= CHOICE {
   locationServerErrorCauses  OTDOA-LocationServerErrorCauses,
   targetDeviceErrorCauses   OTDOA-TargetDeviceErrorCauses,
   ...
}
```

---

- **OTDOA-LocationServerErrorCauses**

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

```asn1
OTDOA-LocationServerErrorCauses ::= SEQUENCE {
   cause  ENUMERATED {
      undefined,
      assistanceDataNotSupportedByServer,
      assistanceDataSupportedButCurrentlyNotAvailableByServer,
      ...
   },
   ...
}
```

---

- **OTDOA-TargetDeviceErrorCauses**

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

– 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, etc.).

– 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, 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.
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
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 \([\text{GNSS TOD} - \text{referenceTimeUnc}, \text{GNSS TOD} + \text{referenceTimeUnc}]\).

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.

<table>
<thead>
<tr>
<th>Value of K</th>
<th>Value of uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 nanoseconds</td>
</tr>
<tr>
<td>1</td>
<td>70 nanoseconds</td>
</tr>
<tr>
<td>2</td>
<td>149.8 nanoseconds</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50</td>
<td>349.62 microseconds</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>127</td>
<td>(\geq 8.43) seconds</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Value of K</th>
<th>Value of uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>127</td>
<td>(\geq 8.43) seconds</td>
</tr>
</tbody>
</table>

-- 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 from the origin of the GNSS System Time as follows:
  - GPS, QZSS, SBAS – Days from January 6th 1980 00:00:00 UTC (USNO);
  - Galileo – TBD;
  - GLONASS – Days from January 1st 1996.
GNSS-SystemTime field descriptions

- **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**

```asn1
-- 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**

```asn1
-- 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,
      ...
    },
    uTRA  SEQUENCE {
      mode   CHOICE {
        rdd   SEQUENCE {
          primary-CFICH-Info INTEGER (0..511),
          ...
        }
      ...
    }...
  }
}

-- ASN1STOP
```
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<table>
<thead>
<tr>
<th>Conditional presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNSSsynch</td>
<td>The field is present and set to 0 if NetworkTime is synchronized to gnss-SystemTime; otherwise the field is optionally present, need OR.</td>
</tr>
</tbody>
</table>

**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 hyperframe length is 12533.76 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 [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 [12].

**earfcn**
This field specifies E-ARFCN of the reference cell for the GNSS-network time relation (E-UTRA).

**primary-CPICH-Info**
This field specifies the physical cell identity of the reference cell (UTRA) for the GNSS-network time relation, as defined in [13].

**cellParameters**
This field specifies the physical cell identity of the reference cell (UTRA) for the GNSS-network time relation, as defined in [13].

**cellGlobalIdUTRA**
The field 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 [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 [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 [14].
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.

---

**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.

```asn
GNSS-ReferenceLocation ::= SEQUENCE {
    threeDlocation   EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,
    ...}
```

---

**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].

```asn
GNSS-IonosphericModel ::= SEQUENCE {
    klobucharModel   KlobucharModelParameter  OPTIONAL, -- Need ON
    neQuickModel     NeQuickModelParameter  OPTIONAL, -- Need ON
    ...
}
```

---

**KlobucharModelParameter**

```asn
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),
    ...}
```

---

**KlobucharModelParameter 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 "00" it indicates the parameters are applicable worldwide [4,7]. All other values for dataID are reserved.

**alpha0**

This field specifies the \( \alpha_0 \) parameter of the Klobuchar model, as specified in [4]. Scale factor \( 2^{-30} \) seconds.
### KlobucharModelParameter field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>alpha1</td>
<td>This field specifies the $\alpha_1$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-27}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>alpha2</td>
<td>This field specifies the $\alpha_2$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-24}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>alpha3</td>
<td>This field specifies the $\alpha_3$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-24}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>beta0</td>
<td>This field specifies the $\beta_0$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{11}$ seconds.</td>
</tr>
<tr>
<td>beta1</td>
<td>This field specifies the $\beta_1$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-14}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>beta2</td>
<td>This field specifies the $\beta_2$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-16}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>beta3</td>
<td>This field specifies the $\beta_3$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-16}$ seconds/semi-circle.</td>
</tr>
</tbody>
</table>

### NeQuickModelParameter

```
NeQuickModelParameter ::= SEQUENCE {
    ai0    INTEGER (0..4095),
    ai1    INTEGER (0..4095),
    ai2    INTEGER (0..4095),
    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
    ...
}
```

### NeQuickModelParameter field descriptions

- **ai0, ai1, ai2**: These fields are used to estimate the ionospheric distortions on pseudoranges as described in [8] on page 71.
- **ionoStormFlag1, ionoStormFlag2, ionoStormFlag3, ionoStormFlag4, ionoStormFlag5**: These fields specify the ionosphere storm flags (1,…,5) for five different regions as described in [8] on page 71. If the ionosphere storm flag for a region is not present the target device shall treat the ionosphere storm 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.

```
GNSS-EarthOrientationParameters ::= SEQUENCE {
    teop    INTEGER (0..65535),
    pmX     INTEGER (-1048576..1048575),
    pmXdot  INTEGER (-16384..16383),
    ...
}
```

---

**KlobucharModelParameter field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>alpha1</td>
<td>This field specifies the $\alpha_1$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-27}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>alpha2</td>
<td>This field specifies the $\alpha_2$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-24}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>alpha3</td>
<td>This field specifies the $\alpha_3$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-24}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>beta0</td>
<td>This field specifies the $\beta_0$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{11}$ seconds.</td>
</tr>
<tr>
<td>beta1</td>
<td>This field specifies the $\beta_1$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-14}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>beta2</td>
<td>This field specifies the $\beta_2$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-16}$ seconds/semi-circle.</td>
</tr>
<tr>
<td>beta3</td>
<td>This field specifies the $\beta_3$ parameter of the Klobuchar model, as specified in [4]. Scale factor $2^{-16}$ seconds/semi-circle.</td>
</tr>
</tbody>
</table>

---

**NeQuickModelParameter**

```
NeQuickModelParameter ::= SEQUENCE {
    ai0    INTEGER (0..4095),
    ai1    INTEGER (0..4095),
    ai2    INTEGER (0..4095),
    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
    ...
}
```

**NeQuickModelParameter field descriptions**

- **ai0, ai1, ai2**: These fields are used to estimate the ionospheric distortions on pseudoranges as described in [8] on page 71.
- **ionoStormFlag1, ionoStormFlag2, ionoStormFlag3, ionoStormFlag4, ionoStormFlag5**: These fields specify the ionosphere storm flags (1,…,5) for five different regions as described in [8] on page 71. If the ionosphere storm flag for a region is not present the target device shall treat the ionosphere storm 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.

```
GNSS-EarthOrientationParameters ::= SEQUENCE {
    teop    INTEGER (0..65535),
    pmX     INTEGER (-1048576..1048575),
    pmXdot  INTEGER (-16384..16383),
    ...
}
```
### GNSS-EarthOrientationParameters field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>teop</td>
<td>This field specifies the EOP data reference time in seconds, as specified in [4].</td>
<td>$2^4$ seconds</td>
</tr>
<tr>
<td>pmX</td>
<td>This field specifies the X-axis polar motion value at reference time in arc-seconds, as specified in [4].</td>
<td>$2^{-20}$ arc-seconds</td>
</tr>
<tr>
<td>pmXdot</td>
<td>This field specifies the X-axis polar motion drift at reference time in arc-seconds/day, as specified in [4].</td>
<td>$2^{-21}$ arc-seconds/day</td>
</tr>
<tr>
<td>pmY</td>
<td>This field specifies the Y-axis polar motion value at reference time in arc-seconds, as specified in [4].</td>
<td>$2^{-20}$ arc-seconds</td>
</tr>
<tr>
<td>pmYdot</td>
<td>This field specifies the Y-axis polar motion drift at reference time in arc-seconds/day, as specified in [4].</td>
<td>$2^{-21}$ arc-seconds/day</td>
</tr>
<tr>
<td>deltaUT1</td>
<td>This field specifies the UT1-UTC difference at reference time in seconds, as specified in [4].</td>
<td>$2^{-24}$ seconds</td>
</tr>
<tr>
<td>deltaUT1dot</td>
<td>This field specifies the Rate of UT1-UTC difference at reference time in seconds/day, as specified in [4].</td>
<td>$2^{-25}$ seconds/day</td>
</tr>
</tbody>
</table>

---

### 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.

```asn1
GNSS-TimeModelList ::= SEQUENCE (SIZE (1..15)) OF GNSS-TimeModelElement

GNSS-TimeModelElement ::= SEQUENCE {
    gnss-TimeModelRefTime  INTEGER (0..65535),
    tA0        INTEGER (-67108864..67108863), OPTIONAL, -- Need ON
    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
    ...            
}
```

### GNSS-TimeModelElement field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>gnss-TimeModelRefTime</td>
<td>This field specifies the reference time of week for <strong>GNSS-TimeModelElement</strong> and it is given in GNSS specific system time.</td>
<td>$2^4$ seconds</td>
</tr>
<tr>
<td>tA0</td>
<td>This field specifies the bias coefficient of the <strong>GNSS-TimeModelElement</strong>.</td>
<td>$2^{-35}$ seconds</td>
</tr>
<tr>
<td>tA1</td>
<td>This field specifies the drift coefficient of the <strong>GNSS-TimeModelElement</strong>.</td>
<td>$2^{-51}$ seconds/second</td>
</tr>
<tr>
<td>tA2</td>
<td>This field specifies the drift rate correction coefficient of the <strong>GNSS-TimeModelElement</strong>.</td>
<td>$2^{-68}$ seconds/second²</td>
</tr>
</tbody>
</table>
3GPP TS 36.355 version 11.1.0 Release 11

ETSI TS 136 355 V11.1.0 (2013-02)

---

**GNSS-TimeModelElement field descriptions**

**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.

**weekNumber**
This field specifies the reference week of the **GNSS-TimeModelElement** given in GNSS specific system time. 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**

<table>
<thead>
<tr>
<th>Value of gnss-TO-ID</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GPS</td>
</tr>
<tr>
<td>2</td>
<td>Galileo</td>
</tr>
<tr>
<td>3</td>
<td>QZSS</td>
</tr>
<tr>
<td>4</td>
<td>GLONASS</td>
</tr>
<tr>
<td>5-15</td>
<td>reserved</td>
</tr>
</tbody>
</table>

---

**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-DifferentialCorrections field descriptions

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].

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

\[ PR(t, IOD) = PR(t_0, IOD) + RRC(t_0, IOD) \cdot (t_1 - t_0) \]

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 field is calculated as follows:

\[ UDRE(t_1) = UDRE(t_0) \times udreGrowthRate \]

udreValidityTime
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 field is calculated as follows:

\[ UDRE(t_1) = UDRE(t_0) \times udreGrowthRate \]

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.

<table>
<thead>
<tr>
<th>gnss-StatusHealth Value</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>UDRE Scale Factor = 1.0</td>
</tr>
<tr>
<td>001</td>
<td>UDRE Scale Factor = 0.75</td>
</tr>
<tr>
<td>010</td>
<td>UDRE Scale Factor = 0.5</td>
</tr>
<tr>
<td>011</td>
<td>UDRE Scale Factor = 0.3</td>
</tr>
<tr>
<td>100</td>
<td>UDRE Scale Factor = 0.2</td>
</tr>
<tr>
<td>101</td>
<td>UDRE Scale Factor = 0.1</td>
</tr>
<tr>
<td>110</td>
<td>Reference Station Transmission Not Monitored</td>
</tr>
</tbody>
</table>
111 Data is invalid - disregard

udre Value to Indication relation

<table>
<thead>
<tr>
<th>udre Value</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>UDRE \leq 1.0 m</td>
</tr>
<tr>
<td>01</td>
<td>1.0 m &lt; UDRE \leq 4.0 m</td>
</tr>
<tr>
<td>10</td>
<td>4.0 m &lt; UDRE \leq 8.0 m</td>
</tr>
<tr>
<td>11</td>
<td>8.0 m &lt; UDRE</td>
</tr>
</tbody>
</table>

Value of udreGrowthRate to Indication relation

<table>
<thead>
<tr>
<th>Value of udreGrowthRate</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>1.5</td>
</tr>
<tr>
<td>001</td>
<td>2</td>
</tr>
<tr>
<td>010</td>
<td>4</td>
</tr>
<tr>
<td>011</td>
<td>6</td>
</tr>
<tr>
<td>100</td>
<td>8</td>
</tr>
<tr>
<td>101</td>
<td>10</td>
</tr>
<tr>
<td>110</td>
<td>12</td>
</tr>
<tr>
<td>111</td>
<td>16</td>
</tr>
</tbody>
</table>

Value of udreValidityTime to Indication relation

<table>
<thead>
<tr>
<th>Value of udreValidityTime</th>
<th>Indication [seconds]</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>20</td>
</tr>
<tr>
<td>001</td>
<td>40</td>
</tr>
<tr>
<td>010</td>
<td>80</td>
</tr>
<tr>
<td>011</td>
<td>160</td>
</tr>
<tr>
<td>100</td>
<td>320</td>
</tr>
<tr>
<td>101</td>
<td>640</td>
</tr>
<tr>
<td>110</td>
<td>1280</td>
</tr>
<tr>
<td>111</td>
<td>2560</td>
</tr>
</tbody>
</table>

-- 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,

-- 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].
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 GLONASS ephemeris, the iod contains the parameter tb as defined in [9]. In case of broadcasted Galileo ephemeris, the iod contains the IOD index as described in [8]. The interpretation of iod depends on the GNSS-ID and is as shown in table GNSS to iod Bit String(11) relation below.

