ETSI TS 103 252 V1.1.1 (2015-06)

Satellite Earth Stations and Systems (SES);
Assisted GNSS logical channel for a broadcast system

Reference
DTS/SES-00363

Keywords
broadcast, GNSS, navigation, receiver, satellite

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Sous-Préfecture de Grasse (06) N° 7803/88

Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document contains the definition of the logical channel for Assisted-GNSS data broadcast, together with the reference architecture underlying the data broadcast mechanism. The protocol thus defined, called Broadcast Positioning Protocol (BPP), is used to broadcast GNSS assistance data to target device(s) through any radio network with Radio Broadcast Service capability.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 136 355: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP) [3GPP TS 36.355 V10.2.0 Release 10]".

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

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

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

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

[6] "Galileo OS Signal in Space ICD (OS SIS ICD)", Version 1, Galileo Joint Undertaking.

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

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

[9] RTCM-SC104 (V3.2): "RTCM Recommended Standards for Differential GNSS Service", February 2013.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EN 302 583 (V1.1.3): "Digital Video Broadcasting (DVB); Framing Structure, channel coding and modulation for Satellite Services to Handheld devices (SH) below 3 GHz".

[i.2] ETSI TS 102 470-2 (V1.2.1): "Digital Video Broadcasting (DVB); IP Datacast: Program Specific Information (PSI)/Service Information (SI); Part 2 : IP Datacast over DVB-SH".

[i.3] ETSI EN 302 755 (V1.3.1): "Digital Video Broadcasting (DVB); Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)".

[i.4] ETSI TS 136 331: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); "Radio Resource Control (RRC); Protocol specification [3GPP TS 36.331]".

[i.5] ETSI EN 302 307 V1.2.1: "Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications (DVB-S2)".

[i.6] ETSI TR 102 376: "Digital Video Broadcasting (DVB) User guidelines for the second generation system for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications (DVB-S2)".

3 Definitions and abbreviations

3.1 Definitions

For the purpose of the present document, the following terms and definitions apply.

location server: physical or logical entity that manages the navigation assistance data, and that provides these assistance data to the Target Device in order to help determine their position location

radio network (N/W): network through which the different assistance data will be carried to the Target Device

reference source: 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: device that requires assistance data to be positioned (e.g. UE, SUPL SET, other)

3.2 Abbreviations

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

A-GNSS	Assisted-GNSS
ASN	Abstract Syntax Notation
BIPM	International Bureau of Weights and Measures
BPP	Broadcast Positioning Protocol
CAN	Controller Area Network
CGC	Complementary ground Component
CNAV	Civil NAVigation
CRL	Communications Research Laboratories
DGNSS	Differential Global Navigation Satellite System
DN	Day Number
DTR	Digital Terrestrial Repeater (it can also be applied to Radio System Access Point)
DVB	Digital Video Broadcast
DVB-NGH	Digital Video Broadcast Next Generation Handheld
DVB-SH	Digital Video Broadcast Satellite to Handheld
DVB-T	Digital Video Broadcast Terrestrial
DVB-T2	Digital Video Broadcast Terrestrial of Second Generation
ECEF	Earth-Centered, Earth-Fixed
ECI	Earth-Centered-Inertial
EGNOS	European Geostationary Navigation Overlay Service
EOP	Earth Orientation Parameters
ETSI	European Telecommunications Standards Institute
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
FDMA	Frequency Division Multiple Access
FEC	Forward Error Correction
FTA	Fine Time Assistance
GAGAN	GPS Aided Geo Augmented Navigation
GLONASS	Global Navigation Satellite System

GMAR	GNSS Metering Association for Road user charging
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HOW	HandOver Word
ICD	Interface Control Document
IE	Information Element
IOD	Issue Of Data
IODC	Issue of Data Clock
IS	Interface Specification
ITS	Intelligent Transportation System
LPP	LTE Positioning Protocol
LS	Location Server
LSB	Least Significant Bit
MSAS	Multi-functional Satellite Augmentation System
MSB	Most Significant Bit
msd	mean solar day
MSD	Minimum Set of Data
NAV	Navigation
NGH	Next Generation Handheld
NICT	National Institute of Information and Communications Technology
NIST	National Institute of Standards and Technology
OFDM	Orthagonal Frequency Dvision Multiplexing
OS	Open Service
PDU	Protocol Data Unit
PER	Packet Error Rate
PRC	Pseudo-Range Correction
PRN	Pseudo Random Noise
PZ-90	Parametry Zemli 1990 Goda - Parameters of the Earth Year 1990
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase shift Keying
QZS	Quasi Zenith Satellite
QZSS	Quasi-Zenith Satellite System
QZST	Quasi-Zenith System Time
RF	Radio Frequency
RRC	Range-Rate Correction
RRC	Radio Resource Control
RU	Russia
SBAS	Space Based Augmentation System
SET	SUPL Enabled Terminal
SH	Satellite to Handheld
SHIP	SH Frame Information Packet
SUPL	Secure User Plane Location
SV	Space Vehicle
SV-ID	Space Vehicle IDentity
TD	Target Device
TDM	Time Division Multiplex
TLM	Telemetry
TOD	Time Of Day
TOW	Time Of Week
TPS	Transmission Parameter Signalling
UDRE	User Differential Range Error
USNO	US Naval Observatory
UT	User Terminal
UT1	Universal Time No.1
UTC	Coordinated Universal Time
WAAS	Wide Area Augmentation System
WGS-84	World Geodetic System 1984
WLAN	Wireless Local Area Network

4 Reference System Architecture

Figure 4.1 gives the reference system architecture corresponding to the BPP protocol.

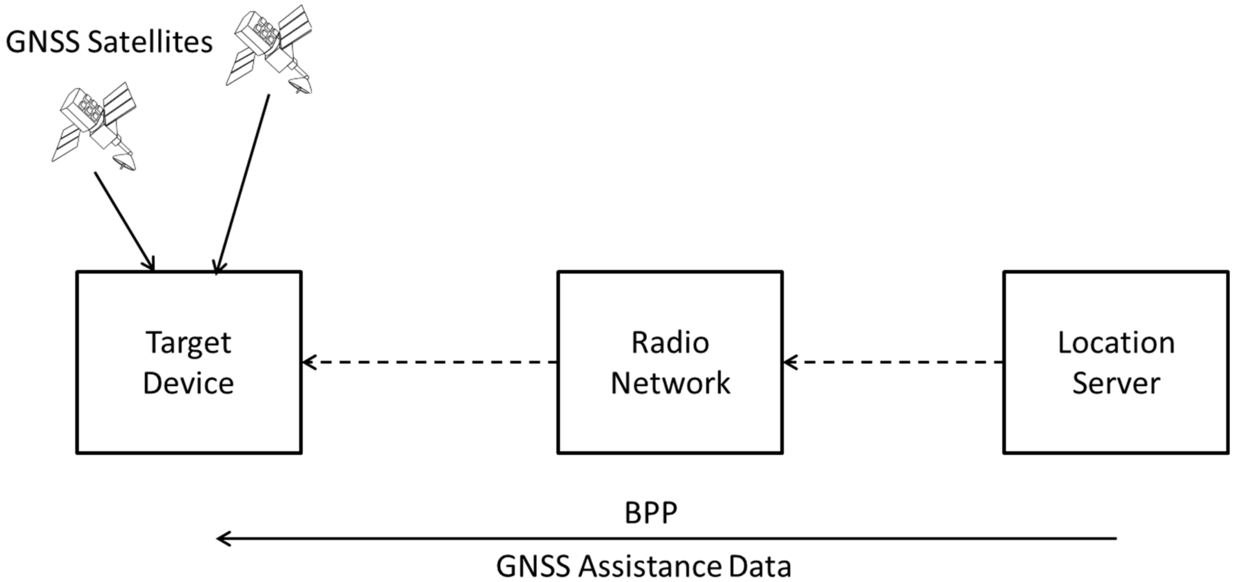


Figure 4.1: BPP System Reference Architecture

The system is composed of the following entities on one hand:

- The Radio Network, with broadcast Service Capability such as Broadcast Network, allowing the broadcast of the different flux (video, audio…) to the Target Device. This network can be (but not limited to) one of the following networks:
    - Satellite Broadcast network (example DVB-S2 based system).
    - Terrestrial link (Digital Terrestrial Repeaters, DTR), or Digital terrestrial Transmitters (DTT) also called Base Station.
    - Other radio networks like WLAN (with Access Points playing the role of DTT).
    - A hybrid network, composed of a satellite network, and a DTR network, called complimentary ground component (CGC).
- The Target Device, that will receive the Radio Network signals and the GNSS signals from the GNSS constellation. The Target Device can also have other functions.

On the other hand, the following entities:

- A GNSS constellation or many GNSS constellations that provide GNSS signals, which can be received by the Target Device (usually, a Target Device is designed for one constellation, for instance GPS, Galileo, GLONAS, Beidou).
- A Location Server, which can provide the different GNSS systems assistance data to the Target Device, using the DVB Broadcast Network as described in figure 4.1. The data can be multiplexed in the Broadcast Platform.

The arrow (GNSS Assistance Data) symbolizes the logical link between the Location Server and the Target Device. The physical path is the related radio N/W link.

As an example, the system can use the different possible Digital Video Broadcasting Network to provide the assistance channel. For instance DVB-S2, DVB-T2 and DVB-NGH networks could provide GNSS Assistance Data.

5 BPP Protocol description

5.1 BPP sessions

A BPP session is used between a Location Server and the target device in order to transfer assistance data from the Location Server to the Target Devices.

Each BPP session comprises one or more BPP transactions, with each BPP transaction performing a single operation: here it is limited to assistance data transfer. It can be constituted by the succession of different assistance data transfer.

The instigator of a BPP session will always instigate the first BPP transaction, but Location Sever is the only possible instigator. Messages within a transaction are linked by a common transaction identifier.

5.2 BPP Position Methods

Internal BPP positioning methods and associated signalling content are defined in the present document.

This version of the present document defines A-GNSS positioning method.

5.3 BPP Messages

Each BPP transaction involves the transfer of one or more BPP messages from the location server to the target device. The general format of a BPP 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 BPP message at a receiver

The following message types are defined:

- Provide Assistance Data;
- Abort; (when the procedure is stopped by the server): the server states the procedure is aborted;
- Error.

6 BPP Procedures

6.1 Introduction

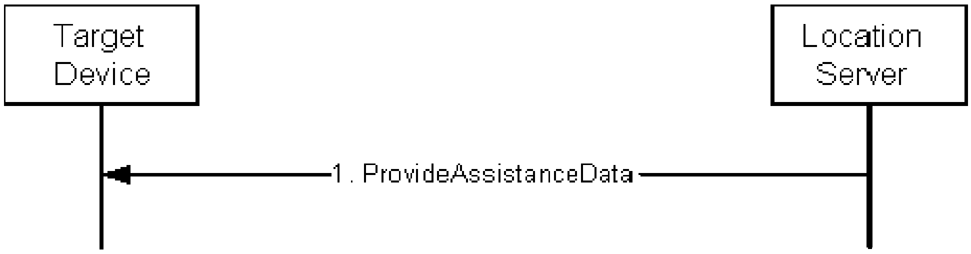
This clause provides the different classes of procedures used in BPP.

Compared to LPP procedures in ETSI TS 136 355 [1], the main procedure is the Assistance data delivery procedure.

6.2 Procedures related to Assistance Data Transfer

6.2.1 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 6.1.



NOTE: The server sends a *ProvideAssistanceData* message to the target containing assistance data. This message may set the *endTransaction* IE to TRUE.

Figure 6.1: BPP Assistance data transfer procedure

6.2.2 Reception of BPP Provide Assistance Data

Upon receiving a *ProvideAssistanceData* message, the target device shall:

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

6.3 Error Handling Procedures

6.3.1 General

This clause describes how the receiving entity (here the target device) behaves in cases when it receives erroneous or unexpected data or detects that certain data are missing.

6.3.2 BPP Error Detection

Upon receiving any BPP message, the target device shall attempt to decode the message and verify the presence of any errors prior to using the following procedure:

- if decoding errors are encountered:
    - if the receiver cannot determine that the received message is a BPP *Error* or *Abort* message:
        - discard the received message and stop the error detection procedure.
- if the message is a duplicate of a previously received message:
    - discard the message and stop the error detection procedure.
- if the *BPP-TransactionID* matches the *BPP-TransactionID* for a procedure that is still on-going for the same session and the message type is invalid for the current state of the procedure:
    - abort the on-going procedure:
        - discard the message and stop the error detection procedure.

6.3.3 Reception of an BPP Error Message

Upon receiving an *Error* message, the target device shall:

- abort any on-going procedure associated with the *LPP-TransactionID* if included in the received message.

The target device may:

- restart the aborted procedure taking into consideration the returned error information.

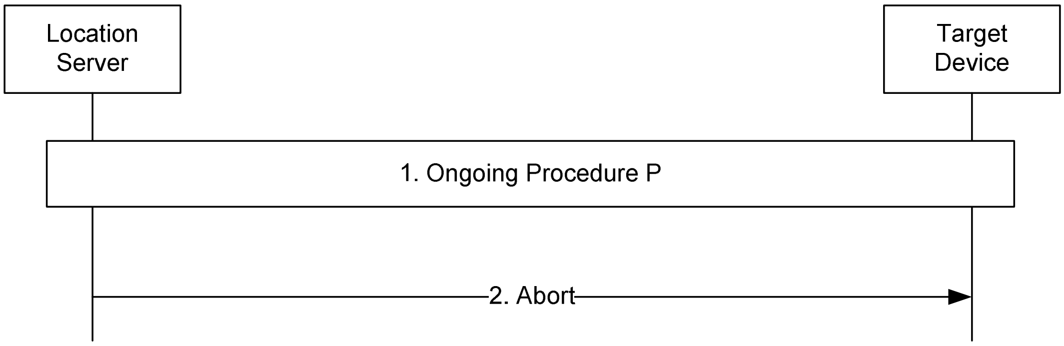
6.4 Abort Procedure

6.4.1 General

The purpose of the abort procedure is to allow the target device to abort any on-going procedure for instance due to some unexpected event (e.g. recognition of error in the data sent by the location server).

6.4.2 Procedures related to Abort

Figure 6.2 shows the Abort procedure.



NOTE 1: A procedure P is on-going between Location Server and Target Device.
NOTE 2: Location Server determines that the procedure shall be aborted and sends an *Abort* message to Target Device carrying the transaction ID for procedure P. Target Device aborts procedure P.

Figure 6.2: BPP Abort procedure

6.4.3 Reception of an BPP Abort Message

Upon receiving an *Abort* message, the Target Device shall:

- abort any on-going procedure associated with the transaction ID indicated in the message.

7 BPP Information Element description

7.1 Introduction

As the present document is derived from ETSI TS 136 355 [1], most of the messages are derived from the LPP protocol as in [1]. All the procedures involving a dialog have been removed, as not relevant in a Broadcast Radio Network.

The contents of each BPP message are specified in clause 7.2 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 ETSI TS 136 331 [i.4].

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 7.2.

To introduce the different Information Elements, and the evolution from LPP protocol, table 7.1 gives an overview of what has been derived from LPP, modified and eventually added for BPP.

An estimation of required bandwidth is provided in clause A.1.

