LPP Extensions Specification

Candidate Version 1.1 – 04 Aug 2020

Open Mobile Alliance

OMA-TS-LPPe-V1_1-20200804-C

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1. Scope

The present document specifies OMA LPP Extensions (LPPe) Release 1.1.

2. References

2.1 Normative References

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[25.101] 3GPP TS 25.101, "User Equipment (UE) radio transmission and reception (FDD)"
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[25.102] 3GPP TS 25.102, "User Equipment (UE) radio transmission and reception (TDD)"
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[25.123] 3GPP TS 25.123, "Requirements for support of radio resource management (TDD)"
URL: http://www.3gpp.org/ftp/specs/html-info/25123.htm

[25.133] 3GPP TS 25.133, "Requirements for support of radio resource management (FDD)"
URL: http://www.3gpp.org/ftp/specs/html-info/25133.htm

[25.214] 3GPP TS 25.214: "Physical layer procedures (FDD)"
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URL: http://www.3gpp.org/ftp/specs/html-info/25224.htm

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[IEEE 802.15.1]	Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Wireless Personal Area Networks (WPANs)
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2.2 Informative References

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[SP3-C] The Extended Standard Product 3 Orbit Format SP3-c. National Geodetic Survey, National Ocean Service, NOAA. 12th February 2007.

3. Terminology and Conventions

3.1 Conventions

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [RFC2119].

All sections and appendixes, except “Scope” and “Introduction”, are normative, unless they are explicitly indicated to be informative.

3.2 Definitions

Baseline	Vector between antenna reference points
Relative Position	See baseline
Relative Velocity	First time derivative of the baseline
Target	Termination point of LPP
Server	Termination point of LPP

3.3 Abbreviations

AD	Assistance Data
AP	Access Point
ARFCN	Absolute Radio Frequency Channel Number
BCCH	Broadcast Control Channel
BSIC	Base transceiver Station Identity Code
BSSID	Basic Service Set Identifier
BT	Bluetooth
BT LE	Bluetooth Low Energy
BTS	Base Transceiver System
CCP	Continuous Carrier Phase
CCPCH	Common Control Pilot Channel
CPICH	Common Pilot Channel
DL-AoD	Downlink Angle-of-Departure
DL-TDOA	Downlink Time Difference Of Arrival
DSL	Digital Subscriber Line
ECID	Enhanced Cell ID
EDGE	Enhanced Data rates for Global Evolution
EGM	Earth Gravity Model
E-OTD	Enhanced Observed Time Difference
EPDU	External Protocol Data Unit
EPRE	Energy Per Resource Element
E-UTRAN	Evolved UTRAN
FDD	Frequency-Division Duplex
GERAN	GSM/EDGE RAN

GNSS	Global Navigation Satellite System, collective name for a variety of satellite positioning systems including GPS, Galileo and GLONASS
GSM	Global System for Mobile communications
HA GNSS	High Accuracy GNSS. Refers to using continuous carrier phase measurements to deduce the accurate location of the target device.
HeNB	Home eNodeB
HNB	Home Node B
ICI	Indirect Code Identifier
IPDL	Idle Period Downlink
LAN	Local Area Network
LBS	Location-Based Services
LCS	Location Services
LPP	LTE Positioning Protocol, defined in 3GPP TS 37.355
LPPe	OMA LPP Extensions
LTE	Long Term Evolution
MBS	Metropolitan Beacon System
NAT	Network Address Translation
NFC	Near Field Communications
NR	New Radio
OMA	Open Mobile Alliance
OTD	Observed Time Difference
OTDOA	Observed Time Difference of Arrival
P-CPICH	Primary Control Pilot Channel
pidf-lo	Presence Information Data Format Location Object
QoR	Quality of Reference station
RAN	Radio Access Network
RLE	Run-Length Encoding
RS	Reference Signal
RSSI	Received Signal Strength Indicator
RTD	Real Time Difference
SLP	SUPL Location Platform
SRN	Short Range Node
SSID	Service Set Identifier
SUPL	Secure User Plane Location
SV	Space Vehicle
TA	Timing Advance
TDD	Time-Division Duplex
TEC	Total Electron Content
TECU	TEC Unit, 10^{16} electrons per square meter
TOA	Time Of Arrival
UARFCN	UTRA Absolute Radio Frequency Channel Number

UE	User Equipment
UMTS	Universal Mobile Telecommunication System
URI	Uniform Resource Identifier [#B073]
UTC	Universal Time Coordinated
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial RAN
WA	Wide Area
WGS	World Geodetic System
WLAN	Wireless Local Area Network

4. Introduction

4.1 Version 1.0

LTE Positioning Protocol LPP is a positioning protocol for E-UTRAN control plane. However, LPP has been designed in such a way that it can also be utilized outside the control plane domain such as in the user plane in the context of SUPL.

LPP elementary messages (Request and Provision of Capabilities and Location Information and Assistance Data) each include a container, an EPDU, which can be used by standardization fora outside 3GPP to define their own extensions to LPP messages. OMA LPP Extensions take advantage of this option.

A variety of known and emerging positioning technologies are not in the scope of 3GPP work. This is natural, because control plane deployments are bandwidth-constrained and limited to access types that are part of the control plane system. However, the user plane does not have any such limitations and, hence, new positioning technologies improving accuracy, availability and integrity can be realized in the user plane.

The advantages resulting from OMA building LPPe on top of the 3GPP-defined LPP include the convergence of control and user plane positioning protocols, reduced work load and being able to use the same LPP and LPPe protocol stack both in the control and user plane.

4.2 Version 1.1

LPPe Version 1.1 supports the following capabilities additional to those in Version 1.0:

- Broadcast of unsolicited LPP/LPPe Provide Assistance Data messages
- Request and provision of assistance data point to point related to LPP/LPPe broadcast support

Receipt of broadcast LPP/LPPe Provide Assistance Data messages can be backward compatible with a target that supports version 1.0 of LPPe in the sense that such messages may be provided (e.g. by a broadcast process in the target) to an LPPe process in the target without causing errors or rejection of the contained assistance data. This backward compatibility applies to unencapsulated LPP/LPPe messages but not to encapsulated messages (see section 5.2.5.1).

4.3 Version Negotiation

Each LPPe message segment indicates the version of the LPPe protocol that was used to encode it. The version includes a major version number (0-255) and a minor version number (0-255). Later major versions of LPPe should be backward compatible at both a procedural level and an encoding level with earlier versions. Later minor versions shall be backward compatible with previous minor versions for the same major version number.

To allow for possible non-backward compatibility between different major LPPe versions, an LPPe message segment also carries a compatibility level (0-15). The compatibility level for this version of LPPe is zero. The compatibility level shall be increased in any new major version of LPPe that is non-backward compatible with the previous major version. A receiver shall discard any received LPPe message that indicates a compatibility level different to all those supported and may return an LPP/LPPe Error message indicating the highest LPPe compatibility level supported.

If a receiver supports the LPPe compatibility level indicated in a received LPPe message but supports a higher major and/or minor version of LPPe than indicated in the message, it may either use the higher major/minor version in subsequent LPPe messages that it sends and allow for the possibility that not all information will be understood or fallback to the lower major/minor version. If a receiver supports the compatibility level indicated in a received LPPe message but supports only a lower major and/or minor version of LPPe than indicated, it shall use the highest major/minor version of LPPe that it supports in subsequent LPPe messages. Once either end has sent an LPPe message to the other end, it shall continue to use the same major/minor version of LPPe in subsequent messages belonging to the same LPP session. Version adaptation is thus applicable only to a receiver that has not yet sent an LPPe message on any new session.

Table 1: shows the association between compatibility levels and major LPPe versions.

Compatibility Level	Major Version
0	1

Table 1: LPPe Compatibility Levels and Major Versions

5. LPPe functionality

The LPPe protocol functionality builds on the 3GPP LPP procedure and transaction handling.

5.1 Integration with 3GPP LPP

The extension of 3GPP LPP messages is based on the EPDU-Sequence (External Protocol Data Unit) included in the following 3GPP messages:

- LPP Provide / Request Capabilities (from 3GPP Rel-9 or later)
- LPP Provide / Request Assistance Data (from 3GPP Rel-9 or later)
- LPP Provide / Request Location Information (from 3GPP Rel-9 or later)
- LPP Abort (from 3GPP Rel-9 or later)
- LPP Error (from 3GPP Rel-9 or later)

The LPP transaction control is handled by the LPP messaging and, thus, LPPe message extensions do not need to carry a LPP transaction ID.

EPDU is defined in Chapter 6.4.1 of [LPP]:

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

maxEPDU INTEGER ::= 16

EPDU ::= SEQUENCE {
  ePDU-Identifier         EPDU-Identifier,
  ePDU-Body               EPDU-Body
}

EPDU-Identifier ::= SEQUENCE {
  ePDU-ID                 EPDU-ID,
  ePDU-Name               EPDU-Name       OPTIONAL,
  ...
}