<table>
<thead>
<tr>
<th>GNSS</th>
<th>svHealth Bit String(8)</th>
<th>Note 1</th>
<th>Note 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS L1/CA[1]</td>
<td>MSB</td>
<td>Bit 1</td>
<td>Bit 2</td>
</tr>
<tr>
<td>QZSS[2]</td>
<td>L1C/L2/L5</td>
<td>SV Health [7]</td>
<td>“0” (reserved)</td>
</tr>
<tr>
<td>GLONASS</td>
<td>B(_2) (MSB) [9, page 30]</td>
<td>“0” (reserved)</td>
<td>“0” (reserved)</td>
</tr>
<tr>
<td>Galileo [8, pages 75-76]</td>
<td>E5a Data</td>
<td>[9]</td>
<td>E5b Data</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>GNSS</th>
<th>Bit 1 (MSB)</th>
<th>Bit 2</th>
<th>Bit 3</th>
<th>Bit 4</th>
<th>Bit 5</th>
<th>Bit 6</th>
<th>Bit 7</th>
<th>Bit 8</th>
<th>Bit 9</th>
<th>Bit 10</th>
<th>Bit 11 (LSB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS L1/CA</td>
<td>&quot;0&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modernized</td>
<td>&quot;0&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBAS</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
</tr>
<tr>
<td>QZSS QZS-L1</td>
<td>&quot;0&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QZSS QZS-L1C/L2C/L5</td>
<td>&quot;0&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GLONASS</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
<td>&quot;0&quot;</td>
</tr>
<tr>
<td>Galileo</td>
<td>&quot;0&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**StandardClockModelList**

```plaintext
-- ASNISTART

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

StandardClockModelElement ::= SEQUENCE {
  stanClockToc  INTEGER (0..16383),
  stanClockAF2  INTEGER (-2048..2047),
  stanClockAF1  INTEGER (-131072..131071),
  stanClockAF0  INTEGER (-134217728..134217727),
  stanClockTgd  INTEGER (-512..511) OPTIONAL, -- Need ON
  stanModelID  INTEGER (0..1) OPTIONAL, -- Need ON
  ...
}

-- ASNISTOP
```

**StandardClockModelList field descriptions**

- **standardClockModelList**
  - `gnss-ClockModel` Model-1 contains one or two clock model elements depending on the GNSS. 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 \( t_{oc} \) defined in [8].
  - Scale factor 60 seconds.

- **stanClockAF2**
  - Parameter \( a_{f2} \) defined in [8].
  - Scale factor \( 2^{-65} \) seconds/second\(^2\).

- **stanClockAF1**
  - Parameter \( a_{f1} \) defined in [8].
  - Scale factor \( 2^{-45} \) seconds/second.

- **stanClockAF0**
  - Parameter \( a_{f0} \) defined in [8].
  - Scale factor \( 2^{-33} \) seconds.

- **stanClockTgd**
  - Parameter \( T_{OD} \) defined in [8].
  - Scale factor \( 2^{-32} \) seconds.
  - This field is required if the target device supports only single frequency Galileo signal.

- **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

<table>
<thead>
<tr>
<th>Value of stanModelID</th>
<th>Identity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I/Nav</td>
</tr>
<tr>
<td>1</td>
<td>F/Nav</td>
</tr>
</tbody>
</table>

--- 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 $t_{oc}$, time of clock (seconds) [4,7]
Scale factor $2^4$ seconds.

**navaf2**
Parameter $a_2$, clock correction polynomial coefficient (sec/sec²) [4,7].
Scale factor $2^{55}$ seconds/second².

**navaf1**
Parameter $a_1$, clock correction polynomial coefficient (sec/sec) [4,7].
Scale factor $2^{43}$ seconds/second.

**navaf0**
Parameter $a_0$, clock correction polynomial coefficient (seconds) [4,7].
Scale factor $2^{31}$ seconds.

**navTgd**
Parameter $T_{GD}$, 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 (-16..15),
  cnavURA2  INTEGER (0..7),
  cnavAf2   INTEGER (-512..511),
  cnavAf1   INTEGER (-524288..524287),
  cnavAf0   INTEGER (-33554432..33554431),
  ...
}

--- ASN1STOP
**CNAV-ClockModel field descriptions**

- **cnavToc**
  Parameter $t_{oc}$, clock data reference time of week (seconds) [4,5,6,7].
  Scale factor 300 seconds.

- **cnavTop**
  Parameter $t_{op}$, clock data predict time of week (seconds) [4,5,6,7].
  Scale factor 300 seconds

- **cnavURA0**
  Parameter $URA_{oc}$ Index, SV clock accuracy index (dimensionless) [4,5,6,7].

- **cnavURA1**
  Parameter $URA_{oc1}$ Index, SV clock accuracy change index (dimensionless) [4,5,6,7].

- **cnavURA2**
  Parameter $URA_{oc2}$ Index, SV clock accuracy change rate index (dimensionless) [4,5,6,7].

- **cnavAf2**
  Parameter $af_{2-n}$, SV clock drift rate correction coefficient (sec/sec^2) [4,5,6,7].
  Scale factor 2^1^-60 seconds/second^2.

- **cnavAf1**
  Parameter $af_{1-n}$, SV clock drift correction coefficient (sec/sec) [4,5,6,7].
  Scale factor 2^-48 seconds/second.

- **cnavAf0**
  Parameter $af_{0-n}$, 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 $ISCL1CA$, 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**

```asn1
GLONASS-ClockModel ::= SEQUENCE {
   gl Tau   INTEGER (-2097152..2097151),
   gl Gamma INTEGER (-1024..1023),
   gl DeltaTau INTEGER (-16..15) OPTIONAL, -- Need ON
   ...
}
```

---

ETSI
**GLONASS-ClockModel** field descriptions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>gloTau</td>
<td>$\tau_n(t_b)$, satellite clock offset (seconds)</td>
<td>$2^{-30}$ seconds.</td>
</tr>
<tr>
<td>gloGamma</td>
<td>$\gamma_n(t_b)$, relative frequency offset from nominal value (dimensionless)</td>
<td></td>
</tr>
<tr>
<td>gloDeltaTau</td>
<td>$\Delta \tau_n$, time difference between transmission in G2 and G1 (seconds)</td>
<td>$2^{-30}$ seconds.</td>
</tr>
</tbody>
</table>

The location server should include this parameter if the target device is dual frequency GLONASS receiver capable.

---

**SBAS-ClockModel**

```asn1
SBAS-ClockModel ::= SEQUENCE {
  sbasTo   INTEGER (0..5399),
  sbasAgfo  INTEGER (-2048..2047),
  sbasAgf1  INTEGER (-128..127),
  ...}
```

**SBAS-ClockModel** field descriptions

- **sbasTo**: Parameter $t_0$ [10].
  Scale factor 16 seconds.
- **sbasAgfo**: Parameter $a_{Gfo}$ [10].
  Scale factor $2^{-31}$ seconds.
- **sbasAgf1**: Parameter $a_{Gf1}$ [10].
  Scale factor $2^{-40}$ seconds/second.

---

**NavModelKeplerianSet**

```asn1
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),
  ...}
```

**NavModelKeplerianSet** field descriptions

- **keplerToe**: Parameter $t_{OE}$, time-of-ephemeris in seconds [8].
  Scale factor 60 seconds.

---
NavModelKeplerianSet field descriptions

**keplerW**
Parameter \(\omega\), argument of perigee (semi-circles) \([8]\).
Scale factor \(2^{-31}\) semi-circles.

**keplerDeltaN**
Parameter \(\Delta n\), mean motion difference from computed value (semi-circles/sec) \([8]\).
Scale factor \(2^{-43}\) semi-circles/second.

**keplerM0**
Parameter \(M_0\), mean anomaly at reference time (semi-circles) \([8]\).
Scale factor \(2^{-31}\) semi-circles.

**keplerOmegaDot**
Parameter \(\Omega_{\text{dot}}\), longitude of ascending node of orbit plane at weekly epoch (semi-circles/sec) \([8]\).
Scale factor \(2^{-43}\) semi-circles/second.

**keplerE**
Parameter \(e\), eccentricity \([8]\).
Scale factor \(2^{-33}\).

**KeplerIDot**
Parameter \(i_{\text{dot}}\), rate of inclination angle (semi-circles/sec) \([8]\).
Scale factor \(2^{-43}\) semi-circles/second.

**keplerAPowerHalf**
Parameter \(\sqrt{A}\), semi-major Axis in (meters) \(^{\frac{1}{2}}\) \([8]\).
Scale factor \(2^{-19}\) meters \(^{\frac{1}{2}}\).

**keplerI0**
Parameter \(i_0\), inclination angle at reference time (semi-circles) \([8]\).
Scale factor \(2^{-31}\) semi-circles.

**keplerOmega0**
Parameter \(\Omega_0\), longitude of ascending node of orbit plane at weekly epoch (semi-circles) \([8]\).
Scale factor \(2^{-31}\) semi-circles.

**keplerCrs**
Parameter \(C_{rs}\), amplitude of the sine harmonic correction term to the orbit radius (meters) \([8]\).
Scale factor \(2^{-5}\) meters.

**keplerCis**
Parameter \(C_{is}\), amplitude of the sine harmonic correction term to the angle of inclination (radians) \([8]\).
Scale factor \(2^{-29}\) radians.

**keplerCus**
Parameter \(C_{us}\), amplitude of the sine harmonic correction term to the argument of latitude (radians) \([8]\).
Scale factor \(2^{-29}\) radians.

**keplerCrc**
Parameter \(C_{rc}\), amplitude of the cosine harmonic correction term to the orbit radius (meters) \([8]\).
Scale factor \(2^{-5}\) meters.

**keplerCic**
Parameter \(C_{ic}\), amplitude of the cosine harmonic correction term to the angle of inclination (radians) \([8]\).
Scale factor \(2^{-29}\) radians.

**keplerCuc**
Parameter \(C_{uc}\), amplitude of the cosine harmonic correction term to the argument of latitude (radians) \([8]\).
Scale factor \(2^{-29}\) radians.

---

```
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),
  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),
```
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 \( t_{\text{oe}} \), time of ephemeris (seconds) [4,7].
Scale factor 2^{24} seconds.

navOmega
Parameter \( \omega \), argument of perigee (semi-circles) [4,7].
Scale factor 2^{-31} semi-circles.

navDeltaN
Parameter \( \Delta n \), mean motion difference from computed value (semi-circles/sec) [4,7].
Scale factor 2^{-43} semi-circles/second.

navM0
Parameter \( M_0 \), mean anomaly at reference time (semi-circles) [4,7].
Scale factor 2^{-31} semi-circles.

navOmegaADot
Parameter \( \dot{\Omega} \), 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 \( \dot{i} \), rate of inclination angle (semi-circles/sec) [4,7].
Scale factor 2^{-43} semi-circles/second.

navAPowerHalf
Parameter \( \sqrt{A} \), square root of semi-major axis (meters^{1/2}) [4,7].
Scale factor 2^{-19} meters^{1/2}.

navI0
Parameter \( i_0 \), inclination angle at reference time (semi-circles) [4,7].
Scale factor 2^{-31} semi-circles.

navOmegaA0
Parameter \( \Omega_0 \), longitude of ascending node of orbit plane at weekly epoch (semi-circles) [4,7].
Scale factor 2^{-31} semi-circles.

navCrs
Parameter \( C_{rs} \), amplitude of sine harmonic correction term to the orbit radius (meters) [4,7].
Scale factor 2^{-6} meters.

navCis
Parameter \( C_{is} \), amplitude of sine harmonic correction term to the angle of inclination (radians) [4,7].
Scale factor 2^{-29} radians.

navCus
Parameter \( C_{us} \), amplitude of sine harmonic correction term to the argument of latitude (radians) [4,7].
Scale factor 2^{-29} radians.

navCrc
Parameter \( C_{rc} \), amplitude of cosine harmonic correction term to the orbit radius (meters) [4,7].
Scale factor 2^{-6} meters.
NavModelNAV-KeplerianSet field descriptions

**navCic**
Parameter $C_{nc}$, amplitude of cosine harmonic correction term to the angle of inclination (radians) [4,7].
Scale factor $2^{-29}$ radians.