Table 7.1: Information Elements Origin

Information Element (IE)	Unchanged IE from LPP	LPP Modified IE	BPP Specific IE
Message Body IE			
Provide Assistance Data		Yes	
Abort		Yes	
Error		Yes	
GNSS Assistance Data			
A-GNSS-provideAsssitanceData	Reference [1] applies		
GNSSCommonAssistData	Reference [1] applies		
GNSS-GenericAssistData	Reference [1] applies		
GNSS Assistance data Elements			
GNSS-ReferenceTime		Yes	
GNSS-SystemTime	Reference [1] applies		
GPS-TOW-Assist	Reference [1] applies		
NetworkTime		Yes	
GNSS-ReferenceLocation	Reference [1] applies		
GNSS-IonosphericModel	Reference [1] applies		
KlobucharModelParameter	Reference [1] applies		
NeQuickModelParameter	Reference [1] applies		
GNSS-EarthOrientationParameters	Reference [1] applies		
GNSS-TimeModelList	Reference [1] applies		
GNSS-DifferentialCorrections	Reference [1] applies		
GNSS-NavigationModel	Reference [1] applies		
StandardClockModelList	Reference [1] applies		
NAV-ClockModel	Reference [1] applies		
CNAV-ClockModel	Reference [1] applies		
GLONASS-ClockModel	Reference [1] applies		
SBAS-ClockModel	Reference [1] applies		
NavModelKeplerianSet	Reference [1] applies		
NavModelNAV-KeplerianSet	Reference [1] applies		
NavModelCNAV-KeplerianSet	Reference [1] applies		
NavModel-GLONASS-ECEF	Reference [1] applies		
NavModel-SBAS-ECEF	Reference [1] applies		
GNSS-RealTimeIntegrity	Reference [1] applies		
GNSS-DataBitAssistance	Reference [1] applies		
GNSS-AcquisitionAssistance	Reference [1] applies		
GNSS-Almanac	Reference [1] applies		
AlmanacKeplerianSet	Reference [1] applies		
AlmanacNAV-KeplerianSet	Reference [1] applies		
AlmanacReducedKeplerianSet	Reference [1] applies		
AlmanacMidiAlmanacSet	Reference [1] applies		
AlmanacGLONASS-AlmanacSet	Reference [1] applies		
AlmanacECEF-SBAS-AlmanacSet	Reference [1] applies		
GNSS-UTC-Model	Reference [1] applies		
UTC-ModelSet1	Reference [1] applies		
UTC-ModelSet2	Reference [1] applies		
UTC-ModelSet3	Reference [1] applies		
UTC-ModelSet4	Reference [1] applies		
GNSS-AuxiliaryInformation	Reference [1] applies		
Common GNSS Information Elements			
GNSS-ID	Reference [1] applies		
GNSS-SignalID	Reference [1] applies		
GNSS-SignalIDs	Reference [1] applies		
SBAS-IDs	Reference [1] applies		
SV-ID	Reference [1] applies		

Table 7.2: Meaning of abbreviations used to specify the need for information elements to be present

Abbreviation	Meaning
Cond *conditionTag*	*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 Device 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.
Need OP	*Optionally present* An information element that is optional to signal. For downlink messages, the UE 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 Device behaviour on absence should be captured either in the procedural text or in the field description.
Need ON	*Optionally present, No action* An information element that is optional to signal. If the message is received by the Target Device, and in case the information element is absent, the Target Device takes no action and where applicable shall continue to use the existing value (and/or the associated functionality).
Need OR	*Optionally present, Release* An information element that is optional to signal. If the message is received by the Target Device, and in case the information element is absent, the Target Device shall discontinue/ stop using/ delete any existing value (and/ or the associated functionality).

7.2 BPP PDU Structure

7.2.1 BPP-PDU-Definitions

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

```
-- ASN1START

BPP-PDU-Definitions {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) BPP (7) version1 (1) BPP-PDU-Definitions (1) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- ASN1STOP
```

7.2.2 BPP-Message

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

```
-- ASN1START

BPP-Message ::= SEQUENCE {
    transactionID           BPP-TransactionID   OPTIONAL,   -- Need ON
    endTransaction          BOOLEAN,
    sequenceNumber                  OPTIONAL,   -- Need ON
    BPP-MessageBody                 OPTIONAL    -- Need ON
}

SequenceNumber ::= INTEGER (0..255)

-- ASN1STOP
```

***BPP-Message* field descriptions**
sequenceNumber This field may be included when BPP operates over the control plane and a BPP-MessageBody is included but shall be omitted otherwise.
BPP-MessageBody This field may be omitted in case the message is sent only to acknowledge a previously received message. This case is not relevant for BPP, as there is no dialog.
transactionID This field is omitted if a BPP-MessageBody is not present (i.e. in an BPP message sent only to acknowledge a previously received message) or if it is not available to the transmitting entity (e.g. in an BPP-Error message triggered by a message that could not be parsed). If present, this field shall be ignored at a receiver in a BPP message for which the BPP-MessageBody is not present.
endTransaction This field indicates whether a BPP message is the last message carrying a BPP-MessageBody in a transaction (TRUE) or not last (FALSE).

7.2.3 BPP-MessageBody

The *BPP-MessageBody* identifies the type of a BPP message and contains all BPP information specifically associated with that type. The *BPP-MessageBody* is used in the positioning procedures defined in clause 6. Type of BPP message contained in the BPP-MessageBody depends of the positioning procedure, according to the following mapping:

- Message type "*provideAssistanceData*" for Assistance data delivery procedure
- Message type "*error*" for Error data handling procedure
- Message type "*abort*" for Abort procedure

```
-- ASN1START

BPP-MessageBody ::= CHOICE {
    c1                      CHOICE {
        provideAssistanceData       ProvideAssistanceData,
        abort                       Abort,
        error                       Error,
        spare7 NULL, spare6 NULL, spare5 NULL, spare4 NULL,
        spare3 NULL, spare2 NULL, spare1 NULL, spare0 NULL
    },
    messageClassExtension   SEQUENCE {}
}

-- ASN1STOP
```

7.2.4 BPP-TransactionID

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

```
-- ASN1START

BPP-TransactionID ::= SEQUENCE {
    initiator               Initiator,
    transactionNumber       ,
    ...
}

Initiator ::= ENUMERATED {
    locationServer,
    targetDevice,
    ...
}

TransactionNumber ::= INTEGER (0..255)

-- ASN1STOP
```

7.3 Message Body IEs

7.3.1 ProvideAssistanceData

The *ProvideAssistanceData* message body in a BPP message is used by the location server to provide assistance data to the target device in an unsolicited manner. (No possible dialog between the LS and the TD).

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

7.3.2 Abort

The *Abort* message body in a BPP message carries a request to abort an on-going BPP procedure.

```
-- ASN1START

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

Abort-r9-IEs ::= SEQUENCE {
    commonIEsAbort                  OPTIONAL,   -- Need ON
    ...,
    }

-- ASN1STOP
```

7.3.3 Error

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

```
-- ASN1START

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

Error-r9-IEs ::= SEQUENCE {
    commonIEsError                  OPTIONAL,   -- Need ON
    ...,
    }
```

```
-- ASN1STOP
```

7.4 A-GNSS Positioning

7.4.1 GNSS Assistance Data

7.4.1.1 A-GNSS-ProvideAssistanceData

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

```
-- ASN1START

A-GNSS-ProvideAssistanceData ::= SEQUENCE {
    gnss-CommonAssistData                                                   OPTIONAL,   -- Need ON
    gnss-GenericAssistData          GNSS-GenericAssistData              OPTIONAL,   -- Need ON
    gnss-Error                      A-GNSS-Error                        OPTIONAL,   -- Need ON
    ...
}

-- ASN1STOP
```

7.4.1.2 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.).

```
-- ASN1START

GNSS-CommonAssistData ::= SEQUENCE {
    gnss-ReferenceTime                  GNSS-ReferenceTime                  OPTIONAL,   -- Need ON
    gnss-ReferenceLocation              GNSS-ReferenceLocation              OPTIONAL,   -- Need ON
    gnss-IonosphericModel               GNSS-IonosphericModel               OPTIONAL,   -- Need ON
    gnss-EarthOrientationParameters GNSS-EarthOrientationParameters OPTIONAL,   -- Need ON
    ...
}

-- ASN1STOP
```

7.4.1.3 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.

```
-- ASN1START

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

GNSS-GenericAssistDataElement ::= SEQUENCE {
    gnss-ID                         GNSS-ID,
    sbas-ID                         SBAS-ID                         OPTIONAL, -- Cond GNSS-ID-SBAS
    gnss-TimeModels                 GNSS-TimeModelList              OPTIONAL,   -- Need ON
    gnss-DifferentialCorrections    GNSS-DifferentialCorrections    OPTIONAL,   -- Need ON
    gnss-NavigationModel            GNSS-NavigationModel            OPTIONAL,   -- Need ON
    gnss-RealTimeIntegrity          GNSS-RealTimeIntegrity          OPTIONAL,   -- Need ON
    gnss-DataBitAssistance          GNSS-DataBitAssistance          OPTIONAL,   -- Need ON
    gnss-AcquisitionAssistance      GNSS-AcquisitionAssistance  OPTIONAL,   -- Need ON
    gnss-Almanac                    GNSS-Almanac                    OPTIONAL,   -- Need ON
    gnss-UTC-Model                  GNSS-UTC-Model                  OPTIONAL,   -- Need ON
    gnss-AuxiliaryInformation       GNSS-AuxiliaryInformation       OPTIONAL,   -- Need ON
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
GNSS-ID-SBAS	The field is mandatory present if the *GNSS-ID* = *sbas*; otherwise it is not present.

7.4.2 GNSS Assistance Data Elements

7.4.2.1 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 DTR (or other Radio Access Point) and/or Satellite (in case of direct satellite link to the Target Device) 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 DTR and/or Satellite 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 DTR and/or Satellite 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.

NOTE: This IE can also be used in the case of a Broadcast Network with a cellular type topology.

```
-- 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),
    ...
}

-- ASN1STOP
```

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

***GNSS-ReferenceTime* field descriptions**
gnss-SystemTime This field provides the specific GNSS system time.
networkTime This field specifies the DTR network time at the epoch corresponding to *gnss-SystemTime.*

***GNSS-ReferenceTime* field descriptions**
referenceTimeUnc This field provides the accuracy of the relation between *gnssSystemTime* and *networkTime* time if IE *networkTime* is provided. When IE *networkTime* is not provided, this field can be included to provide the accuracy of the provided *gnssSystemTime*. If GNSS TOD is the given GNSS time, then the true GNSS time, corresponding to the provided network time as observed at the target device location, lies in the interval [GNSS TOD - *referenceTimeUnc*, GNSS TOD + *referenceTimeUnc*]. The uncertainty *r*, expressed in microseconds, is mapped to a number *K*, with the following formula: $r = C*(((1+x)^K)-1)$ with C = 0,5 and x = 0,14. To encode any higher value of uncertainty than that corresponding in the above formula to K=127, the same value, K=127, shall also be used. The uncertainty is then coded on 7 bits, as the binary encoding of K. Example values for the *referenceTimeUnc* Format: see table 7.3.

Table 7.3: K to uncertainty relation

Value of K	Value of uncertainty
0	0 nanoseconds
1	70 nanoseconds
2	149,8 nanoseconds
-	-
50	349,62 microseconds
-	-
127	≥ 8,43 seconds

7.4.2.2 GNSS-SystemTime

```
-- ASN1START

GNSS-SystemTime ::= SEQUENCE {
    gnss-TimeID                     GNSS-ID,
    gnss-DayNumber                  INTEGER (0..32767),
    gnss-TimeOfDay                  INTEGER (0..86399),
    gnss-TimeOfDayFrac-msec         INTEGER (0..999)        OPTIONAL,   -- Need ON
    notificationOfLeapSecond        BIT STRING (SIZE(2))    OPTIONAL,   -- Cond gnss-TimeID-glonass
    gps-TOW-Assist                  GPS-TOW-Assist          OPTIONAL,   -- Cond gnss-TimeID-gps
    ...
}

-- ASN1STOP
```

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

***GNSS-SystemTime* field descriptions**
gnss-TimeID This field specifies the GNSS for which the *GNSS-SystemTime* is provided.
gnss-DayNumber This field specifies the sequential number of days from the origin of the GNSS System Time as follows: GPS, QZSS, SBAS - Days from January 6th 1980 00:00:00 UTC(USNO); Galileo - Days from August 22nd 1999.00:00:00 UT. GLONASS - Days from January 1st 1996. 03:00:00 UTC (RU)
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 [7], 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.

7.4.2.3 GPS-TOW-Assist

```
-- ASN1START

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

GPS-TOW-AssistElement ::= SEQUENCE {
    satelliteID     INTEGER (1..64),
    tlmWord         INTEGER (0..16383),
    antiSpoof       INTEGER (0..1),
    alert           INTEGER (0..1),
    tlmRsvdBits     INTEGER (0..3),
    ...
}

-- ASN1STOP
```

***GPS-TOW-Assist* field descriptions**
satelliteID This field identifies the satellite for which the *GPS-TOW-Assist* is applicable. This field is identical to the GPS PRN Signal No. defined in [2].
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 [2].
antiSpoof This field contains the Anti-Spoof flag that is being broadcast by the GPS satellite identified by *satelliteID*, as defined in [2].
alert This field contains the Alert flag that is being broadcast by the GPS satellite identified by *satelliteID*, as defined in [2].
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].

7.4.2.4 NetworkTime

The Network Time, and how it is provide, is typically dependent on the used Radio Network: it gives examples of SH/NGH/T2, but can cover DVB-S2 as well, and other Radio Networks.

The IE described here will be different from the LPP, concerning the terms described, but it is the same kind of data.

```
-- ASN1START

NetworkTime ::= SEQUENCE {
    milisecondsFromFrameStructureStart              INTEGER(0..1000),(could be more than 1 s TBC)
    secondsFromFrameStructureStart                  INTEGER(0..127)
    fractionalSecondsFromFrameStructureStart    INTEGER(0..3999), (for milis)
                                                INTEGER (0..
    frameDrift                                  INTEGER (-64..63)   OPTIONAL,   -- Cond GNSSsynch
    cellID      CHOICE {
                DVB-SH      SEQUENCE {
                            Cell_id         INTEGER (0..255), in TPS bits
                            Cell_id_function  OPTIONAL, -- Need ON
                                cell_id_function(){
                                        function_tag            INTEGER (0..255)
                                        function_length         INTEGER (0..255)
                                        cell_id                 INTEGER (0..65535)
                                        wait_for_enable_flag    INTEGER (0..1)
                                        reserved_future_use     INTEGER (0..127)
                            frequency                           INTEGER (0..16777215)
        ...
                            },
                        SEQUENCE {
                            mode    CHOICE {
                DVB-T2 and NGH              SEQUENCE {
                                        Cell_id     INTEGER (0..65535),
                                        RF_IDX      INTEGER (0..7)
                                        Frequency   INTEGER (0..4294967295),

                            },
```

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

-- ASN1STOP
```

Conditional presence	Explanation
GNSSsynch	The field is present and set to 0 if *NetworkTime* is synchronized to *gnss-SystemTime*; otherwise the field is optionally present, need OR.

NOTE: In DVB-SH, the frames are time stamped, derived from GPS (GNSS in the future) pps. So are most of the DVB systems. Network time is synchronized to *gnss-SystemTime*. The synchronization time stamps occupy 24 bits in the SHIP.