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

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

EPDU-Body ::= OCTET STRING
```

***EPDU-Sequence* field descriptions**
EPDU-ID This field provides a unique integer ID for the external positioning method.
EPDU-Name This field provides an optional character encoding which can be used to provide a quasi-unique name for an external PDU – e.g., by containing the name of the defining organization and/or the name of the associated public or proprietary standard for the EPDU.
EPDU-Body The content and encoding of this field are defined externally to LPP.

External PDU Identifier Definition

EPDU-ID	EPDU Defining entity	Method name	Reference
1	OMA LOC	OMA LPP extensions (LPPe)	OMA-TS-LPPe_V1_0

LPPe specifies an extension to each of the eight messages. When encoding the LPP/LPPe message, it is expected that the LPPe extension for the message is first parsed and the resulting ASN.1-coded binary stream is included in the EPDU-Body of the EPDU in the appropriate message.

Duplication of information in LPP and LPPe layer within an "LPP Request" message SHOULD be avoided. If contradicting information is received in LPP and LPPe layer within an "LPP Provide" message the recipient SHALL use the information in LPPe layer.

5.2 LPPe Procedures

Procedures defined in [LPP] carry over to use of LPP with LPPe. Theadditional procedures defined in this section apply to LPPe only and extend the LPP procedures defined in [LPP].

5.2.1 Periodic/Triggered Assistance Data Transfer with Update

This procedure enables a target to request a server to send assistance data periodically either at defined intervals or when specific triggering criteria are met. The procedure also allows a target or a server to modify the type of assistance data and/or the periodicity and triggering criteria while the delivery procedure is ongoing. The procedure shall not be combined with the support of any other assistance data and shall thus use LPP transactions that are dedicated to starting, transferring or updating one specific type of Periodic/Triggered Assistance Data.

5.2.1.1 Initiating and Terminating the Procedure

Figure 1 shows how a Periodic/Triggered Assistance Data Transfer with Update may be initiated and terminated.

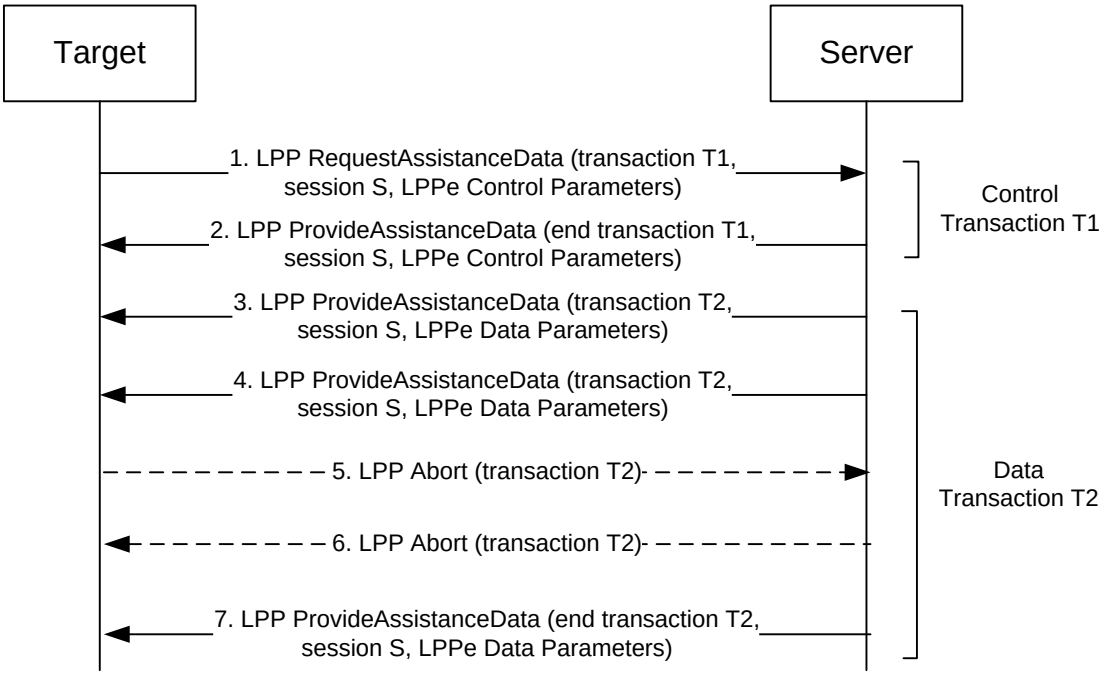


Figure 1: LPPe Periodic/Triggered Assistance Data transfer procedure with Update

1. The target sends an LPP *RequestAssistanceData* message to the server using some available transaction ID T1. The message contains a periodic/triggered session ID S (different to any other LPPe periodic/triggered session ID currently

in use between the target and server), an indication that this is an initial request for a Periodic/Triggered Assistance Data transfer and LPPe control parameters identifying the type of assistance data being requested, the triggering or periodicity conditions for sending it and either a duration or other specific conditions for ending the assistance data transfer.

2. The server responds with an LPP *ProvideAssistanceData* message to the target. The message uses the transaction ID T1 in step 1 and indicates the end of this transaction. The message contains the periodic/triggered session ID S, an indication that this is a response to an initial request, and LPPe control parameters indicating whether or not the request in step 1 can be supported. If the request can be supported, the LPPe control parameters may explicitly confirm or redefine the type of assistance data, the triggering or periodicity parameters and the duration or other conditions for ending the assistance data transfer. Further characteristics of the assistance data to be delivered may also be provided. If the procedure cannot be supported, an error reason shall be provided at the LPPe level and remaining steps are then not performed.

3. When the first triggering or periodicity condition occurs, the server sends an unsolicited LPP *ProvideAssistanceData* message to the target containing the periodic/triggered session ID S, an indication that this is a periodic/triggered assistance data delivery, and LPPe data parameters containing the assistance data confirmed or defined in step 2. The message uses some available transaction ID T2 that may be different to T1.

   NOTE: LPPe control parameters and LPPe data parameters applicable to this procedure shall be explicitly distinguished from one another in the message encoding definitions in section 6.

4. The server may continue to send further LPP *ProvideAssistanceData* messages to the target containing the assistance data confirmed or redefined in step 2 when each additional triggering or periodicity condition occurs.

5. If an error condition occurs at the target that requires the session to end, the target sends an LPP Abort to the server for transaction T2 that may optionally include LPP and/or LPPe error codes. Remaining steps are then omitted. Error conditions that may induce an abort include an attempt by either end to update the assistance data transfer, as described in sections 5.2.1.2 and 5.2.1.3, where the final control parameters provided by the server are not acceptable to the target.

6. If an error condition occurs at the server that requires the session to end without the delivery of further assistance data, the server sends an LPP Abort to the target for transaction T2 that may optionally include LPP and/or LPPe error codes. Remaining steps are then omitted.

7. When the duration or other conditions for ending the assistance data transfer occur, the last LPP *ProvideAssistanceData* message transferred indicates the end of transaction T2. Terminating the transfer as in this step is preferred over the use of an abort (as in step 6) where possible, since additional termination information specific to the assistance data transfer may then be included.

5.2.1.2 Target Update

Figure 2: shows how the target may update an ongoing a Periodic/Triggered Assistance Data Transfer that was started according to section 5.2.1.1.

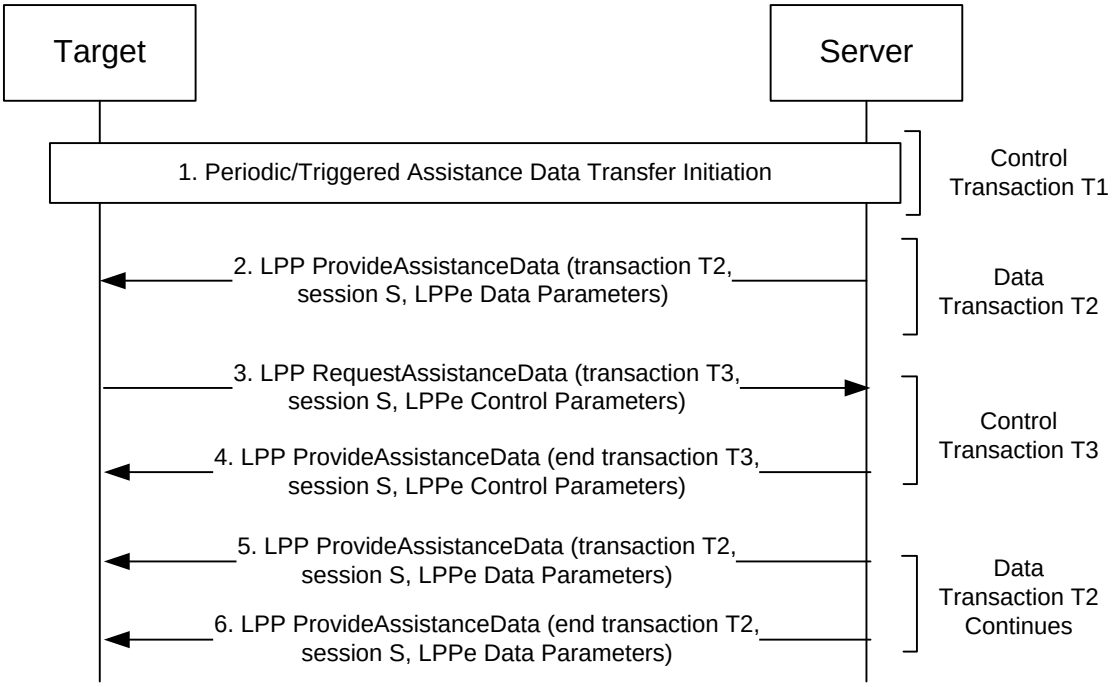


Figure 2: LPPe Periodic/Triggered Assistance Data transfer procedure with Target Update

1. Steps 1 and 2 of Figure 1 are performed to start an LPPe Periodic/Triggered Assistance Data transfer procedure with Update and using a periodic/triggered session ID S.
2. The server may send zero, one or more LPP *ProvideAssistanceData* messages to the target containing the assistance data agreed in step 1 and using a transaction ID T2.
3. If, before the delivery of assistance data has terminated, the target needs to update the type of assistance data and/or the triggering and periodicity conditions and/or the duration or conditions for termination, the target sends an LPP *RequestAssistanceData* message to the server using some available transaction ID T3. The ID T3 shall be different to T2 (if T2 has been started). The message contains the periodic/triggered session ID S, an indication that this is an update request for a Periodic/Triggered Assistance Data transfer and LPPe control parameters identifying any new type of assistance data being requested, any new triggering or periodicity conditions for sending it and any new duration or specific conditions for ending the assistance data transfer. The request also indicates whether the previous assistance data delivery shall continue or be aborted if the new request cannot be supported.
4. The server responds with an LPP *ProvideAssistanceData* message to the target. The message uses the transaction ID T3 and indicates the end of this transaction. The message contains the periodic/triggered session ID S and an indication that this is a response to an update request. The message also contains LPPe control parameters indicating whether or not the update request in step 3 can be supported. If the request can be supported, the control parameters may explicitly confirm or redefine any new type of assistance data, and new triggering or periodicity parameters and any new duration or other conditions for ending the assistance data transfer. Further characteristics of the assistance data to be delivered may also be provided. If the request in step 3 cannot be supported, then, if requested in step 3, the earlier request agreed in step 1 shall continue via further repetitions of step 2 until it ends normally or is modified by a repetition of step 3 or is aborted. But if requested otherwise in step 3, the earlier request (including transaction T2) shall be aborted at the server without the sending of any further assistance data to the target. In either case, steps 5 and 6 are then omitted.
5. If the server can support the request in step 3, it ceases to support the request in step 1 following step 4. Note that due to race conditions, one or more repetitions of step 2 may be perceived to occur by the target following step 3 and prior to step 4. When the first updated triggering or periodicity condition occurs following step 4, the server sends an unsolicited LPP *ProvideAssistanceData* message to the target containing the session ID S, an indication that this is periodic/triggered assistance data and LPPe data parameters containing the new assistance data confirmed or defined

in step 4. The message continues to uses transaction ID T2.