**navCuc**
Parameter $C_{uc}$, 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

```
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),
    cnavVE    INTEGER (0..8589934591),
    cnavOmega  INTEGER (-4294967296..4294967295),
    cnavOMEGA0  INTEGER (-4294967296..4294967295),
    cnavDeltaOMEGA0 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),
    ...
}
```

---

NavModelCNAV-KeplerianSet field descriptions

**cnavTop**
Parameter $t_{op}$, data predict time of week (seconds) [4,5,6,7].
Scale factor 300 seconds.

**cnavURAIndex**
Parameter URAo, Index, SV accuracy (dimensionless) [4,5,6,7].

**cnavDeltaA**
Parameter $\Delta A$, semi-major axis difference at reference time (meters) [4,5,6,7].
Scale factor $2^{-9}$ meters.

**cnavAdot**
Parameter $A_{dot}$, change rate in semi-major axis (meters/sec) [4,5,6,7].
Scale factor $2^{-21}$ meters/sec.

**cnavDeltaNo**
Parameter $\Delta n_0$, 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 $\Delta n_{0, dot}$, rate of mean motion difference from computed value (semi-circles/sec$^2$) [4,5,6,7].
Scale factor $2^{-57}$ semi-circles/second$^2$.

**cnavMo**
Parameter $M_0$, mean anomaly at reference time (semi-circles) [4,5,6,7].
Scale factor $2^{-57}$ semi-circles.

**cnavE**
Parameter $e_0$, eccentricity (dimensionless) [4,5,6,7].
Scale factor $2^{-24}$. 
## NavModelCNAV-KeplerianSet field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>cnavOmega</td>
<td>Parameter $\omega_n$, argument of perigee (semi-circles) [4,5,6,7].</td>
<td>$2^{-32}$</td>
</tr>
<tr>
<td>cnavOMEGA0</td>
<td>Parameter $\Omega_0$, reference right ascension angle (semi-circles) [4,5,6,7].</td>
<td>$2^{-32}$</td>
</tr>
<tr>
<td>cnavDeltaOmegaDot</td>
<td>Parameter $\Delta \Omega$, rate of right ascension difference (semi-circles/sec) [4,5,6,7].</td>
<td>$2^{-44}$</td>
</tr>
<tr>
<td>cnavi</td>
<td>Parameter $i_0$, inclination angle at reference time (semi-circles) [4,5,6,7].</td>
<td>$2^{-32}$</td>
</tr>
<tr>
<td>cnaviDot</td>
<td>Parameter $i_0$-DOT, rate of inclination angle (semi-circles/sec) [4,5,6,7].</td>
<td>$2^{-44}$</td>
</tr>
<tr>
<td>cnavCis</td>
<td>Parameter $C_{i,n}$, amplitude of sine harmonic correction term to the angle of inclination (radians) [4,5,6,7].</td>
<td>$2^{-30}$ radians</td>
</tr>
<tr>
<td>cnavCic</td>
<td>Parameter $C_{c,n}$, amplitude of cosine harmonic correction term to the angle of inclination (radians) [4,5,6,7].</td>
<td>$2^{-30}$ radians</td>
</tr>
<tr>
<td>cnavCrs</td>
<td>Parameter $C_{r,n}$, amplitude of sine harmonic correction term to the orbit radius (meters) [4,5,6,7].</td>
<td>$2^{-8}$ meters</td>
</tr>
<tr>
<td>cnavCrc</td>
<td>Parameter $C_{cr,n}$, amplitude of cosine harmonic correction term to the orbit radius (meters) [4,5,6,7].</td>
<td>$2^{-8}$ meters</td>
</tr>
<tr>
<td>cnavCus</td>
<td>Parameter $C_{us,n}$, amplitude of the sine harmonic correction term to the argument of latitude (radians) [4,5,6,7].</td>
<td>$2^{-30}$ radians</td>
</tr>
<tr>
<td>cnavCuc</td>
<td>Parameter $C_{uc,n}$, amplitude of cosine harmonic correction term to the argument of latitude (radians) [4,5,6,7].</td>
<td>$2^{-30}$ radians</td>
</tr>
</tbody>
</table>

---

## NavModel-GLONASS-ECEF

```
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),
  ... }
```

## NavModel-GLONASS-ECEF field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>gloEn</td>
<td>Parameter $E_n$, age of data (days) [9].</td>
<td>1 days</td>
</tr>
<tr>
<td>gloP1</td>
<td>Parameter $P_1$, time interval between two adjacent values of $t_b$ (minutes) [9].</td>
<td></td>
</tr>
<tr>
<td>gloP2</td>
<td>Parameter $P_2$, change of $t_b$ flag (dimensionless) [9].</td>
<td></td>
</tr>
</tbody>
</table>
NavModel-GLONASS-ECEF field descriptions

\(\text{gloM}\)
Parameter \(M\), type of satellite (dimensionless) [9].

\(\text{gloX}\)
Parameter \(x_m(t_b)\), x-coordinate of satellite at time \(t_b\) (kilometers) [9].
Scale factor \(2^{11}\) kilometers.

\(\text{gloXdot}\)
Parameter \(\dot{x}_m(t_b)\), x-coordinate of satellite velocity at time \(t_b\) (kilometers/sec) [9].
Scale factor \(2^{20}\) kilometers/second.

\(\text{gloXdotdot}\)
Parameter \(\ddot{x}_m(t_b)\), x-coordinate of satellite acceleration at time \(t_b\) (kilometers/sec\(^2\)) [9].
Scale factor \(2^{30}\) kilometers/second\(^2\).

\(\text{gloY}\)
Parameter \(y_m(t_b)\), y-coordinate of satellite at time \(t_b\) (kilometers) [9].
Scale factor \(2^{11}\) kilometers.

\(\text{gloYdot}\)
Parameter \(\dot{y}_m(t_b)\), y-coordinate of satellite velocity at time \(t_b\) (kilometers/sec) [9].
Scale factor \(2^{20}\) kilometers/second.

\(\text{gloYdotdot}\)
Parameter \(\ddot{y}_m(t_b)\), y-coordinate of satellite acceleration at time \(t_b\) (kilometers/sec\(^2\)) [9].
Scale factor \(2^{30}\) kilometers/second\(^2\).

\(\text{gloZ}\)
Parameter \(z_m(t_b)\), z-coordinate of satellite at time \(t_b\) (kilometers) [9].
Scale factor \(2^{11}\) kilometers.

\(\text{gloZdot}\)
Parameter \(\dot{z}_m(t_b)\), z-coordinate of satellite velocity at time \(t_b\) (kilometers/sec) [9].
Scale factor \(2^{20}\) kilometers/second.

\(\text{gloZdotdot}\)
Parameter \(\ddot{z}_m(t_b)\), z-coordinate of satellite acceleration at time \(t_b\) (kilometers/sec\(^2\)) [9].
Scale factor \(2^{30}\) kilometers/second\(^2\).

---

NavModel-SBAS-ECEF

```asn1
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),
  sbasYgDotDot INTEGER (-512..511),
  sbasZgDotDot INTEGER (-512..511),
  ...
}
```

---

<table>
<thead>
<tr>
<th>Conditional presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ClockModel</td>
<td>This field is mandatory present if (\text{gnss-ClockModel Model-5}) is not included; otherwise it is not present.</td>
</tr>
</tbody>
</table>

NavModel-SBAS-ECEF field descriptions

\(\text{sbasTo}\)
Parameter \(t_0\), time of applicability (seconds) [10].
Scale factor 16 seconds.
### NavModel-SBAS-ECEF field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>sbasAccuracy</code></td>
<td>Parameter Accuracy, (dimensionless) [10].</td>
<td></td>
</tr>
<tr>
<td><code>sbasXg</code></td>
<td>Parameter $X_g$, (meters) [10].</td>
<td>0.08 meters</td>
</tr>
<tr>
<td><code>sbasYg</code></td>
<td>Parameter $Y_g$, (meters) [10].</td>
<td>0.08 meters</td>
</tr>
<tr>
<td><code>sbasZg</code></td>
<td>Parameter $Z_g$, (meters) [10].</td>
<td>0.4 meters</td>
</tr>
<tr>
<td><code>sbasXgDot</code></td>
<td>Parameter $X_g$, Rate-of-Change, (meters/sec) [10].</td>
<td>0.000625 meters/second.</td>
</tr>
<tr>
<td><code>sbasYgDot</code></td>
<td>Parameter $Y_g$, Rate-of-Change, (meters/sec) [10]</td>
<td>0.000625 meters/second.</td>
</tr>
<tr>
<td><code>sbasZgDot</code></td>
<td>Parameter $Z_g$, Rate-of-Change, (meters/sec) [10]</td>
<td>0.004 meters/second.</td>
</tr>
<tr>
<td><code>sbasXgDotDot</code></td>
<td>Parameter $X_g$, Acceleration, (meters/sec²) [10].</td>
<td>0.000125 meters/second².</td>
</tr>
<tr>
<td><code>sbasYgDotDot</code></td>
<td>Parameter $Y_g$, Acceleration, (meters/sec²) [10].</td>
<td>0.000125 meters/second².</td>
</tr>
<tr>
<td><code>sbasZgDotDot</code></td>
<td>Parameter $Z_g$, Acceleration, (meters/sec²) [10].</td>
<td>0.0000625 meters/second².</td>
</tr>
</tbody>
</table>

---

**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.

---

```asn1
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
  ...}
```

---

*ETSI*
---

**GNSS-RealTimeIntegrity field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>gnss-BadSignalList</td>
<td>This field specifies a list of satellites with bad signal or signals.</td>
</tr>
<tr>
<td>badSVID</td>
<td>This field specifies the GNSS SV-ID of the satellite with bad signal or signals.</td>
</tr>
<tr>
<td>badSignalID</td>
<td>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.</td>
</tr>
</tbody>
</table>

---

**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.

```asn1
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)),
  ... 
}
```

---

**GNSS-DataBitAssistance field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>gnss-TOD</td>
<td>This field specifies the reference time of the first bit of the data in <em>GNSS-DataBitAssistance</em> in integer seconds in GNSS specific system time, modulo 1 hour. Scale factor 1 second.</td>
</tr>
<tr>
<td>gnss-TODfrac</td>
<td>This field specifies the fractional part of the <em>gnss-TOD</em> in 1-milli-second resolution. Scale factor 1 millisecond. The total GNSS TOD is <em>gnss-TOD</em> + <em>gnss-TODfrac</em>.</td>
</tr>
<tr>
<td>gnss-DataBitsSatList</td>
<td>This list specifies the data bits for a particular GNSS satellite SV-ID and signal GNSS-SignalID.</td>
</tr>
<tr>
<td>svID</td>
<td>This field specifies the GNSS SV-ID of the satellite for which the <em>GNSS-DataBitAssistance</em> is given.</td>
</tr>
<tr>
<td>gnss-SignalType</td>
<td>This field identifies the GNSS signal type of the <em>GNSS-DataBitAssistance</em>.</td>
</tr>
</tbody>
</table>
**GNSS-DataBitAssistance field descriptions**

**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] section 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] section 5.2. In case of QZSS QZS-L1C, it contains the encoded and interleaved modulation symbols as defined in [7] section 5.3. In case of QZSS QZS-L2C, it contains the encoded modulation symbols as defined in [7] section 5.5. In case of QZSS QZS-L5, it contains the encoded modulation symbols as defined in [7] section 5.6.

In case of GLONASS, it contains the 100 sps differentially Manchester encoded modulation symbols as defined in [9] section 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.