<table>
<tr><th>*NetworkTime* field descriptions informative example</th></tr>
<tr><td>***milisecondsFromFrameStructureStart (feasible in DVB: SHframe/NGH Frame) applied or seconds FromFrameStructureStart*** *if T2 superframe is used*

The following text reflects examples in some existing structure) it is only for example and will be described in each relevant case

Case 1: DVB-SH
This field specifies the number of (mili)-seconds from the beginning of the longest frame structure in the corresponding air interface. (Frame length) In DVB, frame length is usually below 1 s.
In the case of DVB-SH, it corresponds to SH frame
• In QPSK, the SH frame length is 219,34 ms
• In 16 QAM, the SH frame length is half, 109,67 ms

(See note)
Case 2: DVB-T2
In case of DVB-T2, the maximum super frame length is 127,5 s and is composed of T2 frames of 250 ms.
The super frames should be the reference as complying with the definition, but T2 frame length is in the same order of magnitude as the SH frame length. It should be more logical to take it as the reference. Two cases are therefore provided

Case 3: DVB-NGH
As DVB-NGH will use the frame and signalling structure of the DVB-T2 system, (at least in its first release), the specifications are the same.
I
Case 4: DVB-S2
In DVB-S2, the frame synchronization can use the clock recovery algorithm specific to DVB-S2 and described in [i.5] and [i.6]</td></tr>
<tr><td>***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 idem*</td></tr>
<tr><td>***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.</td></tr>
<tr><td>***Cell_id***
This field specifies the bits used to identify the cell from which the signal comes from as defined in [i.1], [i.2] and [i.3]</td></tr>
<tr><td>**cell_id_function**
cell_id: The cell_id is used to uniquely identify the cell to which the transmitter belongs to.
wait_for_enable_flag: If this flag is set to "0" then the cell_id within the cell_id_function has to be inserted immediately. If this flag is set to "1" then the cell_id within the cell_id_function has to be inserted immediately after having received the corresponding enable_function.
reserved_future_use: 7 RFU bits.</td></tr>
<tr><td>***FREQUENCY*:** This 32-bit field indicates the centre frequency in Hz of the RF channel whose index is RF_IDX. [i.3]</td></tr>
<tr><td>***RF_IDX*:** This 3-bit field indicates the index of each FREQUENCY listed within this loop. The RF_IDX value is allocated a unique value between 0 and NUM_RF-1. [i.3]</td></tr>
<tr><td>NOTE: In some cases in OFDM, SH frame is not the longest frame. It can be a sub multiple of the OFDM super frame (2 or 4 SH frames per super frame). Nevertheless, as SH frames are time stamped, we keep using SH frame as the reference frame structure.
Moreover, in TDM, the SH frame length is aligned in time with OFDM SH frame.</td></tr>
</table>

7.4.2.5 GNSS-ReferenceLocation

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

```
-- ASN1START

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

-- ASN1STOP
```

7.4.2.6 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 [2], and the NeQuick model as defined in [6].

```
-- ASN1START

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

-- ASN1STOP
```

7.4.2.7 KlobucharModelParameter

```
-- ASN1START

KlobucharModelParameter ::= SEQUENCE {
    dataID          BIT STRING (SIZE (2)),
    alfa0           INTEGER (-128..127),
    alfa1           INTEGER (-128..127),
    alfa2           INTEGER (-128..127),
    alfa3           INTEGER (-128..127),
    beta0           INTEGER (-128..127),
    beta1           INTEGER (-128..127),
    beta2           INTEGER (-128..127),
    beta3           INTEGER (-128..127),
    ...
}

-- ASN1STOP
```

***KlobucharModelParamater* field descriptions**
dataID When *dataID* has the value '11' it indicates that the parameters have been generated by QZSS, and the parameters have been specialized and are applicable within the area defined in [5]. When dataID has the value '00' it indicates the parameters are applicable worldwide [2] and [5]. All other values for *dataID* are reserved.
alpha0 This field specifies the α_0 parameter of the Klobuchar model, as specified in [2]. Scale factor 2^{-30} seconds.
alpha1 This field specifies the α_1 parameter of the Klobuchar model, as specified in [2]. Scale factor 2^{-27} seconds/semi-circle.
alpha2 This field specifies the α_2 parameter of the Klobuchar model, as specified in [2]. Scale factor 2^{-24} seconds/semi-circle^2.
Alpha3 This field specifies the α_3 parameter of the Klobuchar model, as specified in [2]. Scale factor 2^{-24} seconds/semi-circle^3.

***KlobucharModelParamater* field descriptions**
Beta0 This field specifies the β_0 parameter of the Klobuchar model, as specified in [2]. Scale factor 2^{11} seconds.
beta1 This field specifies the β_1 parameter of the Klobuchar model, as specified in [2]. Scale factor 2^{14} seconds/semi-circle.
beta2 This field specifies the β_2 parameter of the Klobuchar model, as specified in [2]. Scale factor 2^{16} seconds/semi-circle^2.
Beta3 This field specifies the β_3 parameter of the Klobuchar model, as specified in [2]. Scale factor 2^{16} seconds/semi-circle^3.

7.4.2.8 NeQuickModelParameter

```
-- ASN1START

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
    ...
}

-- ASN1STOP
```

***NeQuickModelParameter* field descriptions**
ai0, ai1, ai2 These fields are used to estimate the ionospheric distortions on pseudoranges as described in [6], page 71.
ionoStormFlag1, ionoStormFlag2, ionoStormFlag3, ionoStormFlag4, ionoStormFlag5 These fields specify the ionosphere storm flags (1,…,5) for five different regions as described in [6], page 71. If the ionosphere storm flag for a region is not present the target device shall treat the ionosphere storm condition as unknown.

7.4.2.9 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 [2]. The IE *GNSS-EarthOrientationParameters* indicates the relationship between the Earth's rotational axis and WGS-84 reference system.

```
-- ASN1START

GNSS-EarthOrientationParameters ::= SEQUENCE {
    teop                INTEGER (0..65535),
    pmX                 INTEGER (-1048576..1048575),
    pmXdot              INTEGER (-16384..16383),
    pmY                 INTEGER (-1048576..1048575),
    pmYdot              INTEGER (-16384..16383),
    deltaUT1            INTEGER (-1073741824..1073741823),
    deltaUT1dot         INTEGER (-262144..262143),
    ...
}

-- ASN1STOP
```

***GNSS-EarthOrientationParameters* field descriptions**
teop This field specifies the EOP data reference time in seconds, as specified in [2]. Scale factor 2^4 seconds.

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

7.4.2.10 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.

```
-- ASN1START

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

GNSS-TimeModelElement ::= SEQUENCE {
    gnss-TimeModelRefTime       INTEGER (0..65535),
    tA0                         INTEGER (-67108864..67108863),
    tA1                         INTEGER (-4096..4095)                 OPTIONAL,   -- Need ON
    tA2                         INTEGER (-64..63)                     OPTIONAL,   -- Need ON
    gnss-TO-ID                  INTEGER (1..15),
    weekNumber                  INTEGER (0..8191)                     OPTIONAL,   -- Need ON
    deltaT                      INTEGER (-128..127)                   OPTIONAL,   -- Need ON
    ...
}

-- ASN1STOP
```

***GNSS-TimeModelElement* field descriptions**
gnss-TimeModelRefTime This field specifies the reference time of week for *GNSS-TimeModelElement* and it is given in GNSS specific system time. Scale factor 2^{4} seconds.
tA0 This field specifies the bias coefficient of the *GNSS-TimeModelElement*. Scale factor 2^{-35} seconds.
tA1 This field specifies the drift coefficient of the *GNSS-TimeModelElement.* Scale factor of 2^{-51} seconds/second.
tA2 This field specifies the drift rate correction coefficient of the *GNSS-TimeModelElement.* Scale factor of 2^{-68} seconds/second^{2}.
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 [2], [3] and [4]. See table 7.4.
weekNumber This field specifies the reference week of the *GNSS-TimeModelElement* given in GNSS specific system time. Scale factor 1 week.

GNSS-TimeModelElement **field descriptions**
deltaT This field specifies the integer number of seconds of the GNSS-GNSS time offset provided in the *GNSS-TimeModelElement.* Scale factor 1 second.

Table 7.4: gnss-TO-ID to Indication relation

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

7.4.2.11 GNSS-DifferentialCorrections

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

```
-- ASN1START

GNSS-DifferentialCorrections ::= SEQUENCE {
    dgnss-RefTime       INTEGER (0..3599),
    dgnss-SgnTypeList   DGNSS-SgnTypeList,
    ...
}

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

DGNSS-SgnTypeElement ::= SEQUENCE {
    gnss-SignalID        GNSS-SignalID,
    gnss-StatusHealth    INTEGER (0..7),
    dgnss-SatList        DGNSS-SatList,
    ...
}

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

DGNSS-CorrectionsElement ::= SEQUENCE {
    svID                SV-ID,
    iod                 BIT STRING (SIZE(11)),
    udre                INTEGER (0..3),
    pseudoRangeCor      INTEGER (-2047..2047),
    rangeRateCor        INTEGER (-127..127),
    udreGrowthRate      INTEGER (0..7)          OPTIONAL,   -- Need ON
    udreValidityTime    INTEGER (0..7)          OPTIONAL,   -- Need ON
    ...
}

-- ASN1STOP
```

GNSS-DifferentialCorrections **field descriptions**
dgnss-RefTime This field specifies the time for which the DGNSS corrections are valid, modulo 1 hour. *dgnss-RefTime* is given in GNSS specific system time. Scale factor 1-second.
dgnss-SgnTypeList This list includes differential correction data for different GNSS signal types, identified by *GNSS-SignalID*.
gnss-StatusHealth This field specifies the status of the differential corrections. The values of this field and their respective meanings are defined as in table 7.5. 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.

***GNSS-DifferentialCorrections* field descriptions**
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 table 7.6.
pseudoRangeCor This field specifies the correction to the pseudorange for the particular satellite at *dgnss-RefTime*, t_0. 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 [9]. If the location server has received a request for GNSS assistance data from a target device which included a request for the GNSS Navigation Model and DGNSS, the location server shall determine, for each satellite, if the navigation model stored by the target device is still suitable for use with DGNSS corrections and if so and if DGNSS corrections are supported the location server should send DGNSS corrections without including the GNSS Navigation Model. The *iod* value sent for a satellite shall always be the IOD value that corresponds to the navigation model for which the pseudo-range corrections are applicable. The target device shall only use the *pseudoRangeCor* value when the IOD value received matches its available navigation model. Pseudo-range corrections are provided with respect to GNSS specific geodetic datum (e.g. PZ-90.02 if *GNSS-ID* indicates GLONASS). Scale factor 0,32 meters.
rangeRateCor This field specifies the rate-of-change of the pseudorange correction for the particular satellite, using the satellite ephemeris and clock corrections identified by the *iod* field. The value of this field is given in meters per second and the resolution is 0,032 meters/sec in the range of ±4,064 meters/sec. For some time $t_1 > t_0$, the corrections for *iod* are estimated by $PRC(t_1, IOD) = PRC(t_0, IOD) + RRC(t_0,IOD)\cdot(t_1 - t_0)$, and the target device uses this to correct the pseudorange it measures at t_1, $PR_m(t_1,IOD)$, by $PR(t_1, IOD) = PR_m(t_1, IOD) + PRC(t_1, IOD)$. The location server shall always send the RRC value that corresponds to the PRC value that it sends. The target device shall only use the RRC value when the *iod* value received matches its available navigation model. Scale factor 0,032 meters/second.
udreGrowthRate This field provides an estimate of the growth rate of uncertainty (1-σ) in the corrections for the particular satellite identified by *SV-ID*. The estimated UDRE at time value specified in the *udreValidityTime* t_1 is calculated as follows: $UDRE(t_0+t_1) = UDRE(t_0) \times udreGrowthRate$, where t_0 is the DGNSS Reference Time *dgnss-RefTime* for which the corrections are valid, t_1 is the *udreValidityTime* field, UDRE(t_0) is the value of the *udre* field, and *udreGrowthRate* field is the factor as shown in the table Value of *udreGrowthRate* to Indication relation below.
udreValidityTime This field specifies the time when the *udreGrowthRate* field applies and is included if *udreGrowthRate* is included. The meaning of the values for this field is as shown in table 7.7.

Table 7.5: *gnss-StatusHealth* Value to Indication relation

gnss-StatusHealth* *Value	**Indication**
000	UDRE Scale Factor = 1,0
001	UDRE Scale Factor = 0,75
010	UDRE Scale Factor = 0,5
011	UDRE Scale Factor = 0,3
100	UDRE Scale Factor = 0,2
101	UDRE Scale Factor = 0,1
110	Reference Station Transmission Not Monitored
111	Data is invalid - disregard

Table 7.6: *udre Value* to Indication relation

udre Value	Indication
00	UDRE ≤ 1,0 m
01	1,0 m < UDRE ≤ 4,0 m
10	4,0 m < UDRE ≤ 8,0 m
11	8,0 m < UDRE

Table 7.7: Value of *udreGrowthRate* to Indication relation

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

Table 7.8: Value of *udreValidityTime* to Indication relation

Value of *udreValidityTime*	Indication [seconds]
000	20
001	40
010	80
011	160
100	320
101	640
110	1 280
111	2 560

7.4.2.12 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 [5].

```
-- 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-ClockModel ::= CHOICE {
    standardClockModelList  StandardClockModelList,         -- Model-1
```

```
    nav-ClockModel          NAV-ClockModel,                 -- Model-2
    cnav-ClockModel         CNAV-ClockModel,                -- Model-3
    glonass-ClockModel      GLONASS-ClockModel,             -- Model-4
    sbas-ClockModel         SBAS-ClockModel,                -- Model-5
    ...
}

GNSS-OrbitModel ::= CHOICE {
    keplerianSet            NavModelKeplerianSet,           -- Model-1
    nav-KeplerianSet        NavModelNAV-KeplerianSet,       -- Model-2
    cnav-KeplerianSet       NavModelCNAV-KeplerianSet,      -- Model-3
    glonass-ECEF            NavModel-GLONASS-ECEF,          -- Model-4
    sbas-ECEF               NavModel-SBAS-ECEF,             -- Model-5
    ...
}

-- ASN1STOP
```

***GNSS-NavigationModel* field descriptions**
nonBroadcastIndFlag This field indicates if the *GNSS-NavigationModel* elements are not derived from satellite broadcast data or are given in a format not native to the GNSS. A value of 0 means the *GNSS-NavigationModel* data elements correspond to GNSS satellite broadcasted data; a value of 1 means the *GNSS-NavigationModel* data elements are not derived from satellite broadcast.
gnss-SatelliteList This list provides ephemeris and clock corrections for GNSS satellites indicated by *SV-ID*.
svHealth This field specifies the satellite's current health. The health values are GNSS system specific. The interpretation of *svHealth* depends on the *GNSS-ID* and is as shown in table GNSS to svHealth Bit String(8) relation below.
iod This field specifies the Issue of Data and contains the identity for GNSS Navigation Model. In case of broadcasted GPS NAV ephemeris, the *iod* contains the IODC as described in [2]. In case of broadcasted Modernized GPS ephemeris, the *iod* contains the 11-bit parameter t_{oe} as defined in [4], table 30-I and [6], Table 3.5-1. In case of broadcasted SBAS ephemeris, the *iod* contains the 8 bits Issue of Data as defined in [8] Message Type 9. In case of broadcasted QZSS QZS-L1 ephemeris, the *iod* contains the IODC as described in [5]. In case of broadcasted QZSS QZS-L1C/L2C/L5 ephemeris, the *iod* contains the 11-bit parameter t_{oe} as defined in [5]. In case of broadcasted GLONASS ephemeris, the *iod* contains the parameter t_b as defined in [7]. In the case of broadcasted Galileo ephemeris, the *iod* contains the IOD index as described in [6]. The interpretation of *iod* depends on the *GNSS-ID* and is as shown in table 7.10.

Table 7.9: GNSS to svHealth Bit String(8) relation

GNSS	***svHealth* Bit String(8)**							
	Bit 1 (MSB)	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**	**Bit 8 (LSB)**
GPS L1/CA (see note 1)	SV Health [2]						'0' (reserved)	'0' (reserved)
Modernized GPS (see note 2)	L1C Health [4]	L1 Health [2] and [3]	L2 Health [2] and [3]	L5 Health [2] and [3]	'0' (reserved)	'0' (reserved)	'0' (reserved)	'0' (reserved)
SBAS (see note 3)	Ranging On(0),Off(1) [8]	Corrections On(0),Off(1) [8]	Integrity On(0),Off(1) [8]	'0' (reserved)	'0' (reserved)	'0' (reserved)	'0' (reserved)	'0' (reserved)
QZSS (see note 4) QZS-L1	SV Health [7]						'0' (reserved)	'0' (reserved)
QZSS (see note 5) QZS-L1C/L2C/L5	L1C Health [5]	L1 Health [5]	L2 Health [5]	L5 Health [5]	'0' (reserved)	'0' (reserved)	'0' (reserved)	'0' (reserved)
GLONASS	B_n (MSB) [7], page 30	F_T [7], table 4.4				'0' (reserved)	'0' (reserved)	'0' (reserved)

GNSS	***svHealth* Bit String(8)**							
	Bit 1 (MSB)	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**	**Bit 8 (LSB)**
Galileo [8], pages 75-76]	E5a Data Validity Status	E5b Data Validity Status	E1-B Data Validity Status	E5a Signal Health Status See [8], table 67		'0' (reserved)	'0' (reserved)	'0' (reserved)
NOTE 1: If *GNSS-ID* indicates 'gps', and GNSS Orbit Model-2 is included, this interpretation of *svHealth* applies. NOTE 2: If *GNSS-ID* indicates 'gps', and GNSS Orbit Model-3 is included, this interpretation of *svHealth* applies. If a certain signal is not supported on the satellite indicated by *SV-ID*, the corresponding health bit shall be set to '1' (i.e. signal cannot 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) [i.1]. 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.								