6. The server may continue to send further LPP *ProvideAssistanceData* messages to the target containing the session ID S and LPPe data parameters containing the new assistance data confirmed or redefined in step 4 when each additional triggering or periodicity condition occurs. If the duration or other conditions for ending the assistance data transfer occur, the last LPP *ProvideAssistanceData* message transferred indicates the end of transaction T2. If before this occurs the target needs to update the type of assistance data, triggering or periodicity conditions and/or duration or other conditions for terminating the transfer, steps 3 and 4 are repeated.

5.2.1.3 Server Update

Figure 3: shows how the server may update an ongoing a Periodic/Triggered Assistance Data Transfer that was started according to section 5.2.1.1.

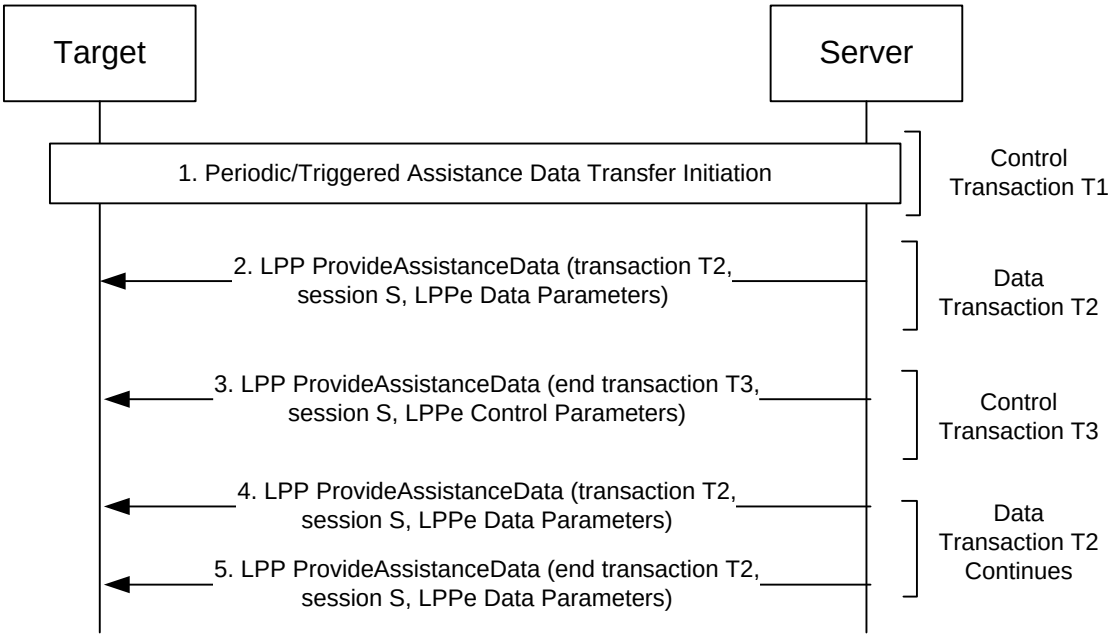


Figure 3: LPPe Periodic/Triggered Assistance Data transfer procedure with Server Update

1. Steps 1 and 2 of Figure 1 are performed to start an LPPe Periodic/Triggered Assistance Data transfer procedure with Update and using a periodic/triggered session ID S.

2. The server may send zero, one or more LPP *ProvideAssistanceData* messages to the target containing the assistance data agreed in step 1 and using a transaction ID T2.

3. If, before the delivery of assistance data has terminated, the server needs to update the type of assistance data and/or the triggering and periodicity conditions and/or the duration or conditions for termination, the server sends an unsolicited LPP *ProvideAssistanceData* message to the target using some available transaction ID T3. The ID T3 shall be different to T2. The message contains the periodic/triggered session ID S, an indication this is a server update for a Periodic/Triggered Assistance Data transfer and LPPe control parameters identifying any new type of assistance data to be provided, any new triggering or periodicity conditions for sending it and any new duration or specific conditions for ending the assistance data transfer. After sending this message, the server ceases to transfer assistance data according to step 2.

4. When the first updated triggering or periodicity condition occurs (as defined in step 3) following step 3, the server sends an unsolicited LPP *ProvideAssistanceData* message to the target containing the periodic/triggered session ID S, an indication that this is periodic/triggered assistance data and LPPe data parameters containing the new assistance data defined in step 3. The message continues to uses transaction ID T2.

5. The server may continue to send further LPP *ProvideAssistanceData* messages to the target containing the periodic/triggered session ID S and LPPe data parameters containing the new assistance data defined in step 3 when

each additional triggering or periodicity condition occurs. If the duration or other conditions for ending the assistance data transfer occur, the last LPP *ProvideAssistanceData* message transferred indicates the end of transaction T2. If before this the server needs to update the type of assistance data, triggering or periodicity conditions and/or duration or other conditions for terminating the transfer, step 3 is repeated.

5.2.1.4 Delivery via Broadcast (version 1.1)

Figure 4 shows how a Periodic/Triggered Assistance Data Transfer may be initiated and terminated in the case that assistance data is transferred via broadcast. The purpose of this procedure is to enable the same assistance that would normally be transferred according to the point to point procedures shown in Figure 1, Figure 2 and Figure 3 to be transferred using broadcast. The procedure is mainly a degenerate version of that described in Figure 1 in section 5.2.1.1.

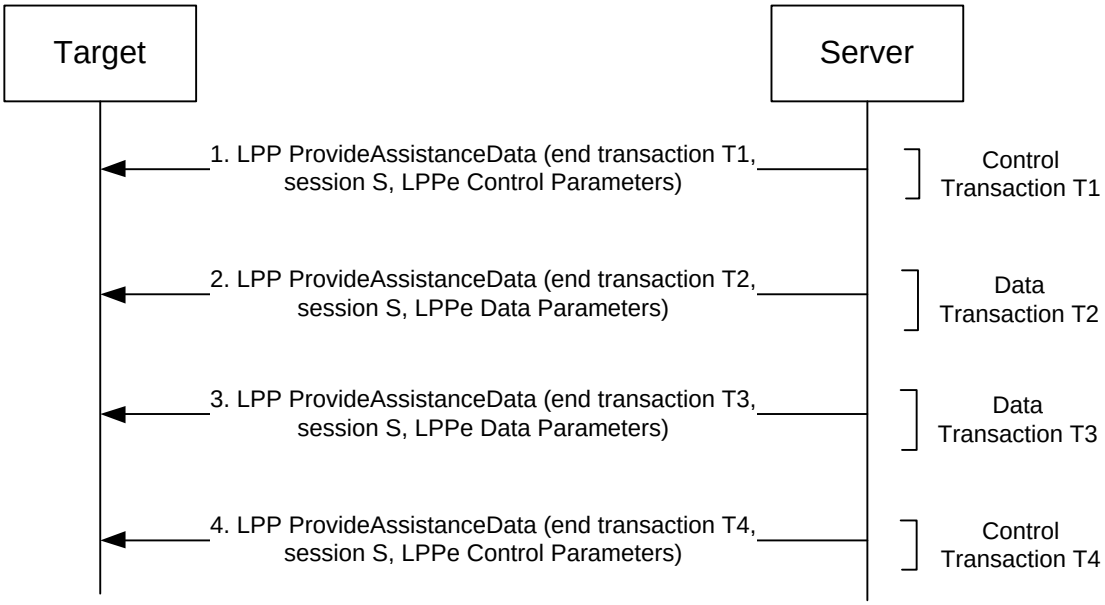


Figure 4: LPPe Periodic/Triggered Assistance Data transfer procedure with Broadcast

1. The server broadcasts an LPP *ProvideAssistanceData* message using the procedure described in section 5.2.5. The message uses an arbitrary transaction ID T1 and indicates the end of this transaction. The message contains a periodic/triggered session ID S chosen by the server, an indication that this is a response to an initial request (for compatibility with LPPe version 1.0 ASN.1), and LPPe control parameters identifying the type of assistance data to be transferred in later steps, the triggering or periodicity conditions for sending this data and either a duration or other specific conditions for ending the assistance data transfer. No other assistance data shall be included in the mssage. The server shall ensure that the session ID S is not used for any other periodic/triggered assistance data transfer in any geographic area at the same time as the procedure in Figure 4 is ongoing and for a period of at least 24 hours after this procedure terminates. The server may periodically re-broadcast the message in step 1 to reach additional targets. A target device that receives the message in step 1 via broadcast may identify it as belonging to this procedure from inclusion of the session ID S and the indication that this is a response to an initial request for periodic/triggered assistance data transfer. If a target receives a subsequent message via broadcast that is identified as belonging to step 1 and carries the same session ID S as that for an ongoing procedure of this type and if the message cannot be identified as a duplicate of the message that iniated this procedure (e.g. from use of the same version 1.1 message ID), then the target shall abort reception for the ongoing procedure and may instigate reception for a new procedure based on the control parameters included in the message.

2. When the first triggering or periodicity condition occurs, the server sends via broadcast (using the procedure in section 5.2.5) an unsolicited LPP ProvideAssistanceData message containing the periodic/triggered session ID S assigned in step 1, an indication that this is a periodic/triggered assistance data delivery, and LPPe data parameters containing the assistance data indicated in step 1. The message carries an arbitary transaction ID T2 and indicates the end of a transaction. No other assistance data shall be included other than that indicated in step 1.

NOTE: LPPe control parameters and LPPe data parameters applicable to this procedure are explicitly distinguished from one another in the message encoding definitions in section 6.

3. The server may continue to broadcast further LPP *ProvideAssistanceData* messages containing new assistance data conforming to what was indicated in step 1 when each additional triggering or periodicity condition occurs. Each subsequent message carries the session ID S, an arbitrary transaction ID T3 and an end of transaction indication. The session may be terminated by the server at any time after which the session ID S shall not be used again for a period of at least 24 hours. A target that is receiving the messages in steps 1, 2 and 3 should assume the procedure has terminated if step 2 or a repetition of step 3 is not observed for a period of one hour.

4. When the session is terminated, a server may optionally broadcast an LPP *ProvideAssistanceData* message to indicate this. The message shall contain an arbitrary transaction ID T4, an indication that this is the end of a transaction, the periodic/triggered session ID S and an indication that this is a server update for a Periodic/Triggered Assistance Data transfer. The message shall also contain LPPe control parameters indicating either a zero or minimal duration (depending on what is defined for the associated assistance data) and a zero or minimal applicable geographic region. The message may be periodically re-broadcast to reach more targets. Targets that follow the rules in step 1 will replace the old control parameters with the new ones and thereby end or soon end the session.

   NOTE: Step 4 shall not be used to modify the control parameters for an ongoing session with a view to continuing the session. This is because the message in step 4 may not be received by all targets, who would then continue using the old control parameters. A server wishing to modify an ongoing session shall instead terminate the session and start a new session using a different session ID.

5.2.2 Periodic/Triggered Location Information Transfer with Update

This procedure enables a server to request a target to send location information periodically either at defined intervals or when specific triggering criteria are met. The procedure also allows a target or a server to modify the type of location information and/or the periodicity and triggering criteria while the delivery procedure is ongoing. The procedure shall not be combined with the support of any other location information and shall thus use LPP transactions that are dedicated to starting, transferring or updating one specific type of Periodic/Triggered Location Information.

5.2.2.1 Initiating and Terminating the Procedure

Figure 5: shows how a Periodic/Triggered Location Information Transfer with Update may be initiated and terminated.

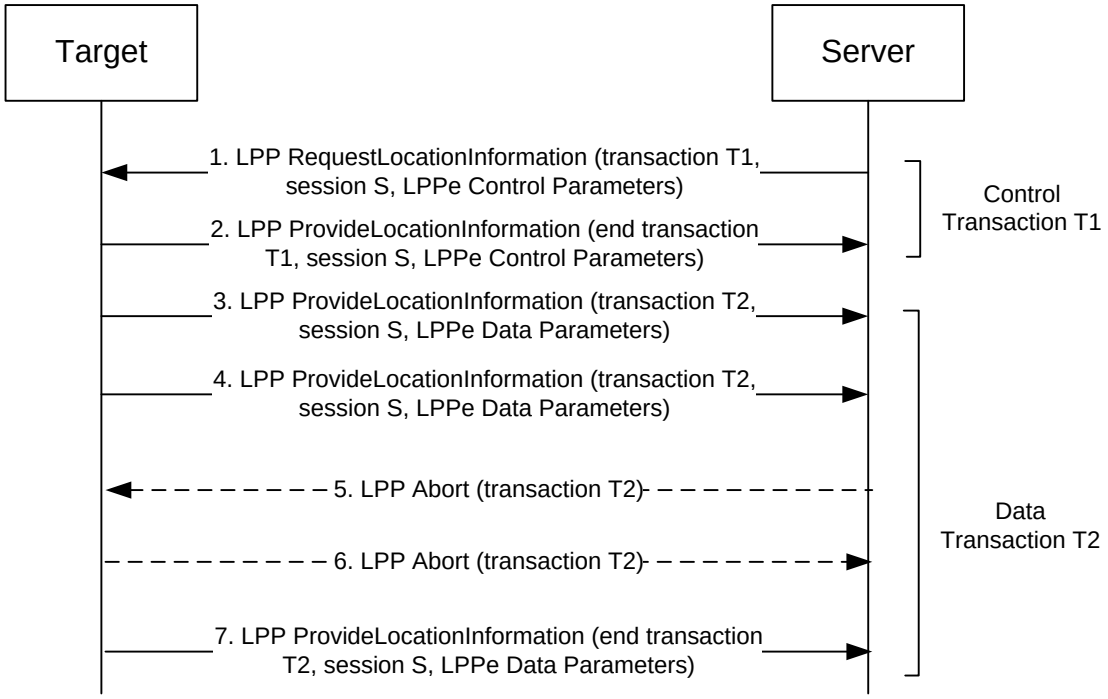


Figure 5: LPPe Periodic/Triggered Location Information transfer procedure with Update