---

**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.

```asn1
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
}
```

---

**GNSS-AcquisitionAssistance field descriptions**
**GNSS-Acquisition Assistance field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>gnss-SignalID</strong></td>
<td>This field specifies the GNSS signal for which the acquisition assistance are provided.</td>
</tr>
<tr>
<td><strong>gnss-AcquisitionAssistList</strong></td>
<td>These fields provide a list of acquisition assistance data for each GNSS satellite.</td>
</tr>
<tr>
<td><strong>confidence</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>svID</strong></td>
<td>This field specifies the GNSS SV-ID of the satellite for which the GNSS-AcquisitionAssistance is given.</td>
</tr>
<tr>
<td><strong>doppler0</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>doppler1</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>dopplerUncertainty</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>codePhase</strong></td>
<td>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 apriori estimate of the target device location. Scale factor 2⁻¹⁰ ms in the range from 0 to (1-2⁻¹⁰) ms. Note: The value (1-2⁻¹⁰) ms is encoded using the codePhase1023 IE.</td>
</tr>
<tr>
<td><strong>intCodePhase</strong></td>
<td>This field contains integer code phase (expressed modulo 128 ms) currently being transmitted at the reference time, as seen by a receiver at the reference location. Scale factor 1 ms in the range from 0 to 127 ms.</td>
</tr>
<tr>
<td><strong>codePhaseSearchWindow</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>azimuth</strong></td>
<td>This field specifies the azimuth angle. An angle of x degrees means the satellite azimuth a is in the range (x ≤ a &lt; x+0.703125) degrees. Scale factor 0.703125 degrees.</td>
</tr>
<tr>
<td><strong>elevation</strong></td>
<td>This field specifies the elevation angle. An angle of y degrees means the satellite elevation e is in the range (y ≤ e &lt; y+0.703125) degrees. Scale factor 0.703125 degrees.</td>
</tr>
<tr>
<td><strong>codePhase1023</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>
GNSS-AcquisitionAssistance field descriptions

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 m/s, and "No Information".

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

<table>
<thead>
<tr>
<th>codePhaseSearchWindow Value</th>
<th>Interpretation Code Phase Search Window [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>'00000'</td>
<td>No information</td>
</tr>
<tr>
<td>'00001'</td>
<td>0.002</td>
</tr>
<tr>
<td>'00010'</td>
<td>0.004</td>
</tr>
<tr>
<td>'00011'</td>
<td>0.008</td>
</tr>
<tr>
<td>'00100'</td>
<td>0.012</td>
</tr>
<tr>
<td>'00101'</td>
<td>0.016</td>
</tr>
<tr>
<td>'00110'</td>
<td>0.024</td>
</tr>
<tr>
<td>'00111'</td>
<td>0.032</td>
</tr>
<tr>
<td>'01000'</td>
<td>0.048</td>
</tr>
<tr>
<td>'01001'</td>
<td>0.064</td>
</tr>
<tr>
<td>'01010'</td>
<td>0.096</td>
</tr>
<tr>
<td>'01011'</td>
<td>0.128</td>
</tr>
<tr>
<td>'01100'</td>
<td>0.164</td>
</tr>
<tr>
<td>'01101'</td>
<td>0.200</td>
</tr>
<tr>
<td>'01110'</td>
<td>0.250</td>
</tr>
<tr>
<td>'01111'</td>
<td>0.300</td>
</tr>
<tr>
<td>'10000'</td>
<td>0.360</td>
</tr>
<tr>
<td>'10001'</td>
<td>0.420</td>
</tr>
<tr>
<td>'10010'</td>
<td>0.480</td>
</tr>
<tr>
<td>'10011'</td>
<td>0.540</td>
</tr>
<tr>
<td>'10100'</td>
<td>0.600</td>
</tr>
<tr>
<td>'10101'</td>
<td>0.660</td>
</tr>
<tr>
<td>'10110'</td>
<td>0.720</td>
</tr>
<tr>
<td>'10111'</td>
<td>0.780</td>
</tr>
<tr>
<td>'11000'</td>
<td>0.850</td>
</tr>
<tr>
<td>'11001'</td>
<td>1.000</td>
</tr>
<tr>
<td>'11010'</td>
<td>1.150</td>
</tr>
<tr>
<td>'11011'</td>
<td>1.300</td>
</tr>
<tr>
<td>'11100'</td>
<td>1.450</td>
</tr>
<tr>
<td>'11101'</td>
<td>1.600</td>
</tr>
<tr>
<td>'11110'</td>
<td>1.800</td>
</tr>
<tr>
<td>'11111'</td>
<td>2.000</td>
</tr>
</tbody>
</table>
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.

```asn1
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,
    ...
}

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
...
-- ASN1STOP

**GNSS-Almanac field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>weekNumber</td>
<td>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.</td>
</tr>
<tr>
<td>toa</td>
<td>This field specifies the almanac reference time given in GNSS specific system time, in units of seconds with a scale factor of $2^{12}$. This field is required for non-GLONASS GNSS.</td>
</tr>
<tr>
<td>ioda</td>
<td>This field specifies the issue of data. This field is required for Galileo GNSS.</td>
</tr>
<tr>
<td>completeAlmanacProvided</td>
<td>If set to TRUE, the gnss-AlmanacList contains almanacs for the complete GNSS constellation indicated by GNSS-ID.</td>
</tr>
<tr>
<td>gnss-AlmanacList</td>
<td>This list contains the almanac model for each GNSS satellite in the GNSS constellation.</td>
</tr>
</tbody>
</table>

---

**AlmanacKeplerianSet**

```plaintext
<almanacKeplerianSet ::= SEQUENCE {
svID     SV-ID,
kepAlmanacE     INTEGER (0..2047),
kepAlmanacDeltaI  INTEGER (-1024..1023),
kepAlmanacOmegaDot  INTEGER (-1024..1023),
kepSVHealth    INTEGER (0..15),
kepAlmanacAPowerHalf INTEGER (-65536..65535),
kepAlmanacOmega0  INTEGER (-32768..32767),
kepAlmanacW     INTEGER (-32768..32767),
kepAlmanacA0   INTEGER (-8192..8191),
kepAlmanacAF0  INTEGER (-8192..8191),
kepAlmanacAF1  INTEGER (-1024..1023),
...
}
```

---

**AlmanacKeplerianSet field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>svID</td>
<td>This field identifies the satellite for which the GNSS Almanac Model is given.</td>
</tr>
<tr>
<td>kepAlmanacE</td>
<td>Parameter $e$, eccentricity, dimensionless [8]. Scale factor $2^{-16}$.</td>
</tr>
<tr>
<td>kepAlmanacDeltaI</td>
<td>Parameter $\delta_i$, semi-circles [8]. Scale factor $2^{-14}$ semi-circles.</td>
</tr>
<tr>
<td>kepAlmanacOmegaDot</td>
<td>Parameter $\Omega_0$, longitude of ascending node of orbit plane at weekly epoch (semi-circles/sec) [8]. Scale factor $2^{-33}$ semi-circles/seconds.</td>
</tr>
<tr>
<td>kepSVHealth</td>
<td>Parameter SV Health KP, dimensionless. This field specifies the SV Health status in GNSS almanac model using Keplerian parameters. In Galileo case this field shall contain the I/NAV health status bits [8].</td>
</tr>
<tr>
<td>kepAlmanacAPowerHalf</td>
<td>Parameter $A^{1/2}$, Semi-Major Axis delta (meters)$^{1/2}$ [8]. Scale factor $2^{-9}$ meters$^{1/2}$.</td>
</tr>
<tr>
<td>kepAlmanacOmega0</td>
<td>Parameter $\Omega_0$, longitude of ascending node of orbit plane at weekly epoch (semi-circles) [8]. Scale factor $2^{-15}$ semi-circles.</td>
</tr>
</tbody>
</table>
### AlmanacKeplerianSet field descriptions

**kepAlmanacW**  
Parameter $\omega$, argument of perigee (semi-circles) [8].  
Scale factor $2^{15}$ semi-circles.

**kepAlmanacM0**  
Parameter $M_0$, mean anomaly at reference time (semi-circles) [8].  
Scale factor $2^{15}$ semi-circles.

**kepAlmanacAF0**  
Parameter $af_0$, seconds [8].  
Scale factor $2^{19}$ seconds.

**kepAlmanacAF1**  
Parameter $af_1$, sec/sec [8].  
Scale factor $2^{38}$ seconds/second.

---

### AlmanacNAV-KeplerianSet

```plaintext
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),
  navAlmHo   INTEGER (-8388608..8388607),
  navAlmaf0    INTEGER (-1024..1023),
  navAlmaf1    INTEGER (-1024..1023),
  ...
}
```

---

---
<table>
<thead>
<tr>
<th><strong>AlmanacNAV-KeplerianSet field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>svID</strong></td>
</tr>
<tr>
<td>This field identifies the satellite for which the GNSS Almanac Model is given.</td>
</tr>
<tr>
<td><strong>navAlmE</strong></td>
</tr>
<tr>
<td>Parameter e, eccentricity, dimensionless [4,7].</td>
</tr>
<tr>
<td>Scale factor $2^{-21}$.</td>
</tr>
<tr>
<td><strong>navAlmDeltaI</strong></td>
</tr>
<tr>
<td>Parameter $\delta_i$, correction to inclination, semi-circles [4,7].</td>
</tr>
<tr>
<td>Scale factor $2^{-19}$ semi-circles.</td>
</tr>
<tr>
<td><strong>navAlmOMEGADOT</strong></td>
</tr>
<tr>
<td>Parameter $\dot{\Omega}$, rate of right ascension, semi-circles/sec [4,7].</td>
</tr>
<tr>
<td>Scale factor $2^{-38}$ semi-circles/second.</td>
</tr>
<tr>
<td><strong>navAlmSVHealth</strong></td>
</tr>
<tr>
<td>Parameter SV Health, satellite health [4,7].</td>
</tr>
<tr>
<td><strong>navAlmSqrtA</strong></td>
</tr>
<tr>
<td>Parameter $\sqrt{A}$, square root of the semi-major axis, meters$^{1/2}$ [4,7]</td>
</tr>
<tr>
<td>Scale factor $2^{-11}$ meters$^{1/2}$.</td>
</tr>
<tr>
<td><strong>navAlmOMEGA0</strong></td>
</tr>
<tr>
<td>Parameter $\Omega_0$, longitude of ascending node of orbit plane at weekly epoch, semi-circles [4,7].</td>
</tr>
<tr>
<td>Scale factor $2^{-23}$ semi-circles.</td>
</tr>
<tr>
<td><strong>navAlmOmega</strong></td>
</tr>
<tr>
<td>Parameter $\omega$, argument of perigee semi-circles [4,7].</td>
</tr>
<tr>
<td>Scale factor $2^{-23}$ semi-circles.</td>
</tr>
<tr>
<td><strong>navAlmMo</strong></td>
</tr>
<tr>
<td>Parameter $M_0$, mean anomaly at reference time semi-circles [4,7].</td>
</tr>
<tr>
<td>Scale factor $2^{-23}$ semi-circles.</td>
</tr>
<tr>
<td><strong>navAlmaf0</strong></td>
</tr>
<tr>
<td>Parameter $\alpha_0$, apparent satellite clock correction seconds [4,7].</td>
</tr>
<tr>
<td>Scale factor $2^{-20}$ seconds.</td>
</tr>
<tr>
<td><strong>navAlmaf1</strong></td>
</tr>
<tr>
<td>Parameter $\alpha_1$, apparent satellite clock correction sec/sec [4,7].</td>
</tr>
<tr>
<td>Scale factor $2^{-38}$ semi-circles seconds/second.</td>
</tr>
</tbody>
</table>

```-- 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

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>svID</strong></td>
<td>This field identifies the satellite for which the GNSS Almanac Model is given.</td>
<td></td>
</tr>
<tr>
<td><strong>redAlmDeltaA</strong></td>
<td>Parameter $\delta A$, meters [4,5,6,7].</td>
<td>$2^{12}$ meters.</td>
</tr>
<tr>
<td><strong>redAlmOmega0</strong></td>
<td>Parameter $\Omega_0$, semi-circles [4,5,6,7].</td>
<td>$2^{6}$ semi-circles.</td>
</tr>
<tr>
<td><strong>redAlmPhi0</strong></td>
<td>Parameter $\Phi_0$, semi-circles [4,5,6,7].</td>
<td>$2^{6}$ semi-circles.</td>
</tr>
<tr>
<td><strong>redAlmL1Health</strong></td>
<td>Parameter L1 Health, dimensionless [4,5,6,7].</td>
<td></td>
</tr>
<tr>
<td><strong>redAlmL2Health</strong></td>
<td>Parameter L2 Health, dimensionless [4,5,6,7].</td>
<td></td>
</tr>
<tr>
<td><strong>redAlmL5Health</strong></td>
<td>Parameter L5 Health, dimensionless [4,5,6,7].</td>
<td></td>
</tr>
</tbody>
</table>