Table 7.10: GNSS to iod Bit String(11) relation

GNSS	***iod* Bit String(11)**										
	Bit 1 (MSB)	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**	**Bit 8**	**Bit 9**	**Bit 10**	**Bit 11 (LSB)**
GPS L1/CA	'0'	Issue of Data, Clock [2]									
Modernized GPS	t_{oe} (seconds, scale factor 300, range 0 - 604 500) [2], [3] and [4]										
SBAS	'0'	'0'	'0'	Issue of Data ([8], Message Type 9)							
QZSS QZS-L1	'0'	Issue of Data, Clock [5]									
QZSS QZS-L1C/L2C/L5	t_{oe} (seconds, scale factor 300, range 0 - 604 500) [5]										
GLONASS	'0'	'0'	'0'	'0'	t_b (minutes, scale factor 15, range 0 - 1 425) [7]						
Galileo	'0'	IOD [6]									

7.4.2.13 StandardClockModelList

```
-- ASN1START

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
    ...
}

-- ASN1STOP
```

***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 [6]. Scale factor 60 seconds.
stanClockAF2 Parameter af_2 defined in [6]. Scale factor 2^{-65} seconds/second^2.
stanClockAF1 Parameter af_1 defined in [6]. Scale factor 2^{-45} seconds/second.
stanClockAF0 Parameter af_0 defined in [6]. Scale factor 2^{-33} seconds.

***StandardClockModelList* field descriptions**
stanClockTgd Parameter T_{GD} defined in [6]. 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 7.11. This field is required if the location server includes both F/Nav and I/Nav Galileo clock models in *gnss-ClockModel.*

Table 7.11: Value of stanModelID to Identity relation

Value of *stanModelID*	Identity
0	I/Nav
1	F/Nav

7.4.2.14 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) [2] and [5] Scale factor 2^{4} seconds.
navaf2 Parameter a_{f2}, clock correction polynomial coefficient (sec/sec^2) [2] and [5] Scale factor 2^{-55} seconds/second^2.
Navaf1 Parameter a_{f1}, clock correction polynomial coefficient (sec/sec) [2] and [5]. Scale factor 2^{-43} seconds/second.
navaf0 Parameter a_{f0}, clock correction polynomial coefficient (seconds) [2] and [5]. Scale factor 2^{-31} seconds.
navTgd Parameter T_{GD}, group delay (seconds) [2] and [5]. Scale factor 2^{-31} seconds.

7.4.2.15 CNAV-ClockModel

```
-- ASN1START

CNAV-ClockModel ::= SEQUENCE {
    cnavToc         INTEGER (0..2015),
    cnavTop         INTEGER (0..2015),
    cnavURA0        INTEGER (-16..15),
    cnavURA1        INTEGER (0..7),
    cnavURA2        INTEGER (0..7),
    cnavAf2         INTEGER (-512..511),
    cnavAf1         INTEGER (-524288..524287),
    cnavAf0         INTEGER (-33554432..33554431),
    cnavTgd         INTEGER (-4096..4095),
    cnavISCl1cp     INTEGER (-4096..4095)           OPTIONAL,   -- Need ON
    cnavISCl1cd     INTEGER (-4096..4095)           OPTIONAL,   -- Need ON
    cnavISCl1ca     INTEGER (-4096..4095)           OPTIONAL,   -- Need ON
    cnavISCl2c      INTEGER (-4096..4095)           OPTIONAL,   -- Need ON
    cnavISCl5i5     INTEGER (-4096..4095)           OPTIONAL,   -- Need ON
```

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

-- ASN1STOP
```

***CNAV-ClockModel* field descriptions**
cnavToc Parameter t_{oc}, clock data reference time of week (seconds) [2], [3], [4] and [5]. Scale factor 300 seconds.
cnavTop Parameter t_{op}, clock data predict time of week (seconds) [2], [3], [4] and [5]. Scale factor 300 seconds
cnavURA0 Parameter URA_{oc} Index, SV clock accuracy index (dimensionless) [2], [3], [4] and [5].
cnavURA1 Parameter URA_{oc1} Index, SV clock accuracy change index (dimensionless) [2], [3], [4] and [5].
cnavURA2 Parameter URA_{oc2} Index, SV clock accuracy change rate index (dimensionless) [2], [3], [4] and [5].
cnavAf2 Parameter a_{f2-n}, SV clock drift rate correction coefficient (sec/sec^2) [2], [3], [4] and [5]. Scale factor 2^{-60} seconds/second^2.
cnavAf1 Parameter a_{f1-n}, SV clock drift correction coefficient (sec/sec) [2], [3], [4] and [5]. Scale factor 2^{-48} seconds/second.
cnavAf0 Parameter a_{f0-n}, SV clock bias correction coefficient (seconds) [2], [3], [4] and [5]. Scale factor 2^{-35} seconds.
cnavTgd Parameter T_{GD}, Group delay correction (seconds) [2], [3], [4] and [5]. Scale factor 2^{-35} seconds.
cnavISCl1cp Parameter ISC_{L1CP}, inter signal group delay correction (seconds) [4] and [5]. Scale factor 2^{-35} seconds. The location server includes this field if the target device is GPS capable and supports the $L1_C$ signal.
cnavISCl1cd Parameter ISC_{L1CD}, inter signal group delay correction (seconds) [4] and [5]. Scale factor 2^{-35} seconds. The location server includes this field if the target device is GPS capable and supports the $L1_C$ signal.
cnavISCl1ca Parameter $ISC_{L1C/A}$, inter signal group delay correction (seconds) [2], [3] and [5]. Scale factor 2^{-35} seconds. The location server includes this field if the target device is GPS capable and supports the $L1_{CA}$ signal.
cnavISCl2c Parameter ISC_{L2C}, inter signal group delay correction (seconds) [2], [3] and [5]. Scale factor 2^{-35} seconds. The location server includes this field if the target device is GPS capable and supports the $L2_C$ signal.
cnavISCl5i5 Parameter ISC_{L5I5}, inter signal group delay correction (seconds) [3] and [5]. Scale factor 2^{-35} seconds. The location server includes this field if the target device is GPS capable and supports the L5 signal.
cnavISCl5q5 Parameter ISC_{L5Q5}, inter signal group delay correction (seconds) [3] and [5]. Scale factor 2^{-35} seconds. The location server includes this field if the target device is GPS capable and supports the L5 signal.

7.4.2.16 GLONASS-ClockModel

```
-- ASN1START

GLONASS-ClockModel ::= SEQUENCE {
    gloTau          INTEGER (-2097152..2097151),
    gloGamma        INTEGER (-1024..1023),
    gloDeltaTau     INTEGER (-16..15)               OPTIONAL,   -- Need ON
    ...
}

-- ASN1STOP
```

***GLONASS-ClockModel* field descriptions**
gloTau Parameter $\tau_n(t_b)$, satellite clock offset (seconds) [7]. Scale factor 2^{-30} seconds.
gloGamma Parameter $\gamma_n(t_b)$, relative frequency offset from nominal value (dimensionless) [7]. Scale factor 2^{-40}.
gloDeltaTau Parameter $\Delta\tau_n$, time difference between transmission in G2 and G1 (seconds) [7]. Scale factor 2^{-30} seconds. The location server includes this parameter if the target device is dual frequency GLONASS receiver capable.

7.4.2.17 SBAS-ClockModel

```
-- ASN1START

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

-- ASN1STOP
```

***SBAS-ClockModel* field descriptions**
sbasTo Parameter t_0 [8]. Scale factor 16 seconds.
sbasAgfo Parameter a_{Gfo} [8]. Scale factor 2^{-31} seconds.
sbasAgf1 Parameter a_{Gf1} [8]. Scale factor 2^{-40} seconds/second.

7.4.2.18 NavModelKeplerianSet

```
-- ASN1START

NavModelKeplerianSet ::= SEQUENCE {
    keplerToe        INTEGER (0 .. 16383),
    keplerW          INTEGER (-2147483648..2147483647),
    keplerDeltaN     INTEGER (-32768..32767),
    keplerM0         INTEGER (-2147483648..2147483647),
    keplerOmegaDot   INTEGER (-8388608.. 8388607),
    keplerE          INTEGER (0..4294967295),
    keplerIDot       INTEGER (-8192..8191),
    keplerAPowerHalf INTEGER (0.. 4294967295),
    keplerI0         INTEGER (-2147483648..2147483647),
    keplerOmega0     INTEGER (-2147483648..2147483647),
    keplerCrs        INTEGER (-32768..32767),
    keplerCis        INTEGER (-32768..32767),
    keplerCus        INTEGER (-32768..32767),
    keplerCrc        INTEGER (-32768..32767),
```

```
    keplerCic         INTEGER (-32768..32767),
    keplerCuc         INTEGER (-32768..32767),
    ...
}

-- ASN1STOP
```

***NavModelKeplerianSet* field descriptions**
keplerToe Parameter t_{oe}, time-of-ephemeris in seconds [6]. Scale factor 60 seconds.
keplerW Parameter ω, argument of perigee (semi-circles) [6]. Scale factor 2^{-31} semi-circles.
keplerDeltaN Parameter Δn, mean motion difference from computed value (semi-circles/sec) [6]. Scale factor 2^{-43} semi-circles/second.
keplerM0 Parameter M_0, mean anomaly at reference time (semi-circles) [6]. Scale factor 2^{-31} semi-circles.
keplerOmegaDot Parameter OMEGAdot, longitude of ascending node of orbit plane at weekly epoch (semi-circles/sec) [6]. Scale factor 2^{-43} semi-circles/second.
keplerE Parameter e, eccentricity [6]. Scale factor 2^{-33}.
KeplerIDot Parameter Idot, rate of inclination angle (semi-circles/sec) [6]. Scale factor 2^{-43} semi-circles/second.
keplerAPowerHalf Parameter sqrtA, semi-major Axis in (meters) ^{½} [6]. Scale factor 2^{-19} meters ^{½} .
keplerI0 Parameter i_0, inclination angle at reference time (semi-circles) [6]. Scale factor 2^{-31} semi-circles.
keplerOmega0 Parameter $OMEGA_0$, longitude of ascending node of orbit plane at weekly epoch (semi-circles) [6]. Scale factor 2^{-31} semi-circles.
keplerCrs Parameter C_{rs}, amplitude of the sine harmonic correction term to the orbit radius (meters) [6]. Scale factor 2^{-5} meters.
keplerCis Parameter C_{is}, amplitude of the sine harmonic correction term to the angle of inclination (radians) [6]. Scale factor 2^{-29} radians.
keplerCus Parameter C_{us}, amplitude of the sine harmonic correction term to the argument of latitude (radians) [6]. Scale factor 2^{-29} radians.
keplerCrc Parameter C_{rc}, amplitude of the cosine harmonic correction term to the orbit radius (meters) [6]. Scale factor 2^{-5} meters.
keplerCic Parameter C_{ic}, amplitude of the cosine harmonic correction term to the angle of inclination (radians) [6]. Scale factor 2^{-29} radians.
keplerCuc Parameter C_{uc}, amplitude of the cosine harmonic correction term to the argument of latitude (radians) [6]. Scale factor 2^{-29} radians.

7.4.2.19 NavModelNAV-KeplerianSet

```
-- ASN1START

NavModelNAV-KeplerianSet ::= SEQUENCE {
    navURA          INTEGER (0..15),
    navFitFlag      INTEGER (0..1),
    navToe          INTEGER (0..37799),
    navOmega        INTEGER (-2147483648..2147483647),
    navDeltaN       INTEGER (-32768..32767),
    navM0           INTEGER (-2147483648..2147483647),
    navOmegaADot    INTEGER (-8388608..8388607),
    navE            INTEGER (0..4294967295),
    navIDot         INTEGER (-8192..8191),
    navAPowerHalf   INTEGER (0..4294967295),
    navI0           INTEGER (-2147483648..2147483647),
    navOmegaA0      INTEGER (-2147483648..2147483647),
    navCrs          INTEGER (-32768..32767),
    navCis          INTEGER (-32768..32767),
    navCus          INTEGER (-32768..32767),
    navCrc          INTEGER (-32768..32767),
    navCic          INTEGER (-32768..32767),
    navCuc          INTEGER (-32768..32767),
    addNAVparam     SEQUENCE {
        ephemCodeOnL2   INTEGER (0..3),
        ephemL2Pflag    INTEGER (0..1),
        ephemSF1Rsvd    SEQUENCE {
            reserved1       INTEGER (0..8388607),   -- 23-bit field
            reserved2       INTEGER (0..16777215),  -- 24-bit field
            reserved3       INTEGER (0..16777215),  -- 24-bit field
            reserved4       INTEGER (0..65535)      -- 16-bit field
        },
        ephemAODA       INTEGER (0..31)
    }   OPTIONAL,   -- Need ON
    ...
}

-- ASN1STOP
```

***NavModelNAV-KeplerianSet* field descriptions**
navURA Parameter URA Index, SV accuracy (dimensionless) [2] and [5].
navFitFlag Parameter Fit Interval Flag, fit interval indication (dimensionless) [2] and [5].
navToe Parameter t_{oe}, time of ephemeris (seconds) [2] and [5]. Scale factor 2^4 seconds.
navOmega Parameter ω, argument of perigee (semi-circles) [2] and [5]. Scale factor 2^{-31} semi-circles.
navDeltaN Parameter Δn, mean motion difference from computed value (semi-circles/sec) [2] and [5]. Scale factor 2^{-43} semi-circles/second.
navM0 Parameter M_0, mean anomaly at reference time (semi-circles) [2] and [5]. Scale factor 2^{-31} semi-circles.
navOmegaADot Parameter $\dot{\Omega}$, rate of right ascension (semi-circles/sec) [2] and [5]. Scale factor 2^{-43} semi-circles/second.
navE Parameter e, eccentricity (dimensionless) [2] and [5]. Scale factor 2^{-33}.
navIDot Parameter IDOT, rate of inclination angle (semi-circles/sec) [2] and [5]. Scale factor 2^{-43} semi-circles/second.
navAPowerHalf Parameter $\sqrt{A}$, square root of semi-major axis ($meters^{1/2}$) [2] and [5]. Scale factor 2^{-19} meters ^{½} .

***NavModelNAV-KeplerianSet* field descriptions**
navI0 Parameter i_0, inclination angle at reference time (semi-circles) [2] and [5]. Scale factor 2^{-31} semi-circles.
navOmegaA0 Parameter Ω_0, longitude of ascending node of orbit plane at weekly epoch (semi-circles) [2] and [5]. Scale factor 2^{-31} semi-circles.
navCrs Parameter C_{rs}, amplitude of sine harmonic correction term to the orbit radius (meters) [2] and [5]. Scale factor 2^{-5} meters.
navCis Parameter C_{is}, amplitude of sine harmonic correction term to the angle of inclination (radians) [2] and [5]. Scale factor 2^{-29} radians.
navCus Parameter C_{us}, amplitude of sine harmonic correction term to the argument of latitude (radians) [2] and [5]. Scale factor 2^{-29} radians.
navCrc Parameter C_{rc}, amplitude of cosine harmonic correction term to the orbit radius (meters) [2] and [5]. Scale factor 2^{-5} meters.
navCic Parameter C_{ic}, amplitude of cosine harmonic correction term to the angle of inclination (radians) [2] and [5]. Scale factor 2^{-29} radians.
navCuc Parameter C_{uc}, amplitude of cosine harmonic correction term to the argument of latitude (radians) [2] and [5]. Scale factor 2^{-29} radians.
addNAVparam These fields include data and reserved bits in the GPS NAV message [2],12. 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.*

7.4.2.20 NavModelCNAV-KeplerianSet