1. The server sends an LPP *RequestLocationInformation* message to the target using some available transaction ID T1. The message contains a periodic/triggered session ID S (different to any other LPPe periodic/triggered session ID currently in use between the target and server), an indication that this is an initial request for a Periodic/Triggered Location Information transfer and LPPe control parameters identifying the type of location information being requested, the triggering or periodicity conditions for sending it and either a duration or other specific conditions for ending the location information transfer.
2. The target responds with an LPP *ProvideLocationInformation* message to the server. The message uses the transaction ID T1 in step 1 and indicates the end of this transaction. The message contains the periodic/triggered session ID S, an indication that this is a response to an initial request, and LPPe control parameters indicating whether or not the request in step 1 can be supported. If the request can be supported, the control parameters may explicitly confirm or redefine the type of location information, the triggering or periodicity parameters and the duration or other conditions for ending the location information transfer. Further characteristics of the location information to be delivered may also be provided. If the procedure cannot be supported, an error reason shall be provided at the LPPe level and remaining steps are then not performed.
3. When the first triggering or periodicity condition occurs, the target sends an unsolicited LPP *ProvideLocationInformation* message to the server containing the periodic/triggered session ID S, an indication that this is a periodic/triggered location information delivery, and LPPe data parameters containing the location information confirmed or defined in step 2. The message uses some available transaction ID T2 that may be different to T1.
4. The target may continue to send further LPP *ProvideLocationInformation* message to the server containing the location information confirmed or redefined in step 2 when each additional triggering or periodicity condition occurs.
5. If an error condition occurs at the server that requires the session to end, the server sends an LPP Abort to the target for transaction T2 that may optionally include LPP and/or LPPe error codes. Remaining steps are then omitted. Error conditions that may induce an abort include an attempt by either end to update the location information transfer, as described in sections 5.2.2.2 and 5.2.2.3, where the final control parameters provided by the target are not acceptable to the server.
6. If an error condition occurs at the target that requires the session to end without the delivery of further location information, the target sends an LPP Abort to the server for transaction T2 that may optionally include LPP and/or

LPPe error codes. Remaining steps are then omitted.

7. When the duration or other conditions for ending the location information transfer occur, the last LPP *ProvideLocationInformation* message transferred indicates the end of transaction T2. Terminating the transfer as in this step is preferred over the use of an abort (as in step 6) where possible, since additional termination information specific to the location information transfer may then be included.

5.2.2.2 Server Update

Figure 6: shows how the server may update an ongoing a Periodic/Triggered Location Information Transfer that was started according to section 5.2.2.1.

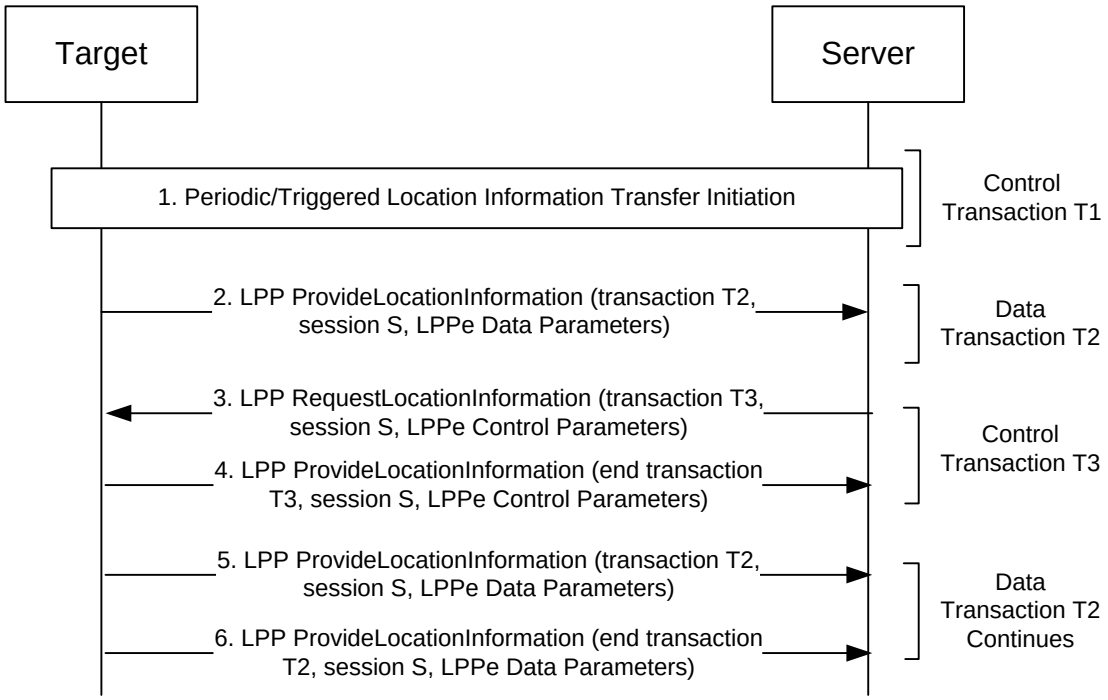


Figure 6: LPPe Periodic/Triggered Location Information transfer procedure with Server Update

1. Steps 1 and 2 of Figure 5 are performed to start an LPPe Periodic/Triggered Location Information transfer procedure with Update and using a session ID S.

2. The target may send zero, one or more LPP *ProvideLocationInformation* messages to the server containing the location information agreed in step 1 and using a transaction ID T2.

3. If, before the delivery of location information has terminated, the server needs to update the type of location information and/or the triggering and periodicity conditions and/or duration or conditions for termination, the server sends an LPP *RequestLocationInformation* message to the target using some available transaction ID T3. The ID T3 shall be different to T2 (if T2 has been started). The message contains the periodic/triggered session ID S, an indication that this is an update request for a Periodic/Triggered Location Information transfer and LPPe control parameters identifying any new type of location information being requested, any new triggering or periodicity conditions for sending it and any new duration or specific conditions for ending the location information transfer. The control parameters shall also indicate whether the previous location information delivery shall continue or be aborted if the new request cannot be supported.

4. The target responds with an LPP *ProvideLocationInformation* message to the server. The message uses the transaction ID T3 and indicates the end of this transaction. The message contains the periodic/triggered session ID S and an indication that this is a response to an update request. The message also contains LPPe control parameters indicating whether or not the update request in step 3 can be supported. If the request can be supported, the control parameters may explicitly confirm or redefine any new type of location information, and new triggering or periodicity parameters

and any new duration or other conditions for ending the location information transfer. Further characteristics of the location information to be delivered may also be provided. If the request in step 3 cannot be supported, then, if requested in step 3, the earlier request in step 1 shall continue via further repetitions of step 2 until it ends normally or is modified by a repetition of step 3 or is aborted. But if requested otherwise in step 3, the earlier request (including transaction T2) shall be aborted at the target without the sending of any further location information to the server. In either case, steps 5 and 6 are then omitted.

5. If the target can support the request in step 3, it ceases to support the request in step 1 following step 4. Note that due to race conditions, one or more repetitions of step 2 may be perceived to occur by the server following step 3 and prior to step 4. When the first updated triggering or periodicity condition occurs following step 4, the target sends an unsolicited LPP *ProvideLocationInformation* message to the server containing the periodic/triggered session ID S, an indication that this is periodic/triggered location information and LPPe data parameters containing the new location information confirmed or defined in step 4. The message continues to uses transaction ID T2.

6. The target may continue to send further LPP *ProvideLocationInformation* messages to the server containing the periodic/triggered session ID S and LPPe data parameters containing the new location information confirmed or redefined in step 4 when each additional triggering or periodicity condition occurs. If the duration or other conditions for ending the location information transfer occur, the last LPP *ProvideLocationInformation* message transferred indicates the end of transaction T2. If before this occurs the server needs to update the type of location information, triggering or periodicity conditions and/or duration or other conditions for terminating the transfer, steps 3 and 4 are repeated.

5.2.2.3 Target Update

Figure 7shows how the target may update an ongoing a Periodic/Triggered Location Information Transfer that was started according to section 5.2.2.1.

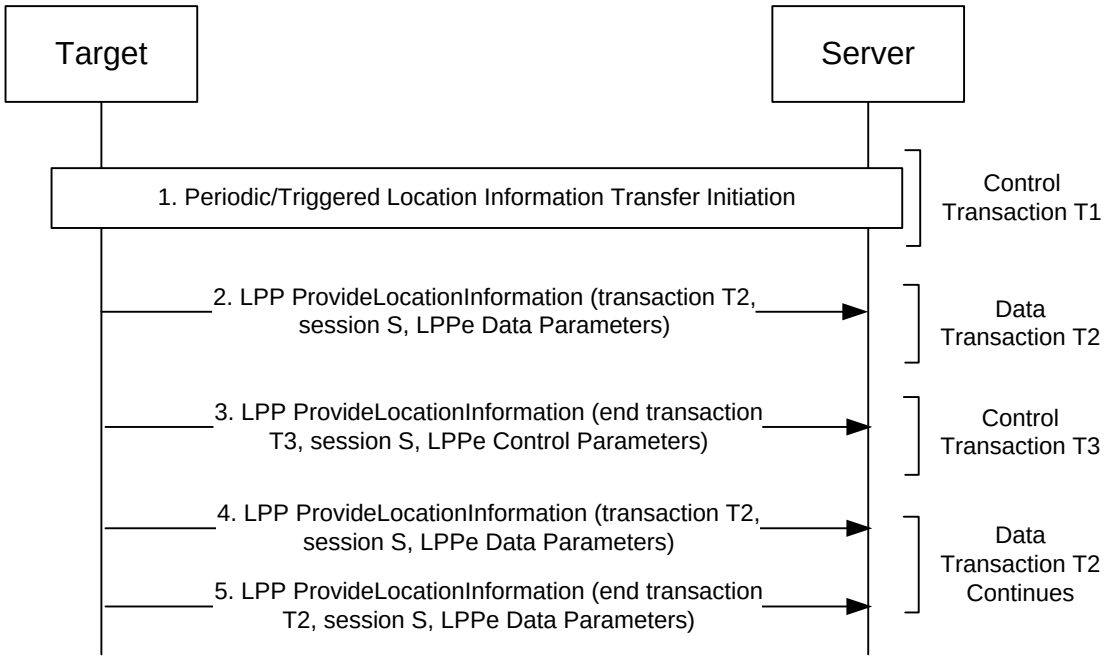


Figure 7 : LPPe Periodic/Triggered Location Information transfer procedure with Target Update

1. Steps 1 and 2 of Figure 5 are performed to start an LPPe Periodic/Triggered Location Information transfer procedure with Update and using a session ID S.

2. The target may send zero, one or more LPP *ProvideLocationInformation* messages to the server containing the location information agreed in step 1 and using a transaction ID T2.

3. If, before the delivery of location information has terminated, the target needs to update the type of location information and/or the triggering and periodicity conditions and/or duration or conditions for termination, the target

sends an unsolicited LPP *ProvideLocationInformation* message to the server using some available transaction ID T3. The ID T3 shall be different to T2 (if T2 has been started). The message contains the periodic/triggered session ID S, an indication that this is a target update for a Periodic/Triggered Location Information transfer and LPPe control parameters identifying any new type of location information to be provided, any new triggering or periodicity conditions for sending it and any new duration or specific conditions for ending the location information transfer. After sending this message, the target ceases to transfer location information according to step 2.