---

### 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.

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>midiAlmE</td>
<td>Parameter $e$, dimensionless [4,5,6,7]. Scale factor $2^{-16}$.</td>
</tr>
<tr>
<td>midiAlmDeltaI</td>
<td>Parameter $\delta$, semi-circles [4,5,6,7]. Scale factor $2^{-14}$ semi-circles.</td>
</tr>
<tr>
<td>midiAlmOmegaDot</td>
<td>Parameter $\Omega$, semi-circles/sec [4,5,6,7]. Scale factor $2^{-33}$ semi-circles/second.</td>
</tr>
<tr>
<td>midiAlmSqrtA</td>
<td>Parameter $\sqrt{A}$, meters$^{1/2}$ [4,5,6,7]. Scale factor $2^{-4}$ meters$^{1/2}$.</td>
</tr>
<tr>
<td>midiAlmOmega0</td>
<td>Parameter $\Omega_0$, semi-circles [4,5,6,7]. Scale factor $2^{-15}$ semi-circles.</td>
</tr>
<tr>
<td>midiAlmOmega</td>
<td>Parameter $\omega$, semi-circles [4,5,6,7]. Scale factor $2^{-15}$ semi-circles.</td>
</tr>
<tr>
<td>midiAlmMo</td>
<td>Parameter $M_0$, semi-circles [4,5,6,7]. Scale factor $2^{-15}$ semi-circles.</td>
</tr>
<tr>
<td>midiAlmA0</td>
<td>Parameter $a_0$, seconds [4,5,6,7]. Scale factor $2^{-20}$ seconds.</td>
</tr>
<tr>
<td>midiAlmA1</td>
<td>Parameter $a_1$, sec/sec [4,5,6,7]. Scale factor $2^{-37}$ seconds/second.</td>
</tr>
<tr>
<td>midiAlmL1Health</td>
<td>Parameter L1 Health, dimensionless [4,5,6,7].</td>
</tr>
<tr>
<td>midiAlmL2Health</td>
<td>Parameter L2 Health, dimensionless [4,5,6,7].</td>
</tr>
<tr>
<td>midiAlmL5Health</td>
<td>Parameter L5 Health, dimensionless [4,5,6,7].</td>
</tr>
</tbody>
</table>

### -- AlmanacGLONASS-AlmanacSet

```plaintext
-- ASN1START
AlmanacGLONASS-AlmanacSet ::= SEQUENCE {
  gloAlmNA    INTEGER (1..1461),
  gloAlmA    INTEGER (1..24),
  gloAlmHA    INTEGER (0..31),
  gloAlmLambdaA    INTEGER (-1048576..1048575),
  gloAlmLambdaA    INTEGER (0..2097151),
  gloAlmDeltaTA    INTEGER (-131072..131071),
  gloAlmDeltaTA    INTEGER (-2097152..2097151),
  gloAlmDeltaTdotA INTEGER (-64..63),
  gloAlmEpsilonA    INTEGER (0..32767),
  gloAlmOmegaA    INTEGER (-32768..32767),
  gloAlmTauA    INTEGER (-512..511),
  gloAlmA    BIT STRING (SIZE(2))    OPTIONAL, -- Need ON...
}
-- ASN1STOP
```
AlmanacGLONASS-AlmanacSet field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>gloAlm-NA</td>
<td>Parameter N, days [9].</td>
<td>1 days</td>
</tr>
<tr>
<td>gloAlmnnA</td>
<td>Parameter n, dimensionless [9].</td>
<td></td>
</tr>
<tr>
<td>gloAlmHA</td>
<td>Parameter H, dimensionless [9].</td>
<td></td>
</tr>
<tr>
<td>gloAlmLambdaA</td>
<td>Parameter λ, semi-circles [9].</td>
<td>2^-20</td>
</tr>
<tr>
<td>gloAlmlambdaA</td>
<td>Parameter t, seconds [9].</td>
<td>2^-2</td>
</tr>
<tr>
<td>gloAlmDeltaA</td>
<td>Parameter Δ, semi-circles [9].</td>
<td>2^-20</td>
</tr>
<tr>
<td>gloAlmDeltaTA</td>
<td>Parameter ΔT, sec/orbit period [9].</td>
<td>2^-9</td>
</tr>
<tr>
<td>gloAlmDeltaTdotA</td>
<td>Parameter ΔT_ddot, sec/orbit period^2 [9].</td>
<td>2^-14</td>
</tr>
<tr>
<td>gloAlmEpsilonA</td>
<td>Parameter ε, dimensionless [9].</td>
<td>2^-20</td>
</tr>
<tr>
<td>gloAlmOmegaA</td>
<td>Parameter ω, semi-circles [9].</td>
<td>2^-15</td>
</tr>
<tr>
<td>gloAlmTauA</td>
<td>Parameter τ, seconds [9].</td>
<td>2^-18</td>
</tr>
<tr>
<td>gloAlmCA</td>
<td>Parameter C, dimensionless [9].</td>
<td></td>
</tr>
<tr>
<td>gloAlmMA</td>
<td>Parameter M, dimensionless [9].</td>
<td></td>
</tr>
</tbody>
</table>

AlmanacECEF-SBAS-AlmanacSet

```asciidoc
-- 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

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>sbasAlmDataID</td>
<td>Parameter Data ID, dimensionless [10].</td>
<td></td>
</tr>
<tr>
<td>svID</td>
<td>This field identifies the satellite for which the GNSS Almanac Model is given.</td>
<td></td>
</tr>
<tr>
<td>sbasAlmHealth</td>
<td>Parameter Health, dimensionless [10].</td>
<td></td>
</tr>
<tr>
<td>sbasAlmXg</td>
<td>Parameter ( X_g ), meters [10]. Scale factor 2600 meters.</td>
<td></td>
</tr>
<tr>
<td>sbasAlmYg</td>
<td>Parameter ( Y_g ), meters [10]. Scale factor 2600 meters.</td>
<td></td>
</tr>
<tr>
<td>sbasAlmZg</td>
<td>Parameter ( Z_g ), meters [10]. Scale factor 26000 meters.</td>
<td></td>
</tr>
<tr>
<td>sbasAlmXgdot</td>
<td>Parameter ( X_g ) Rate-of-Change, meters/sec [10]. Scale factor 10 meters/second.</td>
<td></td>
</tr>
<tr>
<td>sbasAlmYgdot</td>
<td>Parameter ( Y_g ) Rate-of-Change, meters/sec [10]. Scale factor 10 meters/second.</td>
<td></td>
</tr>
<tr>
<td>sbasAlmZgdot</td>
<td>Parameter ( Z_g ) Rate-of-Change, meters/sec [10]. Scale factor 40.96 meters/second.</td>
<td></td>
</tr>
<tr>
<td>sbasAlmTo</td>
<td>Parameter ( t_0 ), seconds [10]. Scale factor 64 meters/seconds.</td>
<td></td>
</tr>
</tbody>
</table>

---

**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].

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.

```asn1
GNSS-UTC-Model ::= CHOICE {
  utcModel1   UTC-ModelSet1, -- Model-1
  utcModel2   UTC-ModelSet2, -- Model-2
  utcModel3   UTC-ModelSet3, -- Model-3
  utcModel4   UTC-ModelSet4, -- Model-4
  ...
}
```

---

**UTC-ModelSet1**

```asn1
UTC-ModelSet1 ::= SEQUENCE {
  gns-Ucc-A1   INTEGER (-8388608..8388607),
  gns-Ucc-A0   INTEGER (-2147483648..2147483647),
  gns-Ucc-Tot  INTEGER (0..255),
  gns-Ucc-WNt  INTEGER (0..255),
  gns-Ucc-DeltaTls INTEGER (-128..127),
  gns-Ucc-WNlsf INTEGER (0..255),
  gns-Ucc-DN   INTEGER (-128..127),
  gns-Ucc-DeltaTlsf INTEGER (-128..127),
  ...
}
```
UTC-ModelSet1 field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>gnss-Utc-A1</td>
<td>Parameter $A_1$, scale factor $2^{-50}$ seconds/second [4,7,8].</td>
<td></td>
</tr>
<tr>
<td>gnss-Utc-A0</td>
<td>Parameter $A_0$, scale factor $2^{-30}$ seconds [4,7,8].</td>
<td></td>
</tr>
<tr>
<td>gnss-Utc-Tot</td>
<td>Parameter $\tau_{tot}$, scale factor $2^{12}$ seconds [4,7,8].</td>
<td></td>
</tr>
<tr>
<td>gnss-Utc-WNt</td>
<td>Parameter WN, scale factor 1 week [4,7,8].</td>
<td></td>
</tr>
<tr>
<td>gnss-Utc-DeltaTls</td>
<td>Parameter $\Delta t_{LS}$, scale factor 1 second [4,7,8].</td>
<td></td>
</tr>
<tr>
<td>gnss-Utc-WNlsf</td>
<td>Parameter WN_{LSF}, scale factor 1 week [4,7,8].</td>
<td></td>
</tr>
<tr>
<td>gnss-Utc-DN</td>
<td>Parameter DN, scale factor 1 day [4,7,8].</td>
<td></td>
</tr>
<tr>
<td>gnss-Utc-DeltaTlsf</td>
<td>Parameter $\Delta t_{LSF}$, scale factor 1 second [4,7,8].</td>
<td></td>
</tr>
</tbody>
</table>

UTC-ModelSet2 field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Scale Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>utcA0</td>
<td>Parameter $A_0$, bias coefficient of GNSS time scale relative to UTC time scale (seconds) [4,5,6,7]. Scale factor $2^{-36}$ seconds.</td>
<td></td>
</tr>
<tr>
<td>utcA1</td>
<td>Parameter $A_1$, drift coefficient of GNSS time scale relative to UTC time scale (sec/sec) [4,5,6,7]. Scale factor $2^{-31}$ seconds/second.</td>
<td></td>
</tr>
<tr>
<td>utcA2</td>
<td>Parameter $A_2$, drift rate correction coefficient of GNSS time scale relative to UTC time scale (sec/sec^2) [4,5,6,7]. Scale factor $2^{-26}$ seconds/second^2.</td>
<td></td>
</tr>
<tr>
<td>utcDeltaTls</td>
<td>Parameter $\Delta t_{LS}$, current or past leap second count (seconds) [4,5,6,7]. Scale factor 1 second.</td>
<td></td>
</tr>
<tr>
<td>utcTot</td>
<td>Parameter $\tau_{tot}$, time data reference time of week (seconds) [4,5,6,7]. Scale factor $2^{4}$ seconds.</td>
<td></td>
</tr>
<tr>
<td>utcWNnot</td>
<td>Parameter WN_{tot}, time data reference week number (weeks) [4,5,6,7]. Scale factor 1 week.</td>
<td></td>
</tr>
<tr>
<td>utcWNlsf</td>
<td>Parameter WN_{LSF}, leap second reference week number (weeks) [4,5,6,7]. Scale factor 1 week.</td>
<td></td>
</tr>
<tr>
<td>utcDN</td>
<td>Parameter DN, leap second reference day number (days) [4,5,6,7]. Scale factor 1 day.</td>
<td></td>
</tr>
</tbody>
</table>
UTC-ModelSet2 field descriptions

utcDeltaTlsf
Parameter $\Delta_{TLSF}$, 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 $N^A$, calender day number within four-year period beginning since the leap year (days) [9].
Scale factor 1 day.

tauC
Parameter $\tau_C$, GLONASS time scale correction to UTC(SU) (seconds) [9].
Scale factor $2^{-31}$ seconds.

b1
Parameter $B_1$, coefficient to determine $\Delta$UT1 (seconds) [9].
Scale factor $2^{-10}$ seconds.

b2
Parameter $B_2$, coefficient to determine $\Delta$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),
  utcT0t     INTEGER (0..255),
  utcN1wnt   INTEGER (0..255),
  utcDeltaTlsf  INTEGER (-128...127),
  utcNN1lsf  INTEGER (0..255),
  utcDN     INTEGER (-128...127),
  utcDeltaTlsf  INTEGER (-128...127),
  utcStandardID  INTEGER (0..7),
  ...
}

-- ASN1STOP

UTC-ModelSet4 field descriptions

utcA1wnt
Parameter $A_{WNT}$, sec/sec ([10], Message Type 12).
Scale factor $2^{-50}$ seconds/second.
**UTC-ModelSet4 field descriptions**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>utcA0wnt</td>
<td>Parameter $A_{0WNT}$, seconds ([10], Message Type 12). Scale factor $2^{-30}$ seconds.</td>
</tr>
<tr>
<td>utcTot</td>
<td>Parameter $t_{0t}$, seconds ([10], Message Type 12). Scale factor $2^{12}$ seconds.</td>
</tr>
<tr>
<td>utcWNt</td>
<td>Parameter $W_{0Nt}$, weeks ([10], Message Type 12). Scale factor 1 week.</td>
</tr>
<tr>
<td>utcDeltaTs</td>
<td>Parameter $\Delta_{LS}$, seconds ([10], Message Type 12). Scale factor 1 second.</td>
</tr>
<tr>
<td>utcWNsf</td>
<td>Parameter $W_{NLSF}$, weeks ([10], Message Type 12). Scale factor 1 week.</td>
</tr>
<tr>
<td>utcDN</td>
<td>Parameter $DN$, days ([10], Message Type 12). Scale factor 1 day.</td>
</tr>
<tr>
<td>utcDeltaTsf</td>
<td>Parameter $\Delta_{LSF}$, seconds ([10], Message Type 12). Scale factor 1 second.</td>
</tr>
<tr>
<td>utcStandardID</td>
<td>If GNSS-ID indicates &quot;sbas&quot;, 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).</td>
</tr>
</tbody>
</table>

---

**Value of UTC Standard ID to UTC Standard relation**

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

---

**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.