```
-- ASN1START

NavModelCNAV-KeplerianSet ::= SEQUENCE {
    cnavTop             INTEGER (0..2015),
    cnavURAindex        INTEGER (-16..15),
    cnavDeltaA          INTEGER (-33554432..33554431),
    cnavAdot            INTEGER (-16777216..16777215),
    cnavDeltaNo         INTEGER (-65536..65535),
    cnavDeltaNoDot      INTEGER (-4194304..4194303),
    cnavMo              INTEGER (-4294967296..4294967295),
    cnavE               INTEGER (0..8589934591),
    cnavOmega           INTEGER (-4294967296..4294967295),
    cnavOMEGA0          INTEGER (-4294967296..4294967295),
    cnavDeltaOmegaDot   INTEGER (-65536..65535),
    cnavIo              INTEGER (-4294967296..4294967295),
    cnavIoDot           INTEGER (-16384..16383),
    cnavCis             INTEGER (-32768..32767),
    cnavCic             INTEGER (-32768..32767),
    cnavCrs             INTEGER (-8388608..8388607),
    cnavCrc             INTEGER (-8388608..8388607),
    cnavCus             INTEGER (-1048576..1048575),
    cnavCuc             INTEGER (-1048576..1048575),
    ...
}

-- ASN1STOP
```

***NavModelCNAV-KeplerianSet* field descriptions**
cnavTop Parameter t_{op}, data predict time of week (seconds) [2], [3], [4] and [5]. Scale factor 300 seconds.
cnavURAindex Parameter URA_{oe} Index, SV accuracy (dimensionless) [2], [3], [4] and [5].

***NavModelCNAV-KeplerianSet* field descriptions**
cnavDeltaA Parameter ΔA, semi-major axis difference at reference time (meters) [2], [3], [4] and [5]. Scale factor 2^{-9} meters.
cnavAdot Parameter $\dot{A}$, change rate in semi-major axis (meters/sec) [2], [3], [4] and [5]. Scale factor 2^{-21} meters/sec.
cnavDeltaNo Parameter Δn_0, mean motion difference from computed value at reference time (semi-circles/sec) [2], [3], [4] and [5]. Scale factor 2^{-44} semi-circles/second.
cnavDeltaNoDot Parameter $\Delta \dot{n}_0$, rate of mean motion difference from computed value (semi-circles/sec^2) [2], [3], [4] and [5]. Scale factor 2^{-57} semi-circles/second^2.
cnavMo Parameter M_{0-n}, mean anomaly at reference time (semi-circles) [2], [3], [4] and [5]. Scale factor 2^{-32} semi-circles.
cnavE Parameter e_n, eccentricity (dimensionless) [2], [3], [4] and [5]. Scale factor 2^{-34}.
cnavOmega Parameter ω_n, argument of perigee (semi-circles) [2], [3], [4] and [5]. Scale factor 2^{-32} semi-circles.
cnavOMEGA0 Parameter Ω_{0-n}, reference right ascension angle (semi-circles) [2], [3], [4] and [5]. Scale factor 2^{-32} semi-circles.
cnavDeltaOmegaDot Parameter $\Delta\dot{\Omega}$, rate of right ascension difference (semi-circles/sec) [2], [3], [4] and [5]. Scale factor 2^{-44} semi-circles/second.
cnavIo Parameter i_{o-n}, inclination angle at reference time (semi-circles) [2], [3], [4] and [5]. Scale factor 2^{-32} semi-circles.
cnavIoDot Parameter I_{0-n}-DOT, rate of inclination angle (semi-circles/sec) [2], [3], [4] and [5]. Scale factor 2^{-44} semi-circles/second..
cnavCis Parameter C_{is-n}, amplitude of sine harmonic correction term to the angle of inclination (radians) [2], [3], [4] and [5]. Scale factor 2^{-30} radians.
cnavCic Parameter C_{ic-n}, amplitude of cosine harmonic correction term to the angle of inclination (radians) [2], [3], [4] and [5]. Scale factor 2^{-30} radians.
cnavCrs Parameter C_{rs-n}, amplitude of sine harmonic correction term to the orbit radius (meters) [2], [3], [4] and [5]. Scale factor 2^{-8} meters.
cnavCrc Parameter C_{rc-n}, amplitude of cosine harmonic correction term to the orbit radius (meters) [2], [3], [4] and [5]. Scale factor 2^{-8} meters.
cnavCus Parameter C_{us-n}, amplitude of the sine harmonic correction term to the argument of latitude (radians) [2], [3], [4] and [5]. Scale factor 2^{-30} radians.
cnavCuc Parameter C_{uc-n}, amplitude of cosine harmonic correction term to the argument of latitude (radians) [2], [3], [4] and [5]. Scale factor 2^{-30} radians.

7.4.2.21 NavModel-GLONASS-ECEF

```
-- ASN1START

NavModel-GLONASS-ECEF ::= SEQUENCE {
    gloEn               INTEGER (0..31),
    gloP1               BIT STRING (SIZE(2)),
    gloP2               BOOLEAN,
    gloM                INTEGER (0..3),
    gloX                INTEGER (-67108864..67108863),
    gloXdot             INTEGER (-8388608..8388607),
    gloXdotdot          INTEGER (-16..15),
    gloY                INTEGER (-67108864..67108863),
    gloYdot             INTEGER (-8388608..8388607),
    gloYdotdot          INTEGER (-16..15),
    gloZ                INTEGER (-67108864..67108863),
    gloZdot             INTEGER (-8388608..8388607),
    gloZdotdot          INTEGER (-16..15),
    ...
}

-- ASN1STOP
```

***NavModel-GLONASS-ECEF* field descriptions**
gloEn Parameter E_n, age of data (days) [7]. Scale factor 1 days.
gloP1 Parameter P1, time interval between two adjacent values of t_b (minutes) [7].
gloP2 Parameter P2, change of t_b flag (dimensionless) [7].
gloM Parameter M, type of satellite (dimensionless) [7].
gloX Parameter $x_n(t_b)$, x-coordinate of satellite at time t_b (kilometers) [7]. Scale factor 2^{-11} kilometers.
gloXdot Parameter $\dot{x}_n(t_b)$, x-coordinate of satellite velocity at time t_b (kilometers/sec) [7]. Scale factor 2^{-20} kilometers/second.
gloXdotdot Parameter $\ddot{x}_n(t_b)$, x-coordinate of satellite acceleration at time t_b (kilometers/sec^2) [7]. Scale factor 2^{-30} kilometers/second^2.
gloY Parameter $y_n(t_b)$, y-coordinate of satellite at time t_b (kilometers) [7]. Scale factor 2^{-11} kilometers.
gloYdot Parameter $\dot{y}_n(t_b)$, y-coordinate of satellite velocity at time t_b (kilometers/sec) [7]. Scale factor 2^{-20} kilometers/second.
gloYdotdot Parameter $\ddot{y}_n(t_b)$, y-coordinate of satellite acceleration at time t_b (kilometers/sec^2) [7]. Scale factor 2^{-30} kilometers/second^2.
gloZ Parameter $z_n(t_b)$, z-coordinate of satellite at time t_b (kilometers) [7]. Scale factor 2^{-11} kilometers.
gloZdot Parameter $\dot{z}_n(t_b)$, z-coordinate of satellite velocity at time t_b (kilometers/sec) [7]. Scale factor 2^{-20} kilometers/second.
gloZdotdot Parameter $\ddot{z}_n(t_b)$, z-coordinate of satellite acceleration at time t_b (kilometers/sec^2) [7]. Scale factor 2^{-30} kilometers/second^2.

7.4.2.22 NavModel-SBAS-ECEF

```
-- ASN1START

NavModel-SBAS-ECEF ::= SEQUENCE {
    sbasTo              INTEGER (0..5399)                   OPTIONAL,   -- Cond ClockModel
    sbasAccuracy        BIT STRING (SIZE(4)),
    sbasXg              INTEGER (-536870912..536870911),
    sbasYg              INTEGER (-536870912..536870911),
    sbasZg              INTEGER (-16777216..16777215),
    sbasXgDot           INTEGER (-65536..65535),
    sbasYgDot           INTEGER (-65536..65535),
    sbasZgDot           INTEGER (-131072..131071),
    sbasXgDotDot        INTEGER (-512..511),
    sbagYgDotDot        INTEGER (-512..511),
    sbasZgDotDot        INTEGER (-512..511),
    ...
}

-- ASN1STOP
```

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

***NavModel-SBAS-ECEF* field descriptions**
sbasTo   Parameter t_0, time of applicability (seconds) [8].   Scale factor 16 seconds.
sbasAccuracy   Parameter Accuracy, (dimensionless) [8].
sbasXg   Parameter X_G, (meters) [8].   Scale factor 0,08 meters.
sbasYg   Parameter Y_G, (meters) [8].   Scale factor 0,08 meters.
sbasZg   Parameter Z_G, (meters) [8].   Scale factor 0,4 meters.
sbasXgDot   Parameter X_G , Rate-of-Change, (meters/sec) [8].   Scale factor 0,000625 meters/second.
sbasYgDot   Parameter Y_G , Rate-of-Change, (meters/sec) [8]   Scale factor 0,000625 meters/second.
sbasZgDot   Parameter Z_G , Rate-of-Change, (meters/sec) [8].   Scale factor 0,004 meters/second.
sbasXgDotDot   Parameter X_G , Acceleration, (meters/sec^2) [8].   Scale factor 0,0000125 meters/second^2.
sbagYgDotDot   Parameter Y_G , Acceleration, (meters/sec^2) [8].   Scale factor 0,0000125 meters/second^2.
sbasZgDotDot   Parameter Z_G Acceleration, (meters/sec^2) [8].   Scale factor 0,0000625 meters/second^2.

7.4.2.23 GNSS-RealTimeIntegrity

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

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

```
-- ASN1START

GNSS-RealTimeIntegrity ::= SEQUENCE {
    gnss-BadSignalList  GNSS-BadSignalList,
    ...
}

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

BadSignalElement ::= SEQUENCE {
    badSVID             SV-ID,
    badSignalID         GNSS-SignalIDs  OPTIONAL,   -- Need OP
    ...
}

-- ASN1STOP
```

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

7.4.2.24 GNSS-DataBitAssistance

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

```
-- ASN1START

GNSS-DataBitAssistance ::= SEQUENCE {
    gnss-TOD                INTEGER (0..3599),
    gnss-TODfrac            INTEGER (0..999)        OPTIONAL,   -- Need ON
    gnss-DataBitsSatList    GNSS-DataBitsSatList,
    ...
}

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

GNSS-DataBitsSatElement ::= SEQUENCE {
    svID                    SV-ID,
    gnss-DataBitsSgnList    GNSS-DataBitsSgnList,
    ...
}

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

GNSS-DataBitsSgnElement ::= SEQUENCE {
    gnss-SignalType         GNSS-SignalID,
    gnss-DataBits           BIT STRING (SIZE (1..1024)),
    ...
}

-- ASN1STOP
```

***GNSS-DataBitAssistance* field descriptions**
gnss-TOD This field specifies the reference time of the first bit of the data in *GNSS-DataBitAssistance* in integer seconds in GNSS specific system time, modulo 1 hour. Scale factor 1 second.
gnss-TODfrac This field specifies the fractional part of the *gnss-TOD* in 1-milli-second resolution. Scale factor 1 millisecond. The total GNSS TOD is *gnss-TOD + gnss-TODfrac.*
gnss-DataBitsSatList This list specifies the data bits for a particular GNSS satellite *SV-ID* and signal *GNSS-SignalID*.
svID This field specifies the GNSS *SV-ID* of the satellite for which the *GNSS-DataBitAssistance* is given.
gnss-SignalType This field identifies the GNSS signal type of the *GNSS-DataBitAssistance.*
gnss-DataBits Data bits are contained in GNSS system and data type specific format. In case of GPS L1 C/A, it contains the NAV data modulation bits as defined in [2] . In case of Modernized GPS L1C, it contains the encoded and interleaved modulation symbols as defined in [4], 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 [2], Table 3-III]. In case of Modernized GPS L5, it contains the FEC encoded CNAV data modulation symbols as defined in [3]. In case of SBAS, it contains the FEC encoded data modulation symbols as defined in [8]. In case of QZSS QZS-L1, it contains the NAV data modulation bits as defined in [5], section 5.2. In case of QZSS QZS-L1C, it contains the encoded and interleaved modulation symbols as defined in [5], section 5.3. In case of QZSS QZS-L2C, it contains the encoded modulation symbols as defined in [5], section 5.5. In case of QZSS QZS-L5, it contains the encoded modulation symbols as defined in [5], section 5.6. In case of GLONASS, it contains the 100 sps differentially Manchester encoded modulation symbols as defined in [7], 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.

7.4.2.25 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 7.1 illustrates the relation between some of the fields, using GPS TOW as exemplary reference.

```
-- ASN1START

GNSS-AcquisitionAssistance ::= SEQUENCE {
    gnss-SignalID               GNSS-SignalID,
    gnss-AcquisitionAssistList  ,
    ...
}

GNSS-AcquisitionAssistList ::= 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
}