4. When the first updated triggering or periodicity condition occurs (as defined in step 3) following step 3, the target sends an unsolicited LPP *ProvideLocationInformation* message to the server containing the periodic/triggered session ID S, an indication that this is periodic/triggered location information and LPPe data parameters containing the new location information defined in step 3. The message continues to uses transaction ID T2. 5. The target may continue to send further LPP ProvideLocationInformation messages to the server containing the periodic/triggered session ID S and LPPe data parameters containing the new location information defined in step 3 when each additional triggering or periodicity condition occurs. If the duration or other conditions for ending the location information transfer occur, the last LPP ProvideLocationInformation message transferred indicates the end of transaction T2. If before this occurs the target needs to update the type of location information, triggering or periodicity conditions and/or duration or other conditions for terminating the transfer, step 3 is repeated.

5.2.3 Segmented Assistance Data Transfer

This procedure enables a server to transfer a large volume of assistance data (e.g. several Mbytes or more) in separate LPP/LPPe messages at a rate convenient to both the server and target. The procedure may be used to avoid target and server congestion including avoiding interference with other location activities being performed by the target and server. The procedure may be optionally used by a server to transfer any type of assistance data to a target and applies to both solicited and unsolicited transfer. The procedure may be used to transfer assistance data when the amount of assistance data would otherwise result in an LPPe message too large to transfer using the underlying transport protocol or location protocol. For example, the maximum message size for SUPL is restricted to less than 65535 octets. The maximum positioning payload carried within a SUPL message is limited to a size of 60,000 octets. For an LPP/LPPe message larger than this and to be transferred in a SUPL message, segmented assistance data transfer can be used. The procedure makes use of the LPP reliable transport capabilities defined in [LPP].

5.2.3.1 Basic Procedure

The basic procedure supports transfer of assistance data using a connection and, where applicable, a location session between the target and server that remain established during the whole transfer procedure.

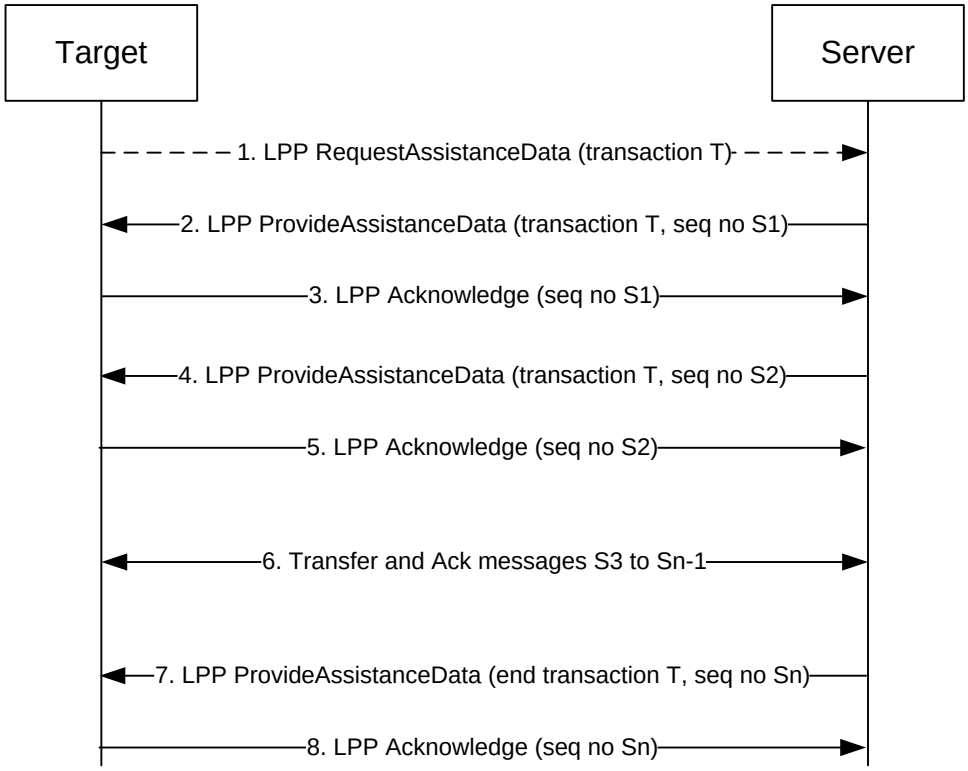


Figure 8: LPPe Segmented Assist ance Data Transfer

1. Optionally, the target sends an LPP request for assistance data to the server as part of a new transaction with transaction ID T. The target may include a preference to transfer the assistance data in a segmented form. Note that such a preference is not mandatory on the server (i.e. can be ignored).

2. The server divides the assistance data to be transferred to the target into n portions. If step 1 was performed, the assistance data comprises everything requested by the target that is available to the server. Each portion of assistance data must be capable of being transferred in a well formed LPP/LPPe Provide Assistance Data message (i.e. a message that can be decoded and interpreted independently of any other message). Assistance data that is part of an octet string can be split between consecutive messages with the target required to concatenate the different portions received into a single octet string. Some assistance data may be duplicated in two or more messages if portions of assistance data that are transferred in different messages must be accompanied by the same mandatory parameters. In that case all appearances of the same mandatory parameter must contain identical data. Optional parameters that appear in more than one segment shall include the same values in each appearance. Other assistance data may need to be split into different messages carrying the same parameters but with different data – e.g. assistance data related to different GNSS SVs. The server sends the first portion of assistance data in an LPP message carrying a reliable transport sequence number S1. The message includes a transaction ID T that is the same as in step 1 if step 1 occurred and does not indicate that transaction T is ended. The message requests an LPP reliable transport acknowledgment.

3. The target recognizes that the assistance data will be transferred in a sequence of LPP messages from the indication in step 2 that the transaction T is not ended. The target acknowledges receipt of the message in step 2 by returning an LPP reliable transport acknowledgment (which shall not be piggybacked on a normal LPP message). The target may use the LPP acknowledgment to flow control the server – e.g. may delay sending the acknowledgment until the target is ready to receive the next message. Note, that the LPP acknowledgment only confirms receipt of the message in step 2 and does not confirm that the message was necessarily correct (e.g. decodable).

4. After and only after receiving the acknowledgment in step 3, the server sends the second portion of assistance data in an LPP message carrying a new sequence number S2 and requesting acknowledgment. If the server does not receive the acknowledgment in step 3 after some timeout period, the server may retransmit the LPP message in step 2 as described in [LPP]. The target discards any duplicate LPP messages (recognized by use of the same sequence number)

but still returns an acknowledgment.

5. The target acknowledges receipt of the message in step 4 with an LPP acknowledgment.
6. The server transfers and the target acknowledges assistance data contained in LPP messages with sequence numbers S3 to Sn-1 by repeating steps 4 and 5. At any time during the transfer, either end may abort the transfer by sending an LPP Abort message to the other end. If the target detects an error in any received LPP message from the server, it may return an LPP Error message indicating the error. This shall also terminate the transfer.
7. The server transfers the last (nth) portion of assistance data in an LPP message with sequence number Sn and requesting an acknowledgment. The server includes an indication that this message ends transaction T.
8. The target acknowledges the message in step 7.

5.2.3.2 Procedure with Resume Capability

With the resume capability, segmented assistance data transfer can be successful even when the connection and/or session between the target and server are released and later reestablished before the transfer is complete.

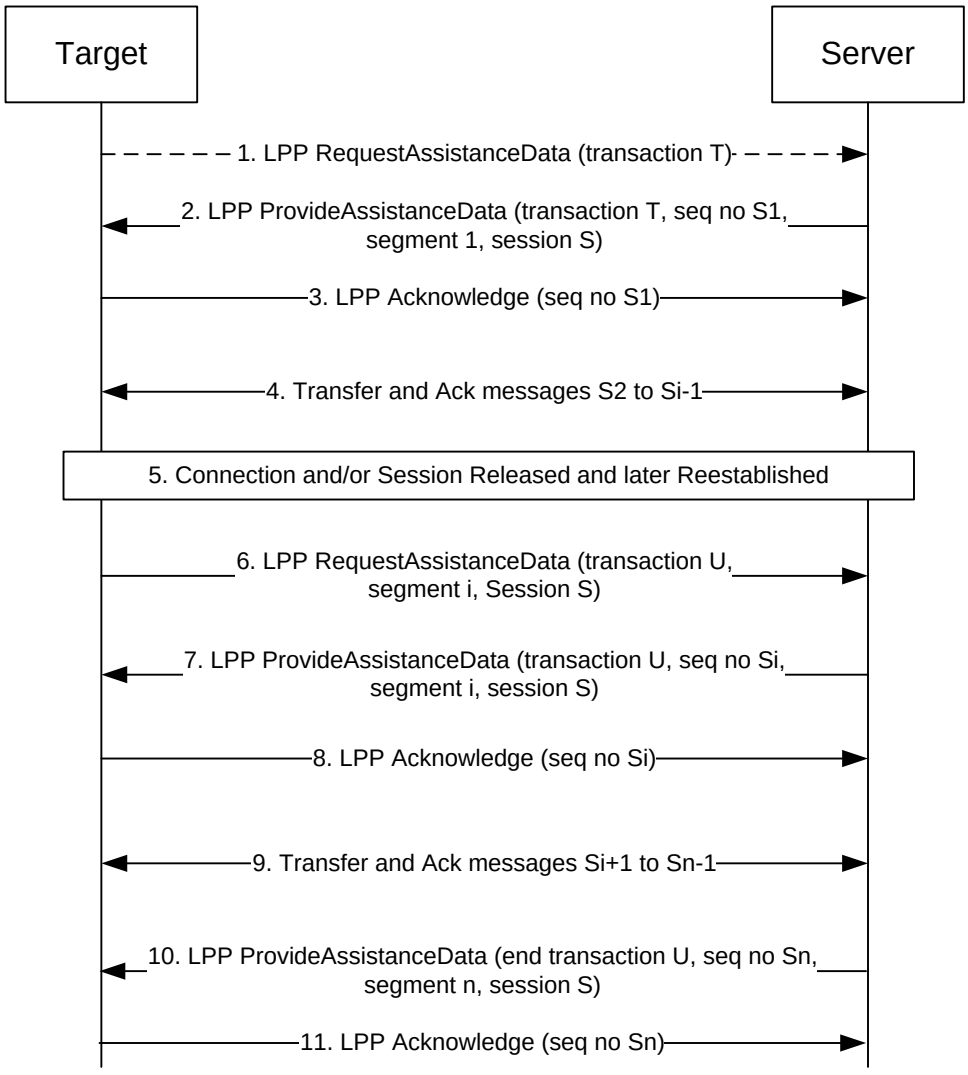


Figure 9: LPPe Segmented Assistance Data Transfer with Resume Capability

1. Optionally, the target sends an LPP request for assistance data to the server as part of a new transaction with transaction ID T. The target may include a preference to transfer the assistance data in a segmented form with resume

capability.

2. This step is the same as step 2 for Figure 8 except that the server assigns a unique session ID S and includes this in the first LPP Provide Assistance Data message together with an indication that this is the first segment of assistance data.
3. This step is the same as step 3 for Figure 8.
4. The server continues to transfer more assistance data to the target as described for Figure 8. The server shall include the session ID S and the segment number in each subsequent Provide Assistance Data message. The server sends segments 2 to i-1. Note that if retransmission occurs, message contents remain the same as for the first transmission (including the sequence number and segment number).
5. The connection (e.g. secure IP connection) and/or session (e.g. SUPL session) between the target and server are released or fail prematurely. The connection and/session are later re-established – e.g. in order to complete the assistance data transfer or for other reasons.
6. When the target recognizes that the session and/or connection have been restored, it sends an LPP Request Assistance Data message to the server containing the session ID S and the segment number i of the next expected LPP Provide Assistance Data message. The message shall contain no request for other assistance data. The transaction ID U for this message need not be the same as the previous transaction ID T.
7. The server resumes the assistance data transfer interrupted by step 5 by sending the i.th portion of assistance data in an LPP Provide Assistance Data message carrying the transaction ID U, a sequence number Si, the session ID S and an indication that this is the i.th segment. The message also requests an acknowledgment. If the server does not receive the request in step 6 (e.g. because the target is not aware that the connection and/or session have been restored to the same server), it may resume the assistance transfer unsolicited. In that case, the server shall begin by sending or resending either LPP message i if message i-1 was acknowledged before step 5 or message i-1 if the acknowledgment for i-1 did not reach the server before step 5. If the server had aborted the transfer (e.g. due to a long timeout period during step 5), it returns an LPP Error message instead of the next assistance data segment and the remaining steps are omitted. If steps 6 and 7 occur in parallel, the server returns an LPP Error for step 6 and the target continues from step 7.
8. The target returns an acknowledgment for the message in step 7 and discards the message if this was already received just before step 5. If the target had aborted the transfer (e.g. due to a long timeout period in step 5), it instead returns an LPP Error message to the server and the remaining steps are omitted.
9. The server transfers segments i+1 to n-1 to the target as in step 4.