```
-- ASNISTART

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
  ...
}
```

---

**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
  ...
}
### Conditional presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDMA</td>
<td>The field is mandatory present if the GLONASS SV indicated by svID broadcasts FDMA signals; otherwise it is not present.</td>
</tr>
</tbody>
</table>

### GNSS-AssistantInformation 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-AssistantInformation 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].

---

### 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.

#### Conditional presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CommonADReq</td>
<td>The field is mandatory present if the target device requests GNSS-CommonAssistData; otherwise it is not present.</td>
</tr>
<tr>
<td>GenADReq</td>
<td>This field is mandatory present if the target device requests GNSS-GenericAssistData for one or more specific GNSS; otherwise it is not present.</td>
</tr>
</tbody>
</table>

---

### 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.

#### Conditional presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNSS-ReferenceTimeReq</td>
<td>OPTIONAL, -- Cond RefTimeReq</td>
</tr>
<tr>
<td>GNSS-ReferenceLocationReq</td>
<td>OPTIONAL, -- Cond RefLocReq</td>
</tr>
<tr>
<td>GNSS-IonosphericModelReq</td>
<td>OPTIONAL, -- Cond IonoModReq</td>
</tr>
<tr>
<td>GNSS-EarthOrientationParametersReq</td>
<td>OPTIONAL, -- Cond EOPReq</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>
---

**Conditional presence**

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RefTimeReq</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-ReferenceTime</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>RefLocReq</td>
<td>This field is mandatory present if the target device requests <strong>GNSS-ReferenceLocation</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>IonoModReq</td>
<td>This field is mandatory present if the target device requests <strong>GNSS-IonosphericModel</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>EOPReq</td>
<td>This field is mandatory present if the target device requests <strong>GNSS-EarthOrientationParameters</strong>; otherwise it is not present.</td>
</tr>
</tbody>
</table>

---

**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, 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.

---

**Conditional presence**

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNSS-ID-SBAS</td>
<td>The field is mandatory present if the <strong>GNSS-ID</strong> = <strong>sbas</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>TimeModReq</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-TimeModelList</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>DGNSS-Req</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-DifferentialCorrections</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>NavModReq</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-NavigationModel</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>RTIReq</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-RealTimeIntegrity</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>DataBitsReq</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-DataBitAssistance</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>AcquAssistReq</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-AcquisitionAssistance</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>AlmanacReq</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-Almanac</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>UTCModReq</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-UTCModel</strong>; otherwise it is not present.</td>
</tr>
<tr>
<td>AuxInfoReq</td>
<td>The field is mandatory present if the target device requests <strong>GNSS-AuxiliaryInformation</strong>; otherwise it is not present.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th><strong>GNSS-ReferenceTimeReq field descriptions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>gnss-TimeReqPrefList</strong></td>
</tr>
<tr>
<td><strong>gps-TOW-assistReq</strong></td>
</tr>
<tr>
<td><strong>notOfLeapSecReq</strong></td>
</tr>
</tbody>
</table>

– GNSS-ReferenceLocationReq

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

```asn1
GNSS-EarthOrientationParametersReq ::= SEQUENCE {
  ...
}
```

### GNSS-TimeModelListReq

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

```asn1
GNSS-TimeModelListReq ::= SEQUENCE (SIZE(1..15)) OF GNSS-TimeModelElementReq

GNSS-TimeModelElementReq ::= SEQUENCE {
  gnss-TO-IDsReq INTEGER (1..15),
  deltaTreq BOOLEAN,
  ...
}
```

#### 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* assistance from the location server.

```asn1
GNSS-DifferentialCorrectionsReq ::= SEQUENCE {
  dgnss-SignalsReq GNSS-SignalIDs,
  dgnss-ValidityTimeReq BOOLEAN,
  ...
}
```

#### GNSS-DifferentialCorrectionsReq field descriptions
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 assistance from the location server.

```asn1
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
  ... 
}
```

**Conditional presence**

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>orbitModelID-2</td>
<td>The field is mandatory present if orbitModelID-PrefList is absent or includes a Model-ID = &quot;2&quot;; otherwise it is not present.</td>
</tr>
</tbody>
</table>

---

**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 1" of January in a leap year, as defined by the parameter Nt in [9] of the assistance currently held by the target device.
GNSS-NavigationModelReq field descriptions

- **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 1 represents SV-ID=1 and bit 64 represents SV-ID=64. 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 & orbitModelID-PrefList 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

<table>
<thead>
<tr>
<th>GNSS-ID</th>
<th>clockModelID</th>
<th>orbitModelID</th>
</tr>
</thead>
<tbody>
<tr>
<td>gps</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>sbas</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>qzss</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>galileo</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>glonass</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>GNSS-ID</th>
<th>clockModelID-PrefList</th>
<th>orbitModelID-PrefList</th>
</tr>
</thead>
<tbody>
<tr>
<td>gps</td>
<td>Model-2</td>
<td>Model-2</td>
</tr>
<tr>
<td>sbas</td>
<td>Model-5</td>
<td>Model-5</td>
</tr>
<tr>
<td>qzss</td>
<td>Model-2</td>
<td>Model-2</td>
</tr>
<tr>
<td>galileo</td>
<td>Model-1</td>
<td>Model-1</td>
</tr>
<tr>
<td>glonass</td>
<td>Model-4</td>
<td>Model-4</td>
</tr>
</tbody>
</table>

---

**GNSS-RealTimeIntegrityReq**

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

```asn1
GNSS-RealTimeIntegrityReq ::= SEQUENCE {
  ...
}
```

---
## GNSS-DataBitAssistanceReq

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

```asn1
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,
  ...
}
```

### 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 value of the **dataBitInterval** is expressed in seconds, is mapped to a binary number K with the following formula:

\[ r = 0.1 \times 2^K \]

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** assistance from the location server.

```asn1
GNSS-AcquisitionAssistanceReq ::= SEQUENCE {
  gnss-SignalID-Req GNSS-SignalID,
  ...
}
```

### GNSS-AcquisitionAssistanceReq field descriptions

**gnss-SignalID-Req**
This field specifies the GNSS signal type for which **GNSS-AcquisitionAssistance** is requested.
-- GNSS-AlmanacReq

The IE GNSS-AlmanacReq is used by the target device to request the GNSS-Almanac assistance from 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**

<table>
<thead>
<tr>
<th>GNSS-ID</th>
<th>modelID</th>
</tr>
</thead>
<tbody>
<tr>
<td>gps</td>
<td>2</td>
</tr>
<tr>
<td>sbas</td>
<td>6</td>
</tr>
<tr>
<td>qzss</td>
<td>2</td>
</tr>
<tr>
<td>galileo</td>
<td>1</td>
</tr>
<tr>
<td>glonass</td>
<td>5</td>
</tr>
</tbody>
</table>

-- GNSS-UTC-ModelReq

The IE GNSS-UTC-ModelReq is used by the target device to request the GNSS-UTC-Model assistance from 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**

<table>
<thead>
<tr>
<th>GNSS-ID</th>
<th>modelID</th>
</tr>
</thead>
<tbody>
<tr>
<td>gps</td>
<td>1</td>
</tr>
<tr>
<td>sbas</td>
<td>4</td>
</tr>
<tr>
<td>qzss</td>
<td>1</td>
</tr>
<tr>
<td>galileo</td>
<td>1</td>
</tr>
<tr>
<td>glonass</td>
<td>3</td>
</tr>
</tbody>
</table>

-- GNSS-AuxiliaryInformationReq

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

```asn1
A-GNSS-ProvideLocationInformation ::= SEQUENCE {
    gnss-SignalMeasurementInformation GNSS-SignalMeasurementInformation  OPTIONAL,
    gnss-LocationInformation   GNSS-LocationInformation    OPTIONAL,
    gnss-Error       A-GNSS-Error       OPTIONAL,
    ...}
```

6.5.2.6  GNSS Location Information Elements

–  GNSS-SignalMeasurementInformation

The IE GNSS-SignalMeasurementInformation is used by the target device to provide GNSS signal 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/N0, 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.

```asn1
GNSS-SignalMeasurementInformation ::= SEQUENCE {
    measurementReferenceTime  MeasurementReferenceTime,
    gnss-MeasurementList   GNSS-MeasurementList,
    ...}
```

**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 field provides 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.

```asn1
MeasurementReferenceTime ::= SEQUENCE {
    ...}
```
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.
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 \([\text{GNSS TOD} - \text{gnss-TOD-unc}, \text{GNSS TOD} + \text{gnss-TOD-unc}]\).
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.
MeasurementReferenceTime field descriptions

**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, as defined in [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 [12] for E-UTRA and [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 [12].

**mode**
This field identifies the reference cell for the GNSS-network time relation, as defined in [13].

**referenceSystemFrameNumber**
This field specifies the system frame number in UTRA, as defined in [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 [14].

**referenceFN, referenceFNMSB**
These fields specify the frame number in GERAN which the GNSS time time stamps, as defined in [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

\[
\text{Reference FN MSB} = \text{floor}(\text{FN}/42432)
\]

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

\[
\text{FN} = \text{referenceFNMSB} \times 42432 + \text{referenceFN}
\]

**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 [14]. The deltaGNSS-TOD is defined as

\[
\text{deltaGNSS-TOD} = \text{gnss-TOD-msec} - \text{fix(tsv}_1)\]

where fix() denotes rounding to the nearest integer towards zero.

### Value of K to Value of uncertainty relation

<table>
<thead>
<tr>
<th>Value of K</th>
<th>Value of uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 microseconds</td>
</tr>
<tr>
<td>1</td>
<td>0.07 microseconds</td>
</tr>
<tr>
<td>2</td>
<td>0.1498 microseconds</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50</td>
<td>349.62 microseconds</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>127</td>
<td>≥ 8430000 microseconds</td>
</tr>
</tbody>
</table>

--

GNSS-MeasurementList

The IE GNSS-MeasurementList is used by the target device to provide measurements of code phase, Doppler, C/N₀ and optionally accumulated carrier phase, also called accumulated deltarange (ADR).

```asn1
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-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 0 and 127 milli-seconds.

The total code phase for a satellite k (Satk) is given modulo this `gnss-CodePhaseAmbiguity` and is reconstructed with:

\[
\text{Code Phase}_\text{Tot}(\text{Satk}) = \text{codePhase}(\text{Satk}) + \text{integerCodePhase}(\text{Satk}) + n \times \text{gnss-CodePhaseAmbiguity}, n = 0, 1, 2, ... \]

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**
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 toPolarity Indication relation below.