-- ASN1STOP
```

***GNSS-AcquisitionAssistance* field descriptions**
gnss-SignalID This field specifies the GNSS signal for which the acquisition assistance are provided.
gnss-AcquisitionAssistList These fields provide a list of acquisition assistance data for each GNSS satellite.
svID This field specifies the GNSS *SV-ID* of the satellite for which the *GNSS-AcquisitionAssistance* is given.
doppler0 This field specifies the Doppler (0^{th} 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 -1 024 m/s to +1 023,5 m/s.
doppler1 This field specifies the Doppler (1^{st} 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/s^2 in the range from -0,2 m/s^2 to +0,1 m/s^2.
dopplerUncertainty This field specifies the Doppler uncertainty value. It is defined such that the Doppler experienced by a stationary target device is in the range [Doppler−Doppler Uncertainty] to [Doppler+Doppler Uncertainty]. Doppler Uncertainty is given in unit of m/s by multiplying the Doppler Uncertainty value in Hz by the nominal wavelength of the assisted signal. Defined values: 2,5 m/s, 5 m/s, 10 m/s, 20 m/s, 40 m/s as encoded by an integer *n* in the range 0-4 according to: $2^{-n}(40)$ m/s; n = 0 - 4.
codePhase This field together with the *codePhase1023* field specifies the code phase, in units of milli-seconds, in the range from 0 to 1 millisecond scaled by the nominal chipping rate of the GNSS signal, where increasing values of the field signify increasing predicted signal code phases, as seen by a receiver at the reference location at the reference time. The reference location would typically be an apriori estimate of the target device location. Scale factor 2^{-10} ms in the range from 0 to $(1-2^{-10})$ ms. (See note)
intCodePhase 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.
codePhaseSearchWindow This field contains the code phase search window. The code phase search window accounts for the uncertainty in the estimated target device location but not any uncertainty in reference time. It is defined such that the expected code phase is in the range [Code Phase−Code Phase Search Window] to [Code Phase+Code Phase Search Window] given in units of milli-seconds. Range 0-31, mapping according to the table 7.12.
azimuth This field specifies the azimuth angle. An angle of x degrees means the satellite azimuth a is in the range ($x \le a < x+0,703125$) degrees. Scale factor 0,703125 degrees.
elevation This field specifies the elevation angle. An angle of y degrees means the satellite elevation e is in the range ($y \le e < y+0,703125$) degrees. Scale factor 0,703125 degrees.
codePhase1023 This field if set to TRUE indicates that the code phase has the value 1 023 × 2^{-10} = $(1-2^{-10})$ ms. This field may only be set to TRUE if the value provided in the *codePhase* IE is 1 022. If this field is set to FALSE, the code phase is the value provided in the *codePhase* IE in the range from 0 to $(1 - 2\times2^{-10})$ ms. If this field is not present and the *codePhase* IE has the value 1 022, the Target Device may assume that the code phase is between $(1 - 2\times2^{-10})$ and $(1 - 2^{-10})$ ms.
NOTE: The value $(1-2^{-10})$ ms is encoded using the *codePhase1023* IE.

Table 7.12: codePhaseSearchWindow Value to Interpretation Code Phase Search Window [ms] relation

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

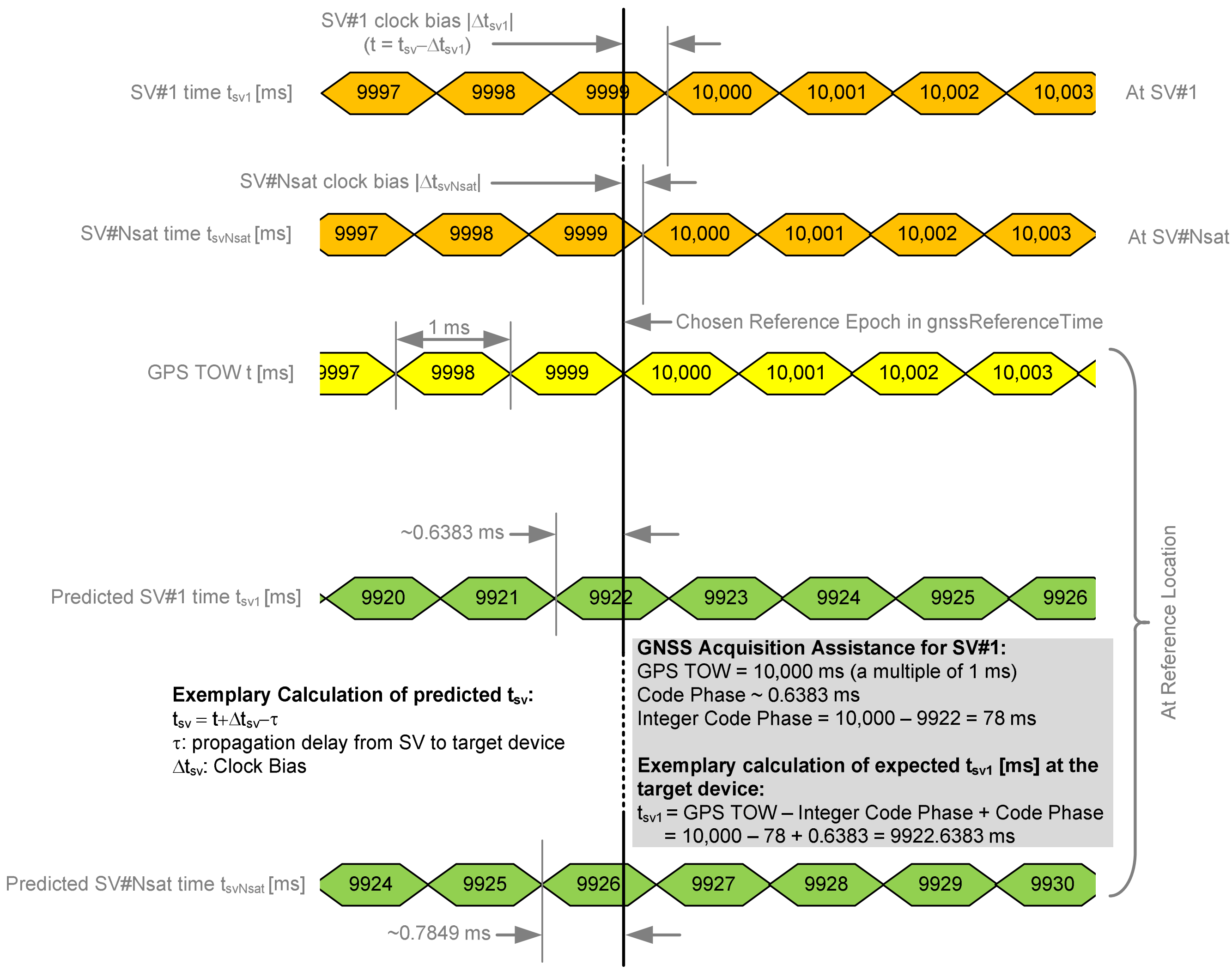


Figure 7.1: Exemplary calculation of some GNSS Acquisition Assistance fields

7.4.2.26 GNSS-Almanac

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

```
-- ASN1START

GNSS-Almanac ::= SEQUENCE {
    weekNumber                  INTEGER (0..255)    OPTIONAL,   -- Need ON
    toa                         INTEGER (0..255)    OPTIONAL,   -- Need ON
    ioda                        INTEGER (0..3)      OPTIONAL,   -- Need ON
    completeAlmanacProvided     BOOLEAN,
    gnss-AlmanacList            ,
    ...
}

GNSS-AlmanacList ::= 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**
weekNumber This field specifies the almanac reference week number in GNSS specific system time to which the almanac reference time *toa* is referenced, modulo 256 weeks. This field is required for non-GLONASS GNSS.
toa 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.
ioda This field specifies the issue of data. This field is required for Galileo GNSS.
completeAlmanacProvided If set to TRUE, the *gnss-AlmanacList* contains almanacs for the complete GNSS constellation indicated by *GNSS-ID*.
gnss-AlmanacList This list contains the almanac model for each GNSS satellite in the GNSS constellation.

7.4.2.27 AlmanacKeplerianSet

```
-- ASN1START

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),
    kepAlmanacM0            INTEGER (-32768..32767),
    kepAlmanacAF0           INTEGER (-8192..8191),
    kepAlmanacAF1           INTEGER (-1024..1023),
    ...
}

-- ASN1STOP
```

***AlmanacKeplerianSet* field descriptions**
svID This field identifies the satellite for which the GNSS Almanac Model is given.
kepAlmanacE Parameter e, eccentricity, dimensionless [6]. Scale factor 2^{-16}.
kepAlmanacDeltaI Parameter δi, semi-circles [6]. Scale factor 2^{-14} semi-circles.
kepAlmanacOmegaDot Parameter OMEGADOT, longitude of ascending node of orbit plane at weekly epoch (semi-circles/sec) [6]. Scale factor 2^{-33} semi-circles/seconds.
kepSVHealth 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 [6].
kepAlmanacAPowerHalf Parameter delta $A^{1/2}$, Semi-Major Axis delta (meters) $^{1/2}$ [6]. Scale factor 2^{-9} meters $^{1/2}$.
kepAlmanacOmega0 Parameter $OMEGA_0$, longitude of ascending node of orbit plane at weekly epoch (semi-circles) [6]. Scale factor 2^{-15} semi-circles.
kepAlmanacW Parameter ω, argument of perigee (semi-circles) [6]. Scale factor 2^{-15} semi-circles.

***AlmanacKeplerianSet* field descriptions**
kepAlmanacM0 Parameter M_0, mean anomaly at reference time (semi-circles) [6]. Scale factor 2^{-15} semi-circles.
kepAlmanacAF0 Parameter af_0, seconds [6]. Scale factor 2^{-19} seconds.
kepAlmanacAF1 Parameter af_1, sec/sec [6]. Scale factor 2^{-38} seconds/second.

7.4.2.28 AlmanacNAV-KeplerianSet

```
-- ASN1START

AlmanacNAV-KeplerianSet ::= SEQUENCE {
    svID                    SV-ID,
    navAlmE                 INTEGER (0..65535),
    navAlmDeltaI            INTEGER (-32768..32767),
    navAlmOMEGADOT          INTEGER (-32768..32767),
    navAlmSVHealth          INTEGER (0..255),
    navAlmSqrtA             INTEGER (0..16777215),
    navAlmOMEGAo            INTEGER (-8388608..8388607),
    navAlmOmega             INTEGER (-8388608..8388607),
    navAlmMo                INTEGER (-8388608..8388607),
    navAlmaf0               INTEGER (-1024..1023),
    navAlmaf1               INTEGER (-1024..1023),
    ...
}

-- ASN1STOP
```

***AlmanacNAV-KeplerianSet* field descriptions**
svID This field identifies the satellite for which the GNSS Almanac Model is given.
navAlmE Parameter e, eccentricity, dimensionless [2] and [5]. Scale factor 2^{-21}.
navAlmDeltaI Parameter δi, correction to inclination, semi-circles [2] and [5]. Scale factor 2^{-19} semi-circles.
navAlmOMEGADOT Parameter $\dot{\Omega}$, rate of right ascension, semi-circles/sec [2] and [5]. Scale factor 2^{-38} semi-circles/second.
navAlmSVHealth Parameter SV Health, satellite health [2] and [5].
navAlmSqrtA Parameter $\sqrt{A}$, square root of the semi-major axis, meters$^{1/2}$ [2] and [5] Scale factor 2^{-11} meters$^{1/2}$.
navAlmOMEGAo Parameter Ω_0, longitude of ascending node of orbit plane at weekly epoch, semi-circles [2] and [5]. Scale factor 2^{-23} semi-circles.
navAlmOmega Parameter ω, argument of perigee semi-circles [2] and [5]. Scale factor 2^{-23} semi-circles.
navAlmMo Parameter M_0, mean anomaly at reference time semi-circles [2] and [5]. Scale factor 2^{-23} semi-circles.
navAlmaf0 Parameter a_{f0}, apparent satellite clock correction seconds [2] and [5]. Scale factor 2^{-20} seconds.
navAlmaf1 Parameter a_{f1}, apparent satellite clock correction sec/sec [2] and [5]. Scale factor 2^{-38} semi-circles seconds/second.

7.4.2.29 AlmanacReducedKeplerianSet

```
-- ASN1START

AlmanacReducedKeplerianSet ::= SEQUENCE {
    svID                      SV-ID,
    redAlmDeltaA              INTEGER (-128..127),
    redAlmOmega0              INTEGER (-64..63),
    redAlmPhi0                INTEGER (-64..63),
    redAlmL1Health            BOOLEAN,
    redAlmL2Health            BOOLEAN,
    redAlmL5Health            BOOLEAN,
    ...
}

-- ASN1STOP
```

***AlmanacReducedKeplerianSet* field descriptions**
svID This field identifies the satellite for which the GNSS Almanac Model is given.
redAlmDeltaA Parameter δ_A, meters [2], [3], [4] and [5]. Scale factor 2^{+9} meters.
redAlmOmega0 Parameter Ω_0, semi-circles [2], [3], [4] and [5]. Scale factor 2^{-6} semi-circles.
redAlmPhi0 Parameter Φ_0, semi-circles [2], [3], [4] and [5]. Scale factor 2^{-6} semi-circles.
redAlmL1Health Parameter L1 Health, dimensionless [2], [3], [4] and [5].
redAlmL2Health Parameter L2 Health, dimensionless [2], [3], [4] and [5].
redAlmL5Health Parameter L5 Health, dimensionless [2], [3], [4] and [5].

7.4.2.30 AlmanacMidiAlmanacSet

```
-- ASN1START

AlmanacMidiAlmanacSet ::= SEQUENCE {
    svID                      SV-ID,
    midiAlmE                  INTEGER (0..2047),
    midiAlmDeltaI             INTEGER (-1024..1023),
    midiAlmOmegaDot           INTEGER (-1024..1023),
    midiAlmSqrtA              INTEGER (0..131071),
    midiAlmOmega0             INTEGER (-32768..32767),
    midiAlmOmega              INTEGER (-32768..32767),
    midiAlmMo                 INTEGER (-32768..32767),
    midiAlmaf0                INTEGER (-1024..1023),
    midiAlmaf1                INTEGER (-512..511),
    midiAlmL1Health           BOOLEAN,
    midiAlmL2Health           BOOLEAN,
    midiAlmL5Health           BOOLEAN,
    ...
}

-- ASN1STOP
```

***AlmanacMidiAlmanacSet* field descriptions**
svID This field identifies the satellite for which the GNSS Almanac Model is given.
midiAlmE Parameter e, dimensionless [2], [3], [4] and [5]. Scale factor 2^{-16}.
midiAlmDeltaI Parameter δ_i, semi-circles [2], [3], [4] and [5]. Scale factor 2^{-14} semi-circles.
▪ ***midiAlmOmegaDot*** Parameter $\dot{\Omega}$, semi-circles/sec [2], [3], [4] and [5]. Scale factor 2^{-33} semi-circles/second.
midiAlmSqrtA Parameter $\sqrt{A}$, meters$^{1/2}$ [2], [3], [4] and [5]. Scale factor 2^{-4} meters$^{1/2}$.
midiAlmOmega0 Parameter Ω_0, semi-circles [2], [3], [4] and [5]. Scale factor 2^{-15} semi-circles.
midiAlmOmega Parameter ω, semi-circles [2], [3], [4] and [5]. Scale factor 2^{-15} semi-circles.
midiAlmMo Parameter M_0, semi-circles [2], [3], [4] and [5]. Scale factor 2^{-15} semi-circles.
midiAlmaf0 Parameter a_{fo}, seconds [2], [3], [4] and [5]. Scale factor 2^{-20} seconds.
midiAlmaf1 Parameter a_{f1}, sec/sec [2], [3], [4] and [5]. Scale factor 2^{-37} seconds/second.
midiAlmL1Health Parameter L1 Health, dimensionless [2], [3], [4] and [5].
midiAlmL2Health Parameter L2 Health, dimensionless [2], [3], [4] and [5].
midiAlmL5Health Parameter L5 Health, dimensionless [2], [3], [4] and [5].

7.4.2.31 AlmanacGLONASS-AlmanacSet

```
-- ASN1START

AlmanacGLONASS-AlmanacSet ::= SEQUENCE {
    gloAlm-NA               INTEGER (1..1461),
    gloAlmnA                INTEGER (1..24),
    gloAlmHA                INTEGER (0..31),
    gloAlmLambdaA           INTEGER (-1048576..1048575),
    gloAlmtlambdaA          INTEGER (0..2097151),
    gloAlmDeltaIa           INTEGER (-131072..131071),
    gloAlmDeltaTA           INTEGER (-2097152..2097151),
    gloAlmDeltaTdotA        INTEGER (-64..63),
    gloAlmEpsilonA          INTEGER (0..32767),
    gloAlmOmegaA            INTEGER (-32768..32767),
    gloAlmTauA              INTEGER (-512..511),
    gloAlmCA                INTEGER (0..1),
    gloAlmMA                BIT STRING (SIZE(2))            OPTIONAL,   -- Need ON
    ...
}

-- ASN1STOP
```

***AlmanacGLONASS-AlmanacSet* field descriptions**
gloAlm-NA Parameter N^A, days [7]. Scale factor 1 days.
gloAlmnA Parameter n^A, dimensionless [7].
gloAlmHA Parameter H_n^A, dimensionless [7].
gloAlmLambdaA Parameter λ_n^A, semi-circles [7]. Scale factor 2^{-20} semi-circles.
gloAlmtlambdaA Parameter $t_{\lambda n}^A$, seconds [7]. Scale factor 2^{-5} seconds.
gloAlmDeltaIa Parameter Δi_n^A, semi-circles [7]. Scale factor 2^{-20} semi-circles.
gloAlmDeltaTA Parameter ΔT_n^A, sec/orbit period [7]. Scale factor 2^{-9} seconds/orbit period.
gloAlmDeltaTdotA Parameter $\Delta T\_DOT_n^A$, sec/orbit period^2 [7]. Scale factor 2^{-14} seconds/orbit period^2.
gloAlmEpsilonA Parameter ε_n^A, dimensionless [7]. Scale factor 2^{-20}.
gloAlmOmegaA Parameter ω_n^A, semi-circles [7]. Scale factor 2^{-15} semi-circles.
gloAlmTauA Parameter τ_n^A, seconds [7]. Scale factor 2^{-18} seconds.
gloAlmCA Parameter C_n^A, dimensionless [7].
gloAlmMA Parameter M_n^A, dimensionless [7]. This parameter is present if its value is nonzero; otherwise it is not present.