10. This step is the same as step 7 for Figure 8 except that the server may include the session ID S and the segment number n.
11. The target acknowledges the message in step 10.

5.2.4 Segmented Location Information Transfer

This procedure enables a target to transfer a large volume of location information in separate LPP/LPPe messages at a rate convenient to both the target and server. The procedure may be used to avoid server and target congestion including avoiding interference with other location activities being performed by the server and target. The procedure may be optionally used by a target to transfer any type of location information to a server and applies to both solicited and unsolicited transfer. The procedure may be used to transfer location information when the amount of location information would otherwise result in an LPPe message too large to transfer using the underlying transport protocol or location protocol. For example, the maximum message size for SUPL is restricted to less than 65335 octets. For an LPP/LPPe message larger than this and to be transferred in a SUPL message, segmented location information transfer can be used. The procedure makes use of the LPP reliable transport capabilities defined in [LPP].

5.2.4.1 Basic Procedure

The basic procedure supports transfer of Location information using a connection and, where applicable, a location session between the server and target that remain established during the whole transfer procedure.

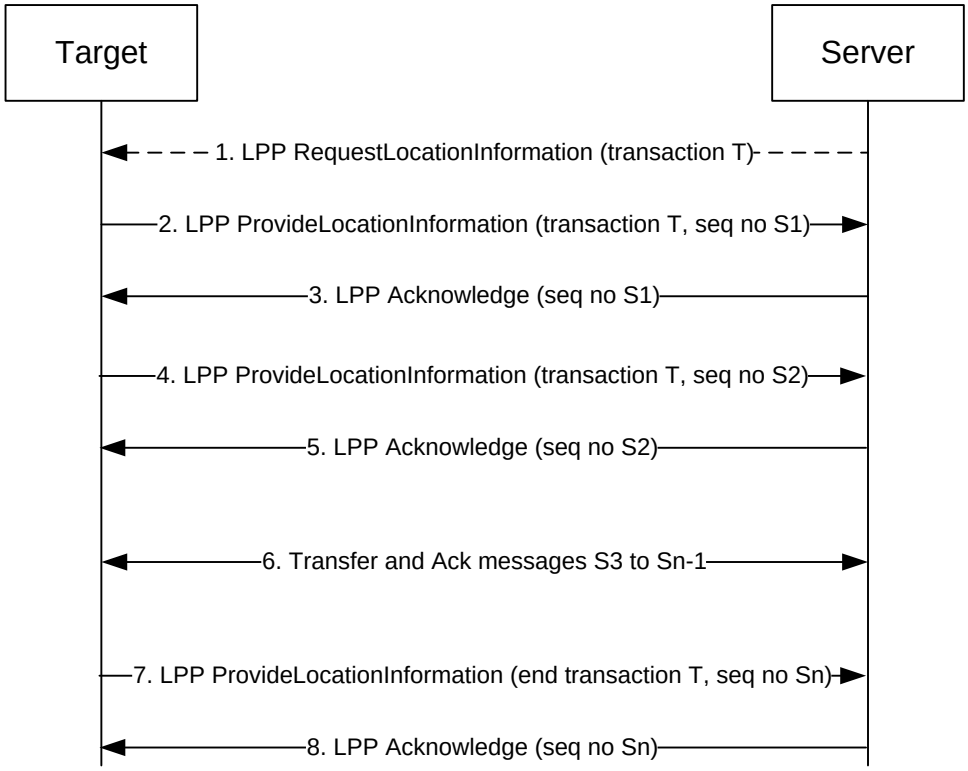


Figure 10: LPPe Segmented Location Information Transfer

1. Optionally, the server sends an LPP request for Location information to the target as part of a new transaction with transaction ID T. The server may include a preference to transfer the location information in a segmented form. Note that such a preference is not mandatory on the target (i.e. can be ignored).
2. The target divides the location information to be transferred to the server into n portions. If step 1 was performed, the location information comprises everything requested by the server that is available to the target Each portion of location information must be capable of being transferred in a well formed LPP/LPPe Provide Location information message (i.e. a message that can be decoded and interpreted independently of any other message). Location information that is part of an octet string can be split between consecutive messages with the server required to concatenate the different portions received into a single octet string. Some location information may be duplicated in two or more messages if portions of location information that are transferred in different messages must be accompanied by the same mandatory parameters. In that case all appearances of the same mandatory parameter must contain identical data. Optional parameters that appear in more than one segment shall include the same values in each appearance. Other location information may need to be split into different messages carrying the same parameters but with different data – e.g. location information related to different GNSS SVs. The target sends the first portion of location information in an LPP message carrying a reliable transport sequence number S1. The message includes a transaction ID T that is the same as in step 1 if step 1 occurred and does not indicate that transaction T is ended. The message requests an LPP reliable transport acknowledgment.
3. The server recognizes that the location information will be transferred in a sequence of LPP messages from the indication in step 2 that the transaction T is not ended. The server acknowledges receipt of the message in step 2 by returning an LPP reliable transport acknowledgment (which shall not be piggybacked on a normal LPP message). The server may use the LPP acknowledgment to flow control the target – e.g. may delay sending the acknowledgment until the server is ready to receive the next message. Note, that the LPP acknowledgment only confirms receipt of the message in step 2 and does not confirm that the message was necessarily correct (e.g. decodable).
4. After and only after receiving the acknowledgment in step 3, the target sends the second portion of location information in an LPP message carrying a new sequence number S2 and requesting acknowledgment. If the target does not receive the acknowledgment in step 3 after some timeout period, the target may retransmit the LPP message

in step 2 as described in [LPP]. The server discards any duplicate LPP messages (recognized by use of the same sequence number) but still returns an acknowledgment.

5. The server acknowledges receipt of the message in step 4 with an LPP acknowledgment.
6. The target transfers and the server acknowledges location information contained in LPP messages with sequence numbers S3 to Sn-1 by repeating steps 4 and 5. At any time during the transfer, either end may abort the transfer by sending an LPP Abort message to the other end. If the server detects an error in any received LPP message from the target, it may return an LPP Error message indicating the error. This shall also terminate the transfer.
7. The target transfers the last (nth) portion of location information in an LPP message with sequence number Sn and requesting an acknowledgment. The target includes an indication that this message ends transaction T.
8. The server acknowledges the message in step 7.

5.2.4.2 Procedure with Resume Capability

With the resume capability, segmented location information transfer can be successful even when the connection and/or session between the server and target are released and later reestablished before the transfer is complete.

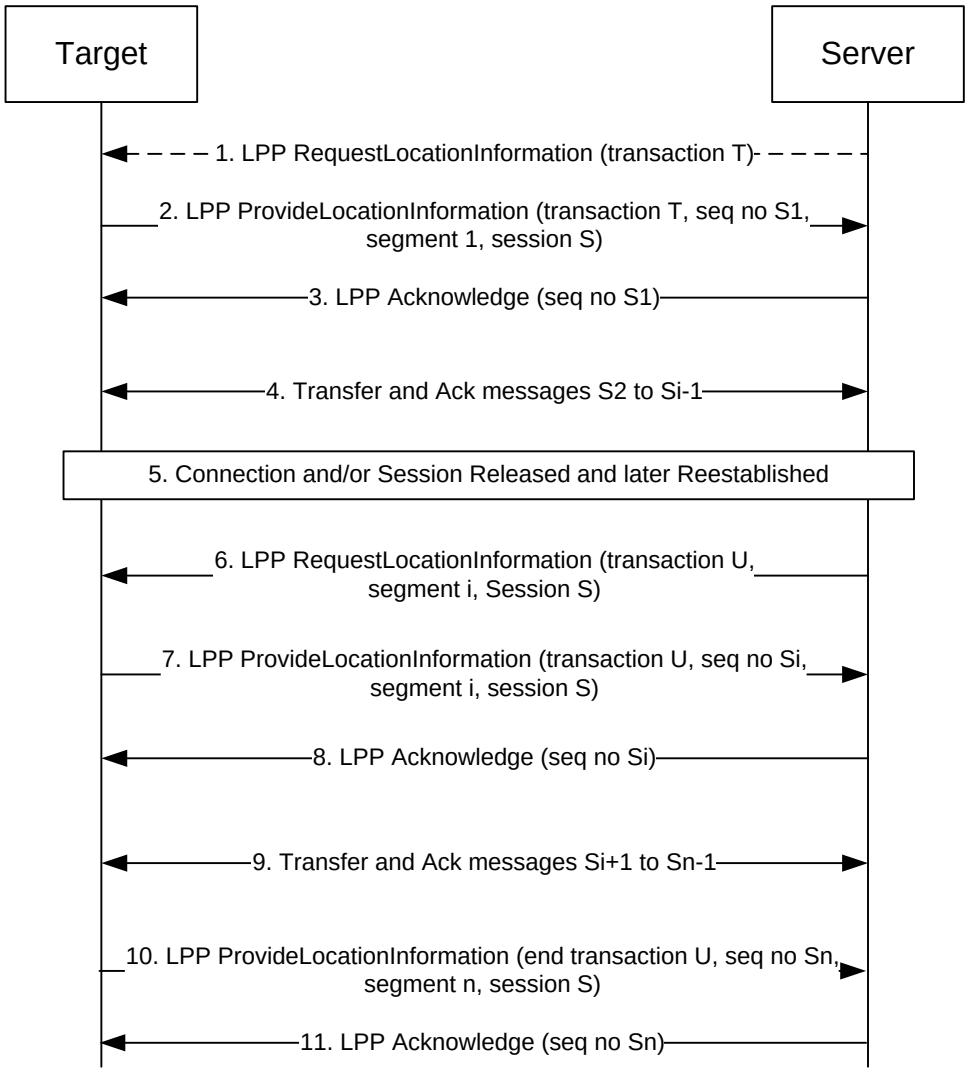


Figure 11: LPPe Segmented Location information Transfer with Resume Capability

1. Optionally, the server sends an LPP request for location information to the target as part of a new transaction with transaction ID T. The server may include a preference to transfer the location information in a segmented form with resume capability.
2. This step is the same as step 2 for Figure 10except that the target assigns a unique session ID S and includes this in the first LPP Provide Location information message together with an indication that this is the first segment of location information.
3. This step is the same as step 3 for Figure 10.
4. The target continues to transfer more location information to the server as described for Figure 10. The target shall include the session ID S and the segment number in each subsequent Provide Location information message. The target sends segments 2 to i-1. Note that if retransmission occurs, message contents remain the same as for the first transmission (including the sequence number and segment number).
5. The connection (e.g. secure IP connection) and/or session (e.g. SUPL session) between the server and target are released or fail prematurely. The connection and/session are later re-established – e.g. in order to complete the location information transfer or for other reasons.
6. When the server recognizes that the session and/or connection have been restored, it sends an LPP Request Location information message to the target containing the session ID S and the segment number i of the next expected LPP Provide Location information message. The message shall contain no request for other location information. The transaction ID U for this message need not be the same as the previous transaction ID T.
7. The target resumes the location information transfer interrupted by step 5 by sending the i.th portion of location information in an LPP Provide Location information message carrying the transaction ID U, a sequence number Si, the session ID S and an indication that this is the i.th segment. The message also requests an acknowledgment. If the target does not receive the request in step 6 (e.g. because the server is not aware that the connection and/or session have been restored to the same target), it may resume the location information transfer unsolicited. In that case, the target shall begin by sending or resending either LPP message i if message i-1 was acknowledged before step 5 or message i-1 if the acknowledgment for i-1 did not reach the target before step 5. If the target had aborted the transfer (e.g. due to a long timeout period during step 5), it returns an LPP Error message instead of the next location information segment and the remaining steps are omitted. If steps 6 and 7 occur in parallel, the target returns an LPP Error for step 6 and the server continues from step 7.
8. The server returns an acknowledgment for the message in step 7 and discards the message if this was already received just before step 5. If the server had aborted the transfer (e.g. due to a long timeout period in step 5), it instead returns an LPP Error message to the target and the remaining steps are omitted.
9. The target transfers segments i+1 to n-1 to the server as in step 4.
10. This step is the same as step 7 for Figure 10 except that the target includes the session ID S and the segment number n.
11. The server acknowledges the message in step 10.

5.2.5 Broadcast of Assistance Data (version 1.1)

5.2.5.1 Broadcast Assistance Data Messages

A broadcast assistance data message may comprise any one of the following messages:

(a) An unencapsulated and unciphered LPP Provide Assistance Data message