**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.
**GNSS-MeasurementList field descriptions**

**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 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).

<table>
<thead>
<tr>
<th>Value of mpathDet</th>
<th>Multipath Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Not measured</td>
</tr>
<tr>
<td>01</td>
<td>Low, MP error &lt; 5m</td>
</tr>
<tr>
<td>10</td>
<td>Medium, 5m &lt; MP error &lt; 43m</td>
</tr>
<tr>
<td>11</td>
<td>High, MP error &gt; 43m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
<th>Polarity Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Data Direct, carrier phase not continuous</td>
</tr>
<tr>
<td>1</td>
<td>Data Inverted, carrier phase not continuous</td>
</tr>
<tr>
<td>2</td>
<td>Data Direct, carrier phase continuous</td>
</tr>
<tr>
<td>3</td>
<td>Data Inverted, carrier phase continuous</td>
</tr>
</tbody>
</table>

**floating-point representation**

<table>
<thead>
<tr>
<th>Index</th>
<th>Mantissa</th>
<th>Exponent</th>
<th>Floating-Point value, ( x_i )</th>
<th>Pseudorange value, ( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>000</td>
<td>000</td>
<td>0.5</td>
<td>( P &lt; 0.5 )</td>
</tr>
<tr>
<td>1</td>
<td>001</td>
<td>000</td>
<td>0.5625</td>
<td>( 0.5 &lt;= P &lt; 0.5625 )</td>
</tr>
<tr>
<td>1</td>
<td>( x )</td>
<td>( y )</td>
<td>( 0.5 \times (1 + x/8) \times 2^y )</td>
<td>( x_i \times 2^y \times 2 )</td>
</tr>
<tr>
<td>62</td>
<td>110</td>
<td>111</td>
<td>112</td>
<td>( 104 &lt;= P &lt; 112 )</td>
</tr>
<tr>
<td>63</td>
<td>111</td>
<td>111</td>
<td>–</td>
<td>( 112 &lt;= P )</td>
</tr>
</tbody>
</table>
---

**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.

---

**GNSS-LocationInformation field descriptions**
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 field provides 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,
  ...
}
-- ASN1STOP

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.
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 it’s A-GNSS location capabilities (e.g., GNSSs and assistance data supported) to the location server.

```asn1
A-GNSS-ProvideCapabilities ::= SEQUENCE {
    gnss-SupportList           GNSS-SupportList   OPTIONAL,
    assistanceDataSupportList AssistanceDataSupportList OPTIONAL,
    locationCoordinateTypes LocationCoordinateTypes OPTIONAL,
    velocityTypes             VelocityTypes     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,
    ...
}

AssistanceDataSupportList ::= SEQUENCE {
    gnss-CommonAssistanceDataSupport GNSS-CommonAssistanceDataSupport,
    gnss-GenericAssistanceDataSupport GNSS-GenericAssistanceDataSupport,
    ...
}
```

### Conditional presence

<table>
<thead>
<tr>
<th>Conditional presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNSS-ID-SBAS</td>
<td>The field is mandatory present if the GNSS-ID = sbas; otherwise it is not present.</td>
</tr>
<tr>
<td>fta</td>
<td>The field is mandatory present if the target device supports the reporting of fine time assistance measurements; otherwise it is not present.</td>
</tr>
</tbody>
</table>

### 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.
**A-GNSS-ProvideCapabilities field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>fta-MeasSupport</td>
<td>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.</td>
</tr>
<tr>
<td>adr-Support</td>
<td>This field specifies whether the target device supports ADR measurement reporting. TRUE means supported.</td>
</tr>
<tr>
<td>velocityMeasurementSupport</td>
<td>This field specifies whether the target device supports measurement reporting related to velocity. TRUE means supported.</td>
</tr>
<tr>
<td>assistanceDataSupportList</td>
<td>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.</td>
</tr>
<tr>
<td>locationCoordinateTypes</td>
<td>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.</td>
</tr>
<tr>
<td>velocityTypes</td>
<td>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.</td>
</tr>
</tbody>
</table>

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.

```yaml
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
  ...}
```

**Conditional presence**

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RefTimeSup</td>
<td>The field is mandatory present if the target device supports GNSS-ReferenceTime; otherwise it is not present.</td>
</tr>
<tr>
<td>RefLocSup</td>
<td>This field is mandatory present if the target device supports GNSS-ReferenceLocation; otherwise it is not present.</td>
</tr>
<tr>
<td>IonoModSup</td>
<td>This field is mandatory present if the target device supports GNSS-IonosphericModel; otherwise it is not present.</td>
</tr>
<tr>
<td>EOPSup</td>
<td>This field is mandatory present if the target device supports GNSS-EarthOrientationParameters; otherwise it is not present.</td>
</tr>
</tbody>
</table>
---

**GNSS-ReferenceTimeSupport**

```asn1
GNSS-ReferenceTimeSupport ::= SEQUENCE {
  gnss-SystemTime  GNSS-ID-Bitmap,
  fta-Support   AccessTypes          OPTIONAL, -- Cond fta
  ...
}
```

---

### Conditional presence

<table>
<thead>
<tr>
<th>Field</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>fta</td>
<td>The field is mandatory present if the target device supports fine time assistance in GNSSReferenceTime IE; otherwise it is not present.</td>
</tr>
</tbody>
</table>

---

**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**

```asn1
GNSS-ReferenceLocationSupport ::= SEQUENCE {
  ...
}
```

---

**GNSS-IonosphericModelSupport**

```asn1
GNSS-IonosphericModelSupport ::=  SEQUENCE {
  ionoModel  BIT STRING {  klobuchar  (0),
                            neQuick  (1) } (SIZE (1..8)),
  ...
}
```

---

### 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**

```asn1
GNSS-EarthOrientationParametersSupport ::= SEQUENCE {
  ...
}
```

---

---

---
The IE \textit{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.

---

\textbf{Conditional presence}

<table>
<thead>
<tr>
<th>Conditional presence</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNSS-ID-SBAS</td>
<td>The field is mandatory present if the GNSS-ID = sbas; otherwise it is not present.</td>
</tr>
<tr>
<td>TimeModSup</td>
<td>The field is mandatory present if the target device supports GNSS-TimeModelList; otherwise it is not present.</td>
</tr>
<tr>
<td>DGNSS-Sup</td>
<td>The field is mandatory present if the target device supports GNSS-DifferentialCorrections; otherwise it is not present.</td>
</tr>
<tr>
<td>NavModSup</td>
<td>The field is mandatory present if the target device supports GNSS-NavigationModel; otherwise it is not present.</td>
</tr>
<tr>
<td>RTISup</td>
<td>The field is mandatory present if the target device supports GNSS-RealTimeIntegrity; otherwise it is not present.</td>
</tr>
<tr>
<td>DataBitsSup</td>
<td>The field is mandatory present if the target device supports GNSS-DataBitAssistance; otherwise it is not present.</td>
</tr>
<tr>
<td>AcquAssistSup</td>
<td>The field is mandatory present if the target device supports GNSS-AcquisitionAssistance; otherwise it is not present.</td>
</tr>
<tr>
<td>AlmanacSup</td>
<td>The field is mandatory present if the target device supports GNSS-Almanac; otherwise it is not present.</td>
</tr>
<tr>
<td>UTCModSup</td>
<td>The field is mandatory present if the target device supports GNSS-UTC-Model; otherwise it is not present.</td>
</tr>
<tr>
<td>AuxInfoSup</td>
<td>The field is mandatory present if the target device supports GNSS-AuxiliaryInformation; otherwise it is not present.</td>
</tr>
</tbody>
</table>

---

\textbf{GNSS-TimeModelListSupport}

---

\textbf{GNSS-GenericAssistanceDataSupport}

---

\textbf{GNSS-TimeModelListSupport}

---

\textbf{GNSS-GenericAssistanceDataSupport}

---

\textbf{GNSS-TimeModelListSupport}

---
- GNSS-DifferentialCorrectionSupport

```asn1
GNSS-DifferentialCorrectionsSupport ::= SEQUENCE {
  gnssSignalIDs   GNSS-SignalIDs,
  dgnss-ValidityTimeSup BOOLEAN,
  ...
}
```

**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

```asn1
GNSS-NavigationModelSupport ::= SEQUENCE {
  clockModel   BIT STRING {
    model-1   (0),
    model-2   (1),
    model-3   (2),
    model-4   (3),
    model-5   (4) } (SIZE (1..8)) OPTIONAL,
  orbitModel   BIT STRING {
    model-1   (0),
    model-2   (1),
    model-3   (2),
    model-4   (3),
    model-5   (4) } (SIZE (1..8)) OPTIONAL,
  ...
}
```

**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 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-2`.
  - If the target device supports QZSS and `GNSS-NavigationModel` assistance, it shall support `orbitModel Model-5`.
  - If the target device supports Galileo and `GNSS-NavigationModel` assistance, it shall support `orbitModel Model-5`.
  - If the target device supports Galileo and `GNSS-NavigationModel` assistance, it shall support `orbitModel Model-2`.
  - If the target device supports GLONASS and `GNSS-NavigationModel` assistance, it shall support `orbitModel Model-4`.
  - 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

```asn1
GNSS-RealTimeIntegritySupport ::= SEQUENCE {
    ...
}
```

--- GNSS-DataBitAssistanceSupport

```asn1
GNSS-DataBitAssistanceSupport ::= SEQUENCE {
    ...
}
```

--- GNSS-AcquisitionAssistanceSupport

```asn1
GNSS-AcquisitionAssistanceSupport ::= SEQUENCE {
    confidenceSupport-r10 ENUMERATED { true } OPTIONAL,
    dopplerUncertaintyExtSupport-r10 ENUMERATED { true } OPTIONAL
}
```

**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

```asn1
GNSS-AlmanacSupport ::= SEQUENCE {
    almanacModel BIT STRING {
        model-1    (0),
        model-2    (1),
        model-3    (2),
        model-4    (3),
        model-5    (4),
        model-6    (5) (SIZE (1..8)) OPTIONAL,
    }
    ...
}
```

**GNSS-AlmanacSupport field descriptions**
**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 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

```asn1
GNSS-UTC-ModelSupport ::= SEQUENCE {
  utc-Model  BIT STRING {  model-1  (0),
                            model-2  (1),
                            model-3  (2),
                            model-4  (3) } (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 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

```asn1
GNSS-AuxiliaryInformationSupport ::= 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

```asn1
A-GNSS-RequestCapabilities ::= SEQUENCE {
  gnss-SupportListReq   BOOLEAN,
  assistanceDataSupportListReq  BOOLEAN,
  locationVelocityTypesReq  BOOLEAN,
  ...
}
```

--- ASN1STOP
### A-GNSS-RequestCapabilities field descriptions

<table>
<thead>
<tr>
<th>Field Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>gnss-SupportListReq</td>
<td>This field specifies whether the target device is requested to include the <code>gnss-SupportList</code> field in the A-GNSS-ProvideCapabilities IE or not. TRUE means requested.</td>
</tr>
<tr>
<td>assistanceDataSupportListReq</td>
<td>This field specifies whether the target device is requested to include the <code>assistanceDataSupportList</code> field in the A-GNSS-ProvideCapabilities IE or not. TRUE means requested.</td>
</tr>
<tr>
<td>locationVelocityTypesReq</td>
<td>This field specifies whether the target device is requested to include the <code>locationCoordinateTypes</code> field and <code>velocityTypes</code> field in the A-GNSS-ProvideCapabilities IE or not. TRUE means requested.</td>
</tr>
</tbody>
</table>

### 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.

```asn1
A-GNSS-Error ::= CHOICE {
  locationServerErrorCauses GNSS-LocationServerErrorCauses,
  targetDeviceErrorCauses   GNSS-TargetDeviceErrorCauses,
  ...
}
```

#### GNSS-LocationServerErrorCauses

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

```asn1
GNSS-LocationServerErrorCauses ::= SEQUENCE {
  cause ENUMERATED {
    undefined,
    undeliveredAssistanceDataIsNotSupportedByServer,
    undeliveredAssistanceDataIsSupportedButCurrentlyNotAvailableByServer,
    undeliveredAssistanceDataIsPartlyNotSupportedAndPartlyNotAvailableByServer,
    ...
  },
  ...
}
```

#### GNSS-TargetDeviceErrorCauses

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

```asn1
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 "multiFrequencyMeasurementsNotPossible" fields, as applicable.

6.5.2.13 Common GNSS Information Elements

– **GNSS-ID**

The IE **GNSS-ID** is used to indicate a specific GNSS.

```asn1
-- ASN1START
GNSS-ID ::= SEQUENCE {
  gnss-id    ENUMERATED{ gps, sbas, qzss, galileo, glonass, ...},
  ...
} -- ASN1STOP
```

– **GNSS-ID-Bitmap**

The IE **GNSS-ID-Bitmap** is used to indicate several GNSSs using a bit map.

```asn1
-- ASN1START
GNSS-ID-Bitmap ::= SEQUENCE {
  gnss-ids   BIT STRING { gps   (0),
                           sbas   (1),
                           qzss  (2),
                           galileo  (3),
                           glonass  (4)  } (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-SignalID**

The IE **GNSS-SignalID** is used to indicate a specific GNSS signal type. The interpretation of **GNSS-SignalID** depends on the **GNSS-ID**.

```asn1
-- ASN1START
GNSS-SignalID ::= SEQUENCE {
  gnss-SignalID  INTEGER (0 .. 7),
  ...
} -- ASN1STOP
```
GNSS-SignalID field descriptions

**gnss-SignalID**

This field specifies a particular GNSS signal. The interpretation of *gnss-SignalID* depends on the GNSS-ID and is as shown in the table System to Value & Explanation relation below.