7.4.2.32 AlmanacECEF-SBAS-AlmanacSet

```
-- ASN1START

AlmanacECEF-SBAS-AlmanacSet ::= SEQUENCE {
    sbasAlmDataID           INTEGER (0..3),
    svID                    SV-ID,
    sbasAlmHealth           BIT STRING (SIZE(8)),
    sbasAlmXg               INTEGER (-16384..16383),
    sbasAlmYg               INTEGER (-16384..16383),
    sbasAlmZg               INTEGER (-256..255),
    sbasAlmXgdot            INTEGER (-4..3),
    sbasAlmYgDot            INTEGER (-4..3),
    sbasAlmZgDot            INTEGER (-8..7),
    sbasAlmTo               INTEGER (0..2047),
    ...
}

-- ASN1STOP
```

***AlmanacECEF-SBAS-AlmanacSet* field descriptions**
sbasAlmDataID Parameter Data ID, dimensionless [8].
svID This field identifies the satellite for which the GNSS Almanac Model is given.
sbasAlmHealth Parameter Health, dimensionless [8].
sbasAlmXg Parameter X_G, meters [8]. Scale factor 2 600 meters.
sbasAlmYg Parameter Y_G, meters [8]. Scale factor 2 600 meters.
sbasAlmZg Parameter Z_G, meters [8]. Scale factor 26 000 meters.
sbasAlmXgdot Parameter X_G Rat-of-Change, meters/sec [8]. Scale factor 10 meters/second.
sbasAlmYgDot Parameter Y_G Rate-of-Change, meters/sec [8]. Scale factor 10 meters/second.
sbasAlmZgDot Parameter Z_G Rate-of-Change, meters/sec [8]. Scale factor 40,96 meters/second.
sbasAlmTo Parameter t_0, seconds [8]. Scale factor 64 meters/seconds.

7.4.2.33 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] and [9].

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.

```
-- ASN1START

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

-- ASN1STOP
```

7.4.2.34 UTC-ModelSet1

```
-- ASN1START

UTC-ModelSet1 ::= SEQUENCE {
    gnss-Utc-A1         INTEGER (-8388608..8388607),
    gnss-Utc-A0         INTEGER (-2147483648..2147483647),
    gnss-Utc-Tot        INTEGER (0..255),
    gnss-Utc-WNt        INTEGER (0..255),
    gnss-Utc-DeltaTls   INTEGER (-128..127),
    gnss-Utc-WNlsf      INTEGER (0..255),
    gnss-Utc-DN         INTEGER (-128..127),
    gnss-Utc-DeltaTlsf  INTEGER (-128..127),
    ...
```

```
}

-- ASN1STOP
```

***UTC-ModelSet1* field descriptions**
gnss-Utc-A1 Parameter A_1, scale factor 2^{-50} seconds/second [2], [5] and [6].
gnss-Utc-A0 Parameter A_0, scale factor 2^{-30} seconds [2], [5] and [6].
gnss-Utc-Tot Parameter t_{ot}, scale factor 2^{12} seconds [2], [5] and [6].
gnss-Utc-WNt Parameter WN_t, scale factor 1 week [2], [5] and [6].
gnss-Utc-DeltaTls Parameter Δt_{LS}, scale factor 1 second [2], [5] and [6].
gnss-Utc-WNlsf Parameter WN_{LSF}, scale factor 1 week [2], [5] and [6].
gnss-Utc-DN Parameter DN, scale factor 1 day [2], [5] and [6].
gnss-Utc-DeltaTlsf Parameter Δt_{LSF}, scale factor 1 second [2], [5] and [6].

7.4.2.35 UTC-ModelSet2

```
-- ASN1START

UTC-ModelSet2 ::= SEQUENCE {
    utcA0               INTEGER (-32768..32767),
    utcA1               INTEGER (-4096..4095),
    utcA2               INTEGER (-64..63),
    utcDeltaTls         INTEGER (-128..127),
    utcTot              INTEGER (0..65535),
    utcWNot             INTEGER (0..8191),
    utcWNlsf            INTEGER (0..255),
    utcDN               BIT STRING (SIZE(4)),
    utcDeltaTlsf        INTEGER (-128..127),
    ...
}

-- ASN1STOP
```

***UTC-ModelSet2* field descriptions**
utcA0 Parameter A_{0-n}, bias coefficient of GNSS time scale relative to UTC time scale (seconds) [2], [3], [4] and [5]. Scale factor 2^{-35} seconds.
utcA1 Parameter A_{1-n}, drift coefficient of GNSS time scale relative to UTC time scale (sec/sec) [2], [3], [4] and [5]. Scale factor 2^{-51} seconds/second.
utcA2 Parameter A_{2-n}, drift rate correction coefficient of GNSS time scale relative to UTC time scale (sec/sec^2) [2], [3], [4] and [5]. Scale factor 2^{-68} seconds/second^2.
utcDeltaTls Parameter Δt_{LS}, current or past leap second count (seconds) [2], [3], [4] and [5]. Scale factor 1 second.
utcTot Parameter $t_{ot,}$ time data reference time of week (seconds) [2], [3], [4] and [5]. Scale factor 2^4 seconds.
utcWNot Parameter WN_{ot}, time data reference week number (weeks) [2], [3], [4] and [5]. Scale factor 1 week.
utcWNlsf Parameter WN_{LSF}, leap second reference week number (weeks) [2], [3], [4] and [5]. Scale factor 1 week.

***UTC-ModelSet2* field descriptions**
utcDN Parameter DN, leap second reference day number (days) [2], [3], [4] and [5]. Scale factor 1 day.
utcDeltaTlsf Parameter Δt_{LSF}, current or future leap second count (seconds) [2], [3], [4] and [5]. Scale factor 1 second.

7.4.2.36 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, day number within four-year period beginning since the leap year (days) [7]. Scale factor 1 day.
tauC Parameter τ_c, GLONASS time scale correction to UTC(SU) (seconds) [7]. Scale factor 2^{-31} seconds.
b1 Parameter B1, coefficient to determine ΔUT1 (seconds) [7]. Scale factor 2^{-10} seconds.
b2 Parameter B2, coefficient to determine ΔUT1 (seconds/msd) [7]. Scale factor 2^{-16} seconds/msd.
kp Parameter KP, notification of expected leap second correction (dimensionless) [7].

7.4.2.37 UTC-ModelSet4

```
-- ASN1START

UTC-ModelSet4 ::= SEQUENCE {
    utcA1wnt            INTEGER (-8388608..8388607),
    utcA0wnt            INTEGER (-2147483648..2147483647),
    utcTot              INTEGER (0..255),
    utcWNt              INTEGER (0..255),
    utcDeltaTls         INTEGER (-128..127),
    utcWNlsf            INTEGER (0..255),
    utcDN               INTEGER (-128..127),
    utcDeltaTlsf        INTEGER (-128..127),
    utcStandardID       INTEGER (0..7),
    ...
}

-- ASN1STOP
```

***UTC-ModelSet4* field descriptions**
utcA1wnt Parameter A_{1WNT}, sec/sec ([8], Message Type 12). Scale factor 2^{-50} seconds/second.

***UTC-ModelSet4* field descriptions**
utcA0wnt Parameter A_{0WNT}, seconds ([8], Message Type 12). Scale factor 2^{-30} seconds.
utcTot Parameter t_{ot}, seconds ([8], Message Type 12). Scale factor 2^{12} seconds.
utcWNt Parameter WN_t, weeks ([8], Message Type 12). Scale factor 1 week.
utcDeltaTls Parameter Δt_{LS}, seconds ([8], Message Type 12). Scale factor 1 second.
utcWNlsf Parameter WN_{LSF}, weeks ([8], Message Type 12). Scale factor 1 week.
utcDN Parameter DN, days ([8], Message Type 12). Scale factor 1 day.
utcDeltaTlsf Parameter Δt_{LSF}, seconds ([8], Message Type 12). Scale factor 1 second.
utcStandardID If *GNSS-ID* indicates 'sbas', this field indicates the UTC standard used for the SBAS network time indicated by *SBAS-ID* to UTC relation as defined in table 7.13 ([8], Message Type 12).

Table 7.13: Value of UTC Standard ID to UTC Standard relation

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

7.4.2.38 GNSS-AuxiliaryInformation

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

```
-- ASN1START

GNSS-AuxiliaryInformation ::= CHOICE {
    gnss-ID-GPS     GNSS-ID-GPS,
    gnss-ID-GLONASS GNSS-ID-GLONASS,
    ...
}

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

GNSS-ID-GPS-SatElement ::= SEQUENCE {
    svID                SV-ID,
    signalsAvailable    GNSS-SignalIDs,
    ...
}

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

GNSS-ID-GLONASS-SatElement ::= SEQUENCE {
    svID                SV-ID,
    signalsAvailable    GNSS-SignalIDs,
    channelNumber       INTEGER (-7..13)        OPTIONAL,       -- Cond FDMA
```

```
    ...
}

-- ASN1STOP
```

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

***GNSS-AuxiliaryInformation* field descriptions**
gnss-ID-GPS This choice may only be present if *GNSS-ID* indicates GPS.
gnss-ID-GLONASS This choice may only be present if *GNSS-ID* indicates GLONASS.
svID This field specifies the GNSS SV for which the *GNSS-AuxiliaryInformation* is given.
signalsAvailable This field indicates the ranging signals supported by the satellite indicated by *svID*. This field is given as a bit string as defined in *GNSS-SignalIDs* for a particular GNSS. If a bit is set to '1' it indicates that the satellite identified by *svID* transmits ranging signals according to the signal correspondence in *GNSS-SignalIDs*. If a bit is set to '0' it indicates that the corresponding signal is not supported on the satellite identified by *svID*.
channelNumber This field indicates the GLONASS carrier frequency number of the satellite identified by *svID*, as defined in [7].

7.4.3 Common GNSS Information Elements

7.4.3.1 GNSS-ID

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

```
-- ASN1START

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

-- ASN1STOP
```

7.4.3.2 GNSS-ID-Bitmap

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

```
-- ASN1START

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

7.4.3.3 GNSS-SignalID

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

```
-- ASN1START

GNSS-SignalID   ::= SEQUENCE {
    gnss-SignalID       INTEGER (0 .. 7),
    ...
}

-- 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 table 7.14.

Table 7.14: System to Value and Explanation relation

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

7.4.3.5 GNSS-SignalIDs

The IE *GNSSSignal-IDs* is used to indicate several GNSS signals using a bit map. The interpretation of *GNSSSignal-IDs* depends on the *GNSS-ID.*

```
-- ASN1START

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

-- ASN1STOP
```

GNSS-SignalIDs **field descriptions**
gnss-SignalIDs 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 table 7.15. Unfilled table entries indicate no assignment and shall be set to zero.

Table 7.15: Interpretation of the bit map in *gnssSignalIDs*

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

7.4.3.6 SBAS-ID

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

```
-- ASN1START

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

-- ASN1STOP
```

7.4.3.7 SBAS-IDs

The IE *SBAS-IDs* is used to indicate several SBASs using a bit map.

```
-- ASN1START

SBAS-IDs ::= SEQUENCE {
    sbas-IDs        BIT STRING {    waas        (0),
                                    egnos       (1),
                                    msas        (2),
                                    gagan       (3)   } (SIZE (1..8)),
    ...
}

-- ASN1STOP
```

***SBAS-IDs* field descriptions**
sbas-IDs This field specifies one or several SBAS(s) using a bit map. A one-value at the bit position means the particular SBAS is addressed; a zero-value at the particular bit position means the SBAS is not addressed.

7.4.3.8 SV-ID

The IE *SV-ID* is used to indicate a specific GNSS satellite. The interpretation of *SV-ID* depends on the *GNSS-ID.*

```
-- ASN1START

SV-ID ::= SEQUENCE {
    satellite-id        INTEGER(0..63),
    ...
}

-- ASN1STOP
```

***SV-ID* field descriptions**
satellite-id This field specifies a particular satellite within a specific GNSS. The interpretation of *satellite-id* depends on the *GNSS-ID* see table 7.16.

Table 7.16: Interpretation of *satellite-id*

System	Value of *satellite-id*	Interpretation of *satellite-id*
GPS	'0' - '62' '63'	Satellite PRN Signal No. 1 to 63 Reserved
SBAS	'0' - '38' '39' - '63'	Satellite PRN Signal No. 120 to 158 Reserved
QZSS	'0' - '4' '5' - '63'	Satellite PRN Signal No. 193 to 197 Reserved
GLONASS	'0' - '23' '24' - '63'	Slot Number 1 to 24 Reserved
Galileo	'0' - '35' '36' - '63'	Code No 1 to 36 Reserved

Annex A (informative): Considerations on the bandwidth requirement

A.1 Volume of GNSS assistance data

This clause analyses the volume of GNSS assistance data that needs to be broadcast over a radio network.

Table A.1: Nature of the messages and estimated number of bits

Items	Requirements	Number of bits
GNSS-ReferenceTime		
referenceTimeUnc	INTEGER (0..127)	7
referenceTimeUnc	INTEGER (0..127)	7
GNSS-SystemTime		
gnss-DayNumber	INTEGER (0..32 767)	15
gnss-TimeOfDay	INTEGER (0..86 399)	17
gnss-TimeOfDayFrac-msec	INTEGER (0..999)	10
GPS-TOW-Assist		
GPS-TOW-Assist	Sequence Size (1…64)	7
satelliteID	INTEGER (1..64)	7
tlmWord	INTEGER (0..16 383)	14
antiSpoof	INTEGER (0..1)	1
alert	INTEGER (0..1)	1
tlmRsvdBits	INTEGER (0..3)	2
NetworkTime		
milisecondsFromFrameStructureStart	INTEGER(0..1 000)	
secondsFromFrameStructureStart	INTEGER(0..12 533)	14
fractionalSecondsFromFrameStructureStart	INTEGER(0..3 999 999)	22
frameDrift	INTEGER (-64..63)	8
cellID		
physCellId	INTEGER (0..503)	9
UTRA/FDD primary-CPICH-Info	INTEGER (0..511)	9
DVB-SH		
Cell_Id	INTEGER (0..255) in TPS bits	7
Cell_Id Function		
Function_Tag	INTEGER (0..255)	8
Function_Length	INTEGER (0..255)	8
cell_id	INTEGER (0..65 535)	16
wait for enable flag	INTEGER (0..1)	1
reserved_future_use	INTEGER (0..127)	7
Frequency	INTEGER (0..16 777 215)	24
DVB-T2 and NGH		
Cell_Id	INTEGER (0..65 535)	16
RF_IDX	INTEGER (0..7)	3
Frequency	INTEGER (0..4 294 967 295)	32
gSM		
bcchCarrier	INTEGER (0..1 023)	10
bsic	INTEGER (0..63)	6
GNSS-ReferenceLocation	No bit provided?	
GNSS-IonosphericModel		
KlobucharModelParameter		
alfa0	INTEGER (-128..127)	9
alfa1	INTEGER (-128..127)	9
alfa2	INTEGER (-128..127)	9

Items	Requirements	Number of bits
alfa3	INTEGER (-128..127)	9
beta0	INTEGER (-128..127)	9
beta1	INTEGER (-128..127)	9
beta2	INTEGER (-128..127)	9
beta3	INTEGER (-128..127)	9
NeQuickModelParameter		
ai0	INTEGER (0..4 095)	12
ai1	INTEGER (0..4 095)	12
ai2	INTEGER (0..4 095)	12
ionoStormFlag1	INTEGER (0..1)	1
ionoStormFlag2	INTEGER (0..1)	1
ionoStormFlag3	INTEGER (0..1)	1
ionoStormFlag4	INTEGER (0..1)	1
ionoStormFlag5	INTEGER (0..1)	1
GNSS-EarthOrientationParameters		
teop	INTEGER (0..65 535)	16
pmX	INTEGER (-1 048 576..1 048 575)	22
pmXdot	INTEGER (-16 384..16 383)	16
pmY	INTEGER (-1 048 576..1 048 575)	22
pmYdot	INTEGER (-16 384..16 383)	16
deltaUT1	INTEGER (- 1 073 741 824..1 073 741 823)	32
deltaUT1dot	INTEGER (-262 144..262 143)	20
GNSS-TimeModelList		
gnss-TimeModelRefTime	INTEGER (0..65 535)	16
tA0	INTEGER (-67 108 864..67 108 863)	
tA1	INTEGER (-4 096..4 095)	14
tA2	INTEGER (-64..63)	8
gnss-TO-ID	INTEGER (1..15)	4
weekNumber	INTEGER (0..8 191)	13
deltaT	INTEGER (-128..127)	9
GNSS-DifferentialCorrections		
DGNSS-SgnTypeList ::=	SEQUENCE (SIZE (1..3))	3
gnss-SignalID		
gnss-StatusHealth	INTEGER (0..7)	3
dgnss-SatList		
DGNSS-SatList	SEQUENCE (SIZE (1..64))	7
svID		
iod	BIT STRING (SIZE(11))	11
udre	INTEGER (0..3)	2
pseudoRangeCor	INTEGER (-2 047..2 047)	12
rangeRateCor	INTEGER (-127..127)	8
udreGrowthRate	INTEGER (0..7)	2
udreValidityTime	INTEGER (0..7)	2
GNSS-NavigationModel		
svID	SV-ID	
svHealth	BIT STRING (SIZE(8))	8
iod	BIT STRING (SIZE(11))	11