(b) An unencapsulated and unciphered LPP/LPPe Provide Assistance Data message

(c) An encapsulated LPP Provide Assistance Data message that may optionally be ciphered and/or digitally signed

(d) An encapsulated LPP/LPPe Provide Assistance Data message that may optionally be ciphered and/or digitally signed

An unencapsulated message consists of either an LPP message without an LPPe extension in case (a) or an LPP message with an LPPe extension in case (b). Unencapsulated broadcast messages are not ciphered or digitally signed and do not contain the additional message portions shown in Figure 12. An encapsulated LPP or LPP/LPPe message may or may not be ciphered and may or may not be digitally signed and contains additional message portions as illustrated in Figure 12.

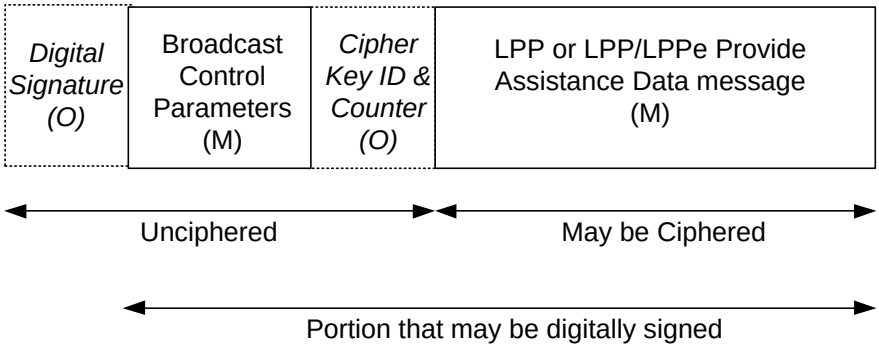


Figure 12: An encapsulated LPP(/LPPe) Broadcast Message with Mandatory (M) and Optional (O) portions

The broadcast control parameters enable detection of an already received broadcast message and contain information on the geographic and time applicability of the message and the types of assistance data included. The cipher key ID and counter value are included when ciphering is used. The message portion contains an LPP or LPP/LPPe Provide Assistance Data message and may be ciphered. A digital signature may be included and, if so, is computed over the entire succeeding message content. The digital signature portion contains the associated public key identifier and appears at the beginning of the message so that a target can determine as soon as reception begins whether it has the correct public key and, if so, can begin the authentication process while message reception is in progress.

A particular broadcast system should, if possible, offer either the unencapsulated variant (cases (a) and (b)) or the encapsulated variant (cases (c) and (d)) but not both over its entire coverage area to enable targets to employ the correct decoding in a consistent manner. LPPe 1.1 capable targets can be informed of the variant being used by a server. Any LPPe 1.0 capable but not LPPe 1.1 capable targets which support broadcast reception will assume the unencapsulated variant and will encounter decoding errors if the encapsulated variant is used. It is expected that a reasonably robust LPPe 1.0 implementation would cease making use of a particular broadcast system once a certain number of consecutive decoding errors were encountered.

5.2.5.2 Broadcast Procedure

Figure 13 shows how the server may broadcast location assistance data to one or more targets. Details of the Broadcast Subsystem including whether it comprises a single entity or multiple entities and its interfaces to the Target and Server are outside the scope of this specification.

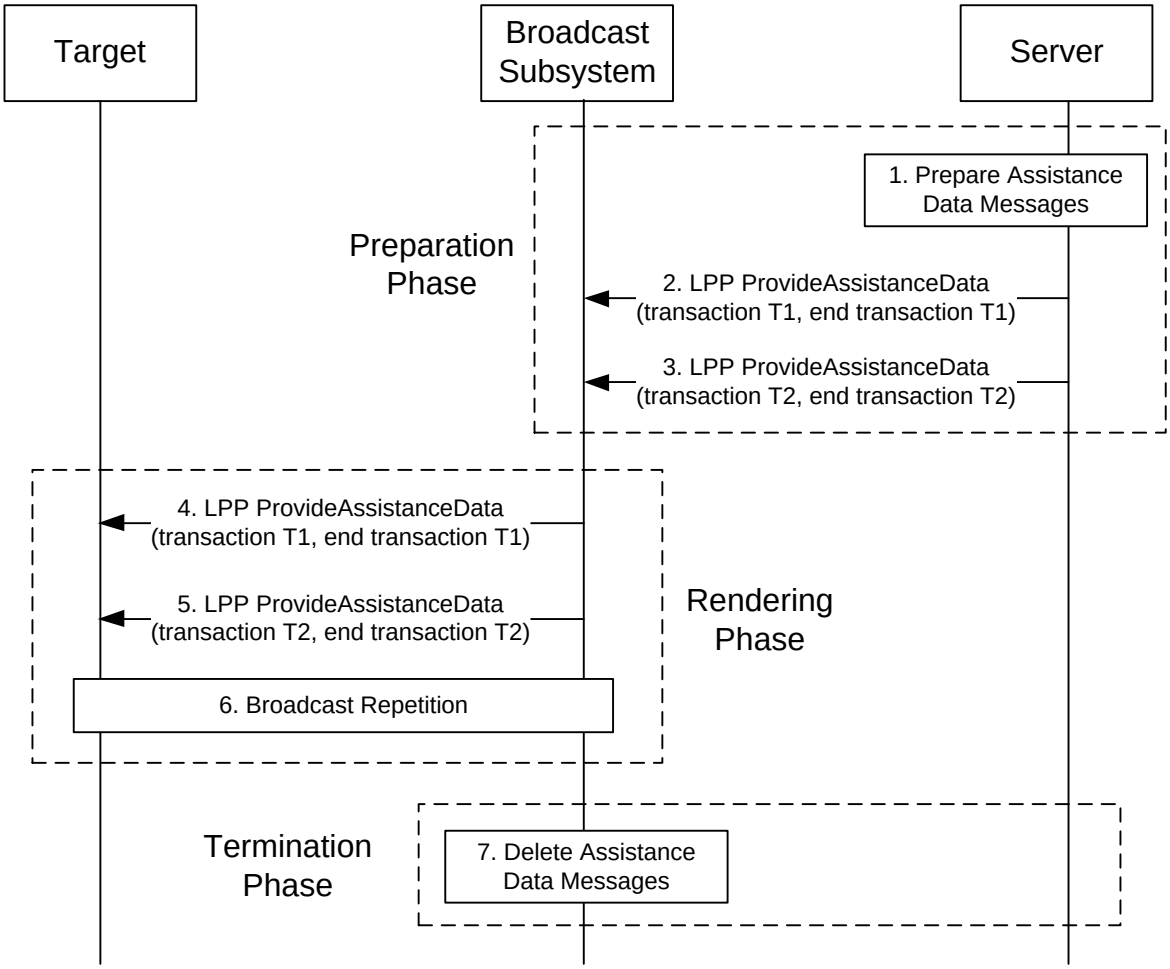


Figure 13: Broadcast of LPP/LPPe Assistance Data

5.2.5.2.1 Preparation Phase

During the preparation phase, LPP/LPPe assistance data is transferred from the server to the Broadcast Subsystem. Depending on the Broadcast Subsystem, the preparation phase may include additional steps not shown in Figure 13 – e.g. exchange of broadcast capabilities between the Broadcast Subsystem and server, a request for specific assistance data from the Broadcast Subsystem to the server, an indication from the Broadcast Subsystem to the server on the current or future available broadcast capacity, an acknowledgment for assistance data successfully transferred to the Broadcast Subsystem from the server. Such additional steps are outside the scope of this specification.

1. The server packages the assistance data to be broadcast into one or more LPP/LPPe Provide Assistance Data messages which may or may not be encapsulated, ciphered and digitally signed as described above. Each LPP/LPPe Provide Assistance Data message is well formed (i.e. can be decoded by a target independently of other messages). The content of each message may be location and/or time specific – i.e. may be applicable to a specific geographic area and/or to a specific period of time. Each message includes an end of transaction indication. Different messages may or may not carry different transaction IDs. Messages shall not include an LPP sequence number or LPP acknowledgment request. The server may include in each message a unique message ID and the validity time and/or the validity area for the included assistance data. The server may optionally cipher some or all messages.
2. The server transports an LPP/LPPe Provide Assistance Data message to the Broadcast Subsystem. The server may include additional information such as broadcast triggering conditions (e.g. periodicity), priority, applicable geographic area and time period. This additional information and the means of transport are outside the scope of this specification.

3. The server may repeat step 2 to transport one or more additional LPP/LPPe Provide Assistance Data messages to the Broadcast Subsystem. Depending on the interface to the Broadcast Subsystem, some or all of the messages in steps 2 and 3 may be sent together as a single package.

5.2.5.2.2 Rendering Phase

During the rendering phase, LPP/LPPe assistance data is broadcast to the target audience. Depending on the Broadcast Subsystem, the rendering phase may include additional steps not shown in Figure 13 – e.g. advance notification by the Broadcast Subsystem to the target audience of the type or types of assistance data to be later broadcast together with scheduling information, requests by interested targets to the Broadcast Subsystem for information to enable subsequent broadcast reception. Such additional steps are outside the scope of this specification.

4. The Broadcast Subsystem broadcasts the LPP/LPPe Provide Assistance Data message received in step 2 without modification. The broadcast may occur from multiple nodes (e.g. multiple base stations) and may be accompanied by additional information identifying, for example, the type of assistance data and use of ciphering. The broadcasting may also employ segmentation with reassembly at the target. Such additional information and use of segmentation is outside the scope of this specification. A target that is both able to and chooses to receive the broadcast may decipher the message if ciphering was employed and decode the message contents. If the message includes a message ID, the target shall discard the message if a broadcast message with the same message ID was received and stored within a period either less than the validity time if a validity time was included or less than 24 hours otherwise. Otherwise, the target should store the assistance data within the message, overwriting any previous assistance data of the same type if needed. The target may use the assistance data to support positioning until such time as the validity time (if included) has expired or the target recognizes it is no longer in the validity area (if included).

   NOTE 1: The server is responsible for ensuring that any message ID assigned to an LPPe message A is not reused for a new LPPe message B before the message validity time for the message A, if included, or 24 hours otherwise have expired since the final broadcast of the message A.

   NOTE 2: Detection of message duplication using a unique message ID does not apply to unencapsulated LPP/LPPe messages. However, message duplication may be recognized in other ways (e.g. via a CRC on the message contents). In the event that message duplication is not recognized, the same assistance data will be re-stored which is inefficient but should not harm target operation.

5. The Broadcast Subsystem broadcasts the one or more additional LPP/LPPe Provide Assistance Data messages received in step 3 in a similar manner to step 4.

6. Broadcast of each message in steps 4 and 5 may be repeated and the periodicity or other triggering conditions for broadcasting may be the same or different for each message.

5.2.5.2.3 Termination Phase

During the termination phase, LPP/LPPe assistance data that no longer needs to be broadcast is removed from the Broadcast Subsystem. Depending on the Broadcast Subsystem, the termination phase may include additional steps not shown in Figure 13 – e.g. notification by the Broadcast Subsystem to the server concerning the actual number of broadcasts for each LPP/LPPe Provide Assistance Data message, the areas in which and/or nodes from which the broadcasts occurred and, if known, the size of the target audience. Such additional steps are outside the scope of this specification.

7. The Broadcast Subsystem ceases broadcasting any message received in step 2 or 3 and deletes it either when instructed by the server or when dictated by scheduling information originally received in step 2 or step 3.

5.2.5.3 Ciphering of Assistance Data

Assistance data that is broadcast may be optionally ciphered using the Advanced Encryption Standard (AES) algorithm [AES] with a 128 bit key and using Counter mode [NIST-800-38A]. An informative description of these algorithms is provided in Appendix F.

The algorithms require specific conventions for bit ordering. The convention followed here is that the bit order applicable to ciphering for an ASN.1 BIT STRING is the bit order defined by ASN.1 (e.g. ITU X.680) where the first bit is the leading bit number zero, the second bit is bit one etc.. The bit order applicable to ciphering for an OCTET STRING starts with the highest order bit of the first octet and follows the bit ordering in each octet (high followed by low bits) and the octet ordering in the OCTET STRING (first octet to last octet). These conventions align with those used in [AES]. The bit ordering applicable to ciphering for a PER encoded LPP/LPPe message is the bit ordering produced by the PER encoding. The same