### System to Value & Explanation relation

<table>
<thead>
<tr>
<th>System</th>
<th>Value</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS</td>
<td>0</td>
<td>GPS L1 C/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>GPS L1C</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>GPS L2C</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>GPS L5</td>
</tr>
<tr>
<td></td>
<td>4-7</td>
<td>Reserved</td>
</tr>
<tr>
<td>SBAS</td>
<td>0</td>
<td>L1</td>
</tr>
<tr>
<td></td>
<td>1-7</td>
<td>Reserved</td>
</tr>
<tr>
<td>QZSS</td>
<td>0</td>
<td>QZS-L1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>QZS-L1C</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>QZS-L2C</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>QZS-L5</td>
</tr>
<tr>
<td></td>
<td>4-7</td>
<td>Reserved</td>
</tr>
<tr>
<td>GLONASS</td>
<td>0</td>
<td>GLONASS G1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>GLONASS G2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>GLONASS G3</td>
</tr>
<tr>
<td></td>
<td>3-7</td>
<td>Reserved</td>
</tr>
<tr>
<td>Galileo</td>
<td>0</td>
<td>Galileo E1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Galileo E5A</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Galileo E5B</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Galileo E6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Galileo E5A + E5B</td>
</tr>
<tr>
<td></td>
<td>5-7</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

---

**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.

```asn1
GNSS-SignalIDs ::= SEQUENCE {
  gnss-SignalIDs  BIT STRING (SIZE(8)),
  ...}
```

---

**GNSS-SignalIDs field descriptions**

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* 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 $\text{gnssSignalIDs}$

<table>
<thead>
<tr>
<th>GNSS</th>
<th>Bit 1 (MSB)</th>
<th>Bit 2</th>
<th>Bit 3</th>
<th>Bit 4</th>
<th>Bit 5</th>
<th>Bit 6</th>
<th>Bit 7</th>
<th>Bit 8 (LSB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS</td>
<td>L1 C/A</td>
<td>L1C</td>
<td>L2C</td>
<td>L5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBAS</td>
<td>L1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QZSS</td>
<td>QZS-L1</td>
<td>QZS-L1C</td>
<td>QZS-L2C</td>
<td>QZS-L5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QZS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GLONASS</td>
<td>G1</td>
<td>G2</td>
<td>G3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galileo</td>
<td>E1</td>
<td>E5a</td>
<td>E5b</td>
<td>E6</td>
<td>E5a+E5b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SBAS-ID**

The IE $\text{SBAS-ID}$ is used to indicate a specific SBAS.

```
-- ASN1START
SBAS-ID ::= SEQUENCE {
    sbas-id    ENUMERATED { waas, egnos, msas, gagan, ...},
    ...}
-- ASN1STOP
```

**SBAS-IDs**

The IE $\text{SBAS-IDs}$ 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 $\text{SV-ID}$ is used to indicate a specific GNSS satellite. The interpretation of $\text{SV-ID}$ depends on the $\text{GNSS-ID}$.

```
-- 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 $\text{satellite-id}$ depends on the $\text{GNSS-ID}$ see the table below.
### Interpretation of satellite-id

<table>
<thead>
<tr>
<th>System</th>
<th>Value of satellite-id</th>
<th>Interpretation of satellite-id</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS</td>
<td>&quot;0&quot; – &quot;62&quot; &quot;63&quot;</td>
<td>Satellite PRN Signal No. 1 to 63 Reserved</td>
</tr>
<tr>
<td>SBAS</td>
<td>&quot;0&quot; – &quot;38&quot; &quot;39&quot; – &quot;63&quot;</td>
<td>Satellite PRN Signal No. 120 to 158 Reserved</td>
</tr>
<tr>
<td>QZSS</td>
<td>&quot;0&quot; – &quot;4&quot; &quot;5&quot; – &quot;63&quot;</td>
<td>Satellite PRN Signal No. 193 to 197 Reserved</td>
</tr>
<tr>
<td>GLONASS</td>
<td>&quot;0&quot; – &quot;23&quot; &quot;24&quot; – &quot;63&quot;</td>
<td>Slot Number 1 to 24 Reserved</td>
</tr>
<tr>
<td>Galileo</td>
<td>TBD</td>
<td>TBD</td>
</tr>
</tbody>
</table>

#### 6.5.3 Enhanced Cell ID Positioning

##### 6.5.3.1 E-CID Location Information

-- **ECID-ProvideLocationInformation**

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

```asn1
-- ASN1START
ECID-ProvideLocationInformation ::= SEQUENCE {
  ecid-SignalMeasurementInformation  ECID-SignalMeasurementInformation OPTIONAL,
  ecid-Error                        ECID-Error OPTIONAL,
  ...
}
-- ASN1STOP
```

##### 6.5.3.2 E-CID Location Information Elements

-- **ECID-SignalMeasurementInformation**

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

```asn1
-- ASN1START
ECID-SignalMeasurementInformation ::= SEQUENCE {
  primaryCellMeasuredResults MeasuredResultsElement OPTIONAL,
  measuredResultsList MeasuredResultsList,
  ...
}
MeasuredResultsList ::= SEQUENCE (SIZE(1..32)) OF MeasuredResultsElement

MeasuredResultsElement ::= SEQUENCE {
  physCellId INTEGER (0..503),
  cellGlobalId CellGlobalIdEUTRA-AndUTRA OPTIONAL,
  arfcnEUTRA ARFCN-ValueEUTRA,
  systemFrameNumber BIT STRING (SIZE (10)) OPTIONAL,
  rsrp-Result INTEGER (0..97) OPTIONAL,
  rsrq-Result INTEGER (0..34) OPTIONAL,
  ue-RxTxClearTimeDiff INTEGER (0..4095) OPTIONAL,
  ...
}
-- ASN1STOP
```

**ECID-SignalMeasurementInformation field descriptions**
### ECID-SignalMeasurementInformation field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>primaryCellMeasuredResults</td>
<td>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 the primary cell is reported in the measuredResultsList.</td>
</tr>
<tr>
<td>measuredResultsList</td>
<td>This list contains the E-CID measurements for up to 32 cells.</td>
</tr>
<tr>
<td>physCellId</td>
<td>This field specifies the physical cell identity of the measured cell.</td>
</tr>
<tr>
<td>cellGlobalId</td>
<td>This field specifies cell global ID of the measured cell. The target device shall provide this field if it was able to determine the ECGI of the measured cell at the time of measurement.</td>
</tr>
<tr>
<td>arfcnEUTRA</td>
<td>This field specifies the ARFCN of the measured E-UTRA carrier frequency, as defined in [12].</td>
</tr>
<tr>
<td>systemFrameNumber</td>
<td>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.</td>
</tr>
<tr>
<td>rsrp-Result</td>
<td>This field specifies the reference signal received power (RSRP) measurement, as defined in [12],[17].</td>
</tr>
<tr>
<td>rsrq-Result</td>
<td>This field specifies the reference signal received quality (RSRQ) measurement, as defined in [12],[17].</td>
</tr>
<tr>
<td>ue-RxTxTimeDiff</td>
<td>This field specifies the UE Rx–Tx time difference measurement, as defined in [17]. It is provided only for measurements on the UE’s primary cell. Measurement report mapping is according to 3GPP TS 36.133 [18].</td>
</tr>
</tbody>
</table>

#### 6.5.3.3 E-CID Location Information Request

- **ECID-RequestLocationInformation**

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

```asn1
ECID-RequestLocationInformation ::= SEQUENCE {
  requestedMeasurements  BIT STRING {  rsrpReq  (0),
                                        rsrqReq  (1),
                                        ueRxTxReq (2) } (SIZE(1..8)),
  ...
}
```

---

**ECID-RequestLocationInformation field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>requestedMeasurements</td>
<td>This field specifies the E-CID 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.</td>
</tr>
</tbody>
</table>

#### 6.5.3.4 E-CID Capability Information

- **ECID-ProvideCapabilities**

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

```asn1
ECID-ProvideCapabilities ::= SEQUENCE {
  ecid-MeasSupported  BIT STRING {  rsrpSup  (0),
                                     rsrqSup  (1),
                                     ueRxTxSup (2) } (SIZE(1..8)),
  ...
}
```

---

**ECID-ProvideCapabilities field descriptions**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ecid-MeasSupported</td>
<td>This field specifies the E-CID measurements supported. This is represented by a bit string, with a one-value at the bit position means the particular measurement is supported; a zero-value means not supported.</td>
</tr>
</tbody>
</table>
ECID-Provide-Capabilities field descriptions

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ecid-MeasSupported</td>
<td>This field specifies the E-CID measurements supported by the target device. This is represented by a bit string, with a one-value at the bit position means the particular measurement is supported; a zero-value means not supported. A zero-value in all bit positions in the bit string means only the basic Cell ID positioning method is supported by the target device.</td>
</tr>
<tr>
<td></td>
<td>If the UE Rx-Tx time difference measurement is supported by the target device (i.e., ueRxTxSup field is set to one), it means that the UE supports the UE Rx-Tx time difference measurement reporting via both LPP signaling and RRC signalling.</td>
</tr>
<tr>
<td></td>
<td>If a target device doesn’t support LPP, the E-SMLC may assume the target device can not report the UE Rx-Tx time difference measurement results via RRC signalling.</td>
</tr>
</tbody>
</table>

6.5.3.5 E-CID Capability Information Request

– ECID-RequestCapabilities

The IE ECID-RequestCapabilities is used by the location server to request E-CID positioning capabilities from a target device.

```asn1
ECID-RequestCapabilities ::= SEQUENCE {
  ...}
```

6.5.3.6 E-CID Error Elements

– ECID-Error

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

```asn1
ECID-Error ::= CHOICE {
  locationServerErrorCauses  ECID-LocationServerErrorCauses,
  targetDeviceErrorCauses   ECID-TargetDeviceErrorCauses,
  ...}
```

– ECID-LocationServerErrorCauses

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

```asn1
ECID-LocationServerErrorCauses ::= SEQUENCE {
  cause ENUMERATED { undefined,
                      ... },
  ...}
```
ECID-TargetDeviceErrorCauses

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

```
-- ASN1START

ECID-TargetDeviceErrorCauses ::= SEQUENCE {
    cause ENUMERATED {
        undefined,
        requestedMeasurementNotAvailable,
        notAllRequestedMeasurementsPossible,
        ...
    },
    rsrpMeasurementNotPossible NULL OPTIONAL,
    rsrqMeasurementNotPossible NULL OPTIONAL,
    ueRxTxMeasurementNotPossible NULL OPTIONAL,
    ...
}
-- ASN1STOP
```

**ECID-TargetDeviceErrorCauses field descriptions**

**cause**
This field provides a ECID specific error cause. If the cause value is "notAllRequestedMeasurementsPossible", the target device was not able to provide all requested ECID measurements (but may be able to provide some measurements). In this case, the target device should include any of the "rsrpMeasurementNotPossible", "rsrqMeasurementNotPossible", or "ueRxTxMeasurementNotPossible" fields, as applicable.

-- End of LPP-PDU-Definitions

```
-- ASN1START
END
-- ASN1STOP
```
Annex A (informative):
Change History
### Change history

<table>
<thead>
<tr>
<th>Date</th>
<th>TSG #</th>
<th>TSG Doc.</th>
<th>CR</th>
<th>Rev</th>
<th>Subject/Comment</th>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-10</td>
<td>RAN2</td>
<td>-#67bis</td>
<td>-</td>
<td>-</td>
<td>RAN2 agreed TS 36.355 v0.1.0</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>2009-11</td>
<td>RAN2</td>
<td>#68</td>
<td>-</td>
<td>-</td>
<td>RAN2 agreed TS 36.355 v2.0.0</td>
<td>0.1</td>
<td>2.0</td>
</tr>
<tr>
<td>2009-12</td>
<td>RP-46</td>
<td>RP-091208</td>
<td>-</td>
<td>-</td>
<td>RAN #46 approval of TS 36, 355</td>
<td>2.0</td>
<td>9.0</td>
</tr>
<tr>
<td>2010-03</td>
<td>RP-47</td>
<td>RP-103034</td>
<td>0001</td>
<td>-</td>
<td>Clarification on Position location</td>
<td>9.0</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>RP-47</td>
<td>RP-103034</td>
<td>0002</td>
<td>-</td>
<td>Clarification on UE Rx-Tx time difference supporting capability</td>
<td>9.0</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>RP-47</td>
<td>RP-103034</td>
<td>0003</td>
<td>2</td>
<td>Completion of LPP common material</td>
<td>9.0</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>RP-47</td>
<td>RP-103034</td>
<td>0004</td>
<td>5</td>
<td>Completion of OTDOA in LPP</td>
<td>9.0</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>RP-47</td>
<td>RP-103034</td>
<td>0006</td>
<td>-</td>
<td>Provision of Frame Drift Information in Network Time</td>
<td>9.0</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
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