Items	Requirements	Number of bits
StandardClockModelList		
stanClockToc	INTEGER (0..16 383)	14
stanClockAF2	INTEGER (-2 048..2 047)	13
stanClockAF1	INTEGER (-131 072..131 071)	19
stanClockAF0	INTEGER (-134 217 728..134 217 727)	29
stanClockTgd	INTEGER (-512..511)	11
stanModelID	INTEGER (0..1)	1
NAV-ClockModel		
navToc	INTEGER (0..37 799)	16
navaf2	INTEGER (-128..127)	9
navaf1	INTEGER (-32 768..32 767)	17
navaf0	INTEGER (-2 097 152..2 097 51)	23
navTgd	INTEGER (-128..127)	9
CNAV-ClockModel		
cnavToc	INTEGER (0..2 015)	11
cnavTop	INTEGER (0..2 015)	11
cnavURA0	INTEGER (-16..15)	6
cnavURA1	INTEGER (0..7)	3
cnavURA2	INTEGER (0..7)	3
cnavAf2	INTEGER (-512..511)	11
cnavAf1	INTEGER (-524 288..524 287)	21
cnavAf0	INTEGER (-33 554 432..33 554 431)	27
cnavTgd	INTEGER (-4 096..4 095)	14
cnavISCl1cp	INTEGER (-4 096..4 095)	14
cnavISCl1cd	INTEGER (-4 096..4 095)	14
cnavISCl1ca	INTEGER (-4 096..4 095)	14
cnavISCl2c	INTEGER (-4 096..4 095)	14
cnavISCl5i5	INTEGER (-4 096..4 095)	14
cnavISCl5q5	INTEGER (-4 096..4 095)	14
GLONASS-ClockModel		
gloTau	INTEGER (-2 097 152..2 097 151)	23
gloGamma	INTEGER (-1 024..1 023)	12
gloDeltaTau	INTEGER (-16..15)	6
SBAS-ClockModel		
sbasTo	INTEGER (0..5 399)	13
sbasAgfo	INTEGER (-2 048..2 047)	13
sbasAgf1	INTEGER (-128..127)	9
NavModelKeplerianSet		
keplerToe	INTEGER (0 .. 16 383)	14
keplerW	INTEGER (-2 147 483 648..2 147 483 647)	33
keplerDeltaN	INTEGER (-32 768..32 767)	17
keplerM0	INTEGER (-2 147 483 648..2 147 483 647)	33
keplerOmegaDot	INTEGER (-8 388 608.. 8 388 607)	25
keplerE	INTEGER (0..4 294 967 295)	32
keplerIDot	INTEGER (-8 192..8 191)	15
keplerAPowerHalf	INTEGER (0.. 4 294 967 295)	32
keplerI0	INTEGER (-2 147 483 648..2 147 483 647)	33
keplerOmega0	INTEGER (-2 147 483 648..2 147 483 647)	33
keplerCrs	INTEGER (-32 768..32 767)	17

Items	Requirements	Number of bits
keplerCis	INTEGER (-32 768..32 767)	17
keplerCus	INTEGER (-32 768..32 767)	17
keplerCrc	INTEGER (-32 768..32 767)	17
keplerCic	INTEGER (-32 768..32 767)	17
keplerCuc	INTEGER (-32 768..32 767)	17
NavModelNAV-KeplerianSet		
navURA	INTEGER (0..15)	4
navFitFlag	INTEGER (0..1)	1
navToe	INTEGER (0..37 799)	16
navOmega	INTEGER (- 2 147 483 648..2 147 483 647)	33
navDeltaN	INTEGER (-32 768..32 767)	17
navM0	INTEGER (- 2 147 483 648..2 147 483 647)	33
navOmegaADot	INTEGER (-8 388 608..8 388 607)	25
navE	INTEGER (0..4 294 967 295)	32
navIDot	INTEGER (-8 192..8 191)	15
navAPowerHalf	INTEGER (0..4 294 967 295)	32
navI0	INTEGER (- 2 147 483 648..2 147 483 647)	33
navOmegaA0	INTEGER (- 2 147 483 648..2 147 483 647)	33
navCrs	INTEGER (-32 768..32 767)	17
navCis	INTEGER (-32 768..32 767)	17
navCus	INTEGER (-32 768..32 767)	17
navCrc	INTEGER (-32 768..32 767)	17
navCic	INTEGER (-32 768..32 767)	17
navCuc	INTEGER (-32 768..32 767)	17
addNAVparam SEQUENCE {		
ephemCodeOnL2	INTEGER (0..3)	2
ephemL2Pflag	INTEGER (0..1)	1
ephemSF1Rsvd SEQUENCE {		
reserved1	INTEGER (0..8 388 607)	23
reserved2	INTEGER (0..16 777 215)	24
reserved3	INTEGER (0..16 777 215)	24
reserved4	INTEGER (0..65 535)	16
ephemAODA	INTEGER (0..31)	5
NavModelCNAV-KeplerianSet		
cnavTop	INTEGER (0..2 015)	11
cnavURAindex	INTEGER (-16..15)	6
cnavDeltaA	INTEGER (-33 554 432..33 554 431)	27
cnavAdot	INTEGER (-16 777 216..16 777 215)	26
cnavDeltaNo	INTEGER (-65 536..65 535)	18
cnavDeltaNoDot	INTEGER (-4 194 304..4 194 303)	24
cnavMo	INTEGER (-4 294 967 296..4 294 967 295)	34
cnavE	INTEGER (0..8 589 934 591)	33
cnavOmega	INTEGER (-4294967296..4294967295)	34
cnavOMEGA0	INTEGER (-4 294 967 296..4 294 967 295)	34
cnavDeltaOmegaDot	INTEGER (-65 536..65 535)	18
cnavIo	INTEGER (-4 294 967 296..4 294 967 295)	34
cnavIoDot	INTEGER (-16 384..16 383)	16
cnavCis	INTEGER (-32 768..32 767)	17
cnavCic	INTEGER (-32 768..32 767)	17
cnavCrs	INTEGER (-8 388 608..8 388 607)	25
cnavCrc	INTEGER (-8 388 608..8 388 607)	25
cnavCus	INTEGER (-1 048 576..1 048 575)	22
cnavCuc	INTEGER (-1 048 576..1 048 575)	22

Items	Requirements	Number of bits
NavModel-GLONASS-ECEF		
gloEn	INTEGER (0..31)	5
gloP1	BIT STRING (SIZE(2))	2
gloP2	BOOLEAN	
gloM	INTEGER (0..3)	2
gloX	INTEGER (-67 108 864..67 108 863)	28
gloXdot	INTEGER (-8 388 608..8 388 607)	25
gloXdotdot	INTEGER (-16..15)	6
gloY	INTEGER (-67 108 864..67 108 863)	28
gloYdot	INTEGER (-8 388 608..8 388 607)	25
gloYdotdot	INTEGER (-16..15)	6
gloZ	INTEGER (-67 108 864..67 108 863)	28
gloZdot	INTEGER (-8 388 608..8 388 607)	25
gloZdotdot	INTEGER (-16..15)	6
NavModel-SBAS-ECEF		
sbasTo	INTEGER (0..5 399)	
sbasAccuracy	BIT STRING (SIZE(4))	4
sbasXg	INTEGER (- 536 870 912..536 870 911)	31
sbasYg	INTEGER (- 536 870 912..536 870 911)	31
sbasZg	INTEGER (-16 777 216..16 777 215)	26
sbasXgDot	INTEGER (-65 536..65 535)	18
sbasYgDot	INTEGER (-65 536..65 535)	18
sbasZgDot	INTEGER (-131 072..131 071)	19
sbasXgDotDot	INTEGER (-512..511)	11
sbagYgDotDot	INTEGER (-512..511)	11
sbasZgDotDot	INTEGER (-512..511)	11
GNSS-RealTimeIntegrity		
GNSS-BadSignalList ::=	SEQUENCE (SIZE(1..64))	7
GNSS-DataBitAssistance		
gnss-TOD	INTEGER (0..3 599)	12
gnss-TODfrac	INTEGER (0..999	10
GNSS-DataBitsSatList :	:= SEQUENCE (SIZE(1..64))	7
GNSS-DataBitsSgnList ::=	SEQUENCE (SIZE(1..8))	4
GNSS-AcquisitionAssistance		
doppler0	INTEGER (-2 048..2 047)	13
doppler1	INTEGER (0..63)	6
dopplerUncertainty	INTEGER (0..4)	3
codePhase	INTEGER (0..1 022)	10
intCodePhase	INTEGER (0..127)	7
codePhaseSearchWindow	INTEGER (0..31)	5
azimuth	INTEGER (0..511)	9
elevation	INTEGER (0..127)	7
GNSS-Almanac		
weekNumber	INTEGER (0..255)	8
toa	INTEGER (0..255)	8
ioda	INTEGER (0..3)	2
AlmanacKeplerianSet		

Items	Requirements	Number of bits
kepAlmanacE	INTEGER (0..2 047)	11
kepAlmanacDeltaI	INTEGER (-1 024..1 023)	13
kepAlmanacOmegaDot	INTEGER (-1 024..1 023)	13
kepSVHealth	INTEGER (0..15)	4
kepAlmanacAPowerHalf	INTEGER (-65 536..65 535)	18
kepAlmanacOmega0	INTEGER (-32 768..32 767)	17
kepAlmanacW	INTEGER (-32 768..32 767)	17
kepAlmanacM0	INTEGER (-32 768..32 767)	17
kepAlmanacAF0	INTEGER (-8 192..8 191)	15
kepAlmanacAF1	INTEGER (-1 024..1 023)	12
AlmanacNAV-KeplerianSet		
navAlmE	INTEGER (0..65 535)	16
navAlmDeltaI	INTEGER (-32 768..32 767)	17
navAlmOMEGADOT	INTEGER (-32 768..32 767)	17
navAlmSVHealth	INTEGER (0..255)	8
navAlmSqrtA	INTEGER (0..16 777 215)	24
navAlmOMEGAo	INTEGER (-8 388 608..8 388 607)	25
navAlmOmega	INTEGER (-8 388 608..8 388 607)	25
navAlmMo	INTEGER (-8 388 608..8 388 607)	25
navAlmaf0	INTEGER (-1 024..1 023)	13
navAlmaf1	INTEGER (-1 024..1 023)	13
AlmanacReducedKeplerianSet		
redAlmDeltaA	INTEGER (-128..127)	9
redAlmOmega0	INTEGER (-64..63)	8
redAlmPhi0	INTEGER (-64..63)	8
AlmanacMidiAlmanacSet		
midiAlmE	INTEGER (0..2 047)	11
midiAlmDeltaI	INTEGER (-1 024..1 023)	12
midiAlmOmegaDot	INTEGER (-1 024..1 023)	12
midiAlmSqrtA	INTEGER (0..131 071)	17
midiAlmOmega0	INTEGER (-32 768..32 767)	17
midiAlmOmega	INTEGER (-32 768..32 767)	17
midiAlmMo	INTEGER (-32 768..32 767)	17
midiAlmaf0	INTEGER (-1 024..1 023)	13
midiAlmaf1	INTEGER (-512..511)	11
AlmanacGLONASS-AlmanacSet		
gloAlm-NA	INTEGER (1..1 461)	11
gloAlmnA	INTEGER (1..24)	5
gloAlmHA	INTEGER (0..31)	5
gloAlmLambdaA	INTEGER (-1 048 576..1 048 575)	22
gloAlmtlambdaA	INTEGER (0..2 097 151)	21
gloAlmDeltaIa	INTEGER (-131 072..131 071)	19
gloAlmDeltaTA	INTEGER (-2 097 152..2 097 151)	23
gloAlmDeltaTdotA	INTEGER (-64..63)	8
gloAlmEpsilonA	INTEGER (0..32 767)	15
gloAlmOmegaA	INTEGER (-32 768..32 767)	17
gloAlmTauA	INTEGER (-512..511)	11
gloAlmCA	INTEGER (0..1)	1
gloAlmMA	BIT STRING (SIZE(2))	2
AlmanacECEF-SBAS-AlmanacSet		
sbasAlmDataID	INTEGER (0..3)	2
svID		
sbasAlmHealth	BIT STRING (SIZE(8))	8
sbasAlmXg	INTEGER (-16 384..16 383)	16

Items	Requirements	Number of bits
sbasAlmYg	INTEGER (-16 384..16 383)	16
sbasAlmZg	INTEGER (-256..255)	10
sbasAlmXgdot	INTEGER (-4..3)	4
sbasAlmYgDot	INTEGER (-4..3)	4
sbasAlmZgDot	INTEGER (-8..7)	5
sbasAlmTo	INTEGER (0..2 047)	11
GNSS-UTC-Model		
UTC-ModelSet1		
gnss-Utc-A1	INTEGER (-8 388 608..8 388 607)	25
gnss-Utc-A0	INTEGER (- 2 147 483 648..2 147 483 647)	33
gnss-Utc-Tot	INTEGER (0..255)	8
gnss-Utc-WNt	INTEGER (0..255)	8
gnss-Utc-DeltaTls	INTEGER (-128..127)	9
gnss-Utc-WNlsf	INTEGER (0..255)	8
gnss-Utc-DN	INTEGER (-128..127)	9
gnss-Utc-DeltaTlsf	INTEGER (-128..127)	9
UTC-ModelSet2		
utcA0	INTEGER (-32 768..32 767)	17
utcA1	INTEGER (-4 096..4 095)	14
utcA2	INTEGER (-64..63)	8
utcDeltaTls	INTEGER (-128..127)	9
utcTot	INTEGER (0..65 535)	16
utcWNot	INTEGER (0..8 191)	13
utcWNlsf	INTEGER (0..255)	8
utcDN	BIT STRING (SIZE(4))	4
utcDeltaTlsf	INTEGER (-128..127)	9
UTC-ModelSet3		
nA	INTEGER (1..1 461)	11
tauC	INTEGER (- 2 147 483 648..2 147 483 647)	33
b1	INTEGER (-1 024..1 023)	12
b2	INTEGER (-512..511)	10
kp	BIT STRING (SIZE(2))	
UTC-ModelSet4		
utcA1wnt	INTEGER (-8 388 608..8 388 607)	25
utcA0wnt	INTEGER (- 2 147 483 648..2 147 483 647)	33
utcTot	INTEGER (0..255)	8
utcWNt	INTEGER (0..255)	8
utcDeltaTls	INTEGER (-128..127)	9
utcWNlsf	INTEGER (0..255)	8
utcDN	INTEGER (-128..127)	9
utcDeltaTlsf	INTEGER (-128..127)	9
utcStandardID	INTEGER (0..7)	3
GNSS-AuxiliaryInformation		
GNSS-ID-GPS ::= SEQUENCE	(SIZE(1..64))	64
GNSS-ID-GLONASS ::=	SEQUENCE (SIZE(1..64))	64
channelNumber	INTEGER (-7..13)	5
Common GNSS Information Elements		
GNSS-ID	(SIZE (1..16))	16
GNSS-SignalID	INTEGER (0 .. 7)	3

Items	Requirements	Number of bits
GNSS-SignalIDs	BIT STRING (SIZE(8))	8
SBAS-IDs	(SIZE (1..8)	8
SV-ID	INTEGER(0..63)	6
	Total	**4 140**

A.2 Bandwidth Estimation

The following estimated bit rate for different refreshment periods can be noted.

Table A.2: Estimated bandwidth versus refreshment period

Refreshment Period (s)	Estimated Rate (b/s)
1	4 000
10	400
60	70

The assumed Packet error rate (PER) is 10^{-3}.

A scheduler should be implemented to adjust the throughput to the available bandwidth of the broadcast channel.

History

Document history		
V1.1.1	June 2015	Publication