conventions for bit ordering also apply to authentication in section 5.2.5.4.

The initial counter C1 used to cipher an entire LPP/LPPe message is provided to a target by a server in two portions. The first portion, denoted C0, is provided using point to point mode along with the 128 bit ciphering key and an identifier for both of these values. The second portion, denoted D0, is provided in unciphered form as part of the overall encapsulated message as shown in Figure 11A. A target then obtains C1 as:

C1 = (C0 + D0) mod 2**128 (where all values are treated as non-negative integers)

To obtain any subsequent counter Ci from the previous counter Ci-1 for any message, the following operation is used:

Ci = (Ci-1 + 1) mod 2**128

The value for D0 shall be different for different broadcast messages and shall ensure that the counters derived from C1 for any message are different to the counters for any other message.

5.2.5.4 Authentication of Assistance Data

Assistance data that is broadcast may be optionally digitally signed using the RSASSA-PSS variant of the PKCS#1 v.2.1 RSA method defined in [PKCS#1] and [RFC3447] where [RFC3447] takes precedence in case of any conflict. These references define a set of fixed procedures and some options. The method for LPPe uses as input the procedures and options shown in Table 2.

Authentication Input	**Procedure or Option Used**	**[PKCS#1] and [RFC3447] section**
Encoding method	EMSA-PSS	9.1
Hash Function	SHA-256 [NIST 180-4]	9.1.1, 9.1.2
Mask Generation Function	MGF1 with SHA-1 [NIST 180-4]	B.2.1
Encoding salt length	0 to 32 octets (exact value is provided by the server)	9.1
RSA modulus n (and signature length)	2048 bits	8.1
Signature Generation	RSASSA-PSS-SIGN	8.1.1
Signature Verification	RSASSA-PSS-VERIFY	8.1.2

Table 2: Applicable Authentication Procedures and Options

At a server, a digital signature is computed over an entire broadcast message (that has already been ciphered if ciphering is used) by first hashing and masking the message to yield a message representation of length 2047 bits and then generating a signature of length 2048 bits for the message representation using an RSA private key. At a target, the signature is converted to an expected message representation using the RSA public key and then compared to the actual message representation derived from the received message.

The public key and salt length are provided to a target by a server and assigned a unique ID. This transfer occurs using point to point LPPe before the target begins to receive broadcast assistance data. The server identifies the public key and salt length to be used to authenticate any received broadcast LPPe message by including the unique identifier that was sent earlier point to point.

A target shall authenticate any broadcast message received that contains a digital signature if the target already has the identified public key and salt length. If a server has earlier indicated by point to point means that authentication shall be used for a particular broadcast system, a target shall ignore any broadcast message received that does not contain a digital signature. Broadcast messages that fail authentication shall also be discarded and a target may cease using the associated broadcast system for some implementation dependent time period. When receiving a new broadcast message, a target should

perform verification and decoding in the following order.

(1) Verification from broadcast control parameters that the message is not a duplicate and has a valid time and geographic area applicability.

(2) Verification from broadcast control parameters that the message contains (or may contain) types of assistance data of interest to the target.

(3) Verification that the target has the correct key or keys to perform authentication and deciphering when either or both of these are required.

(4) Verification of any digital signature if included.

(5) Deciphering of message content if ciphering was used.

(6) ASN.1 decoding of message content.

5.3 LPPe Mode

According to 3GPP TS 36.355 [LPP], LPP is always used between a target device and a server and supports three types of procedures each with a specific directionality. Thus, capabilities may only be requested by a server from a target and are only sent from the target to the server; assistance data may only be requested by a target from a server and is only sent from a server to a target; and location information may only be requested by a server from a target and is only sent from a target to a server. These limitations are compatible with a control plane solution between a network server and wireless terminal device but become restrictive for a user plane solution between arbitrary end points. In order to retain compliance to the procedures in [LPP] but enable wider flexibility among LPPe supporting endpoints, a mode is introduced that qualifies how a particular LPP/LPPe procedure is being used. In this version of LPPe, the following modes are supported.

Mode	Description	Applicable LPP Procedures
Normal (default)	The server and target roles are as defined in the LPP transaction ID	All
Reversed	The server and target roles are temporarily reversed in the LPP transaction. Thus, the real server indicates it is the target in the LPP transaction ID and the real target indicates it is the server. Normal LPP rules are then followed concerning the directionality of transactions – e.g. the real server may send an LPP Provide Capabilities to the real target because at an LPPe level the real server appears to be the target for which such a transfer is allowed.	Solicited and Unsolicited Provide Capabilities. Solicited and Unsolicited Provide Location Information

Table 3: LPPe Modes

In this version of LPPe, the reversed mode is applicable to a solicited or unsolicited provision of capabilities from a real server to a real target and to a solicited or unsolicited provision of location information from a real server to a real target. In the first case, the capabilities being requested or provided are those of the server to support the corresponding capabilities in the target (e.g. if the real server indicates a capability C, it means the target can make use of C if the target supports C). In the second case, the location being requested or provided is that of the real target device. Since in LPP and LPPe, the Request and Provide Location Information messages can indicate measurements as well as a location estimate, some restrictions are needed for reversed mode usage as shown in Table 4 and Table 5.

LPP/LPPe Parameter Type	Parameter(s)	Restrictions
LPP Position Method Parameters (A-GNSS, OTDOA, ECID)	All	Not Allowed
LPP Common Parameters	Location Information Type	Shall indicate "Location Estimate Required"
	QoS	Allowed (if not included server may assume any QoS unless high accuracy AGNSS is requested)
	Location Coordinate Types	Allowed
	Velocity Types	Allowed
	All other parameters	Not Allowed
LPPe Position Method Parameters	AGNSS: High Accuracy Method Requested (Boolean set to TRUE)	Allowed
	All other parameters	Not Allowed
LPPe Common Parameters	All	Not Allowed

Table 4: Restriction on use of an LPP/LPPe Request Location Information in Reversed Mode

LPP/LPPe Parameter Type	Parameter(s)	Restrictions
LPP Position Method Parameters (A-GNSS, OTDOA, ECID)	All	Not Allowed
LPP Common Parameters	Location Estimate	Allowed
	Velocity Estimate	Allowed
	Location Error	Allowed
	All other parameters	Not Allowed
LPPe Position Method Parameters	All	Not Allowed
LPPe Common Parameters	High Accuracy Location Estimate	Allowed
	High Accuracy Velocity Estimate	Allowed
	All other parameters	Not Allowed

Table 5: Restriction on use of an LPP/LPPe Provide Location Information in Reversed Mode

An endpoint may only use the Reversed mode when it is known that the other end also supports LPPe. This is to avoid LPP errors for an endpoint receiver that supports LPP but not LPPe.

6. Information Element Abstract Syntax Definition

6.1 General

The contents of each LPPe payload and message extensions are specified in Chapters 6.2 and 6.3, respectively, using ASN.1 to specify the syntax and using tables, when needed, to provide information on the fields and parameters in the message. The information elements carried within the message extensions are specified as type definitions in Chapters 6.4 and 6.5.

When necessary, appendices are used to provide further information, such as formulae, on the usage of the data content.

LPPe re-uses as far as possible the data definitions from [LPP] in order to avoid duplication.

The ASN.1 in this section uses the same format and coding conventions as described in [LPP].

New ASN.1 data types and new parameters within LPPe 1.0 data types that are added in LPPe 1.1 are identified by including a ‘ver1-1” tag in their names. Parameters applicable to LPPe 1.1 that are included within LPPe 1.1 data types do not include such a tag as they implicitly apply to LPPe 1.1 from their context. It should be noted that some parameters within LPPe 1.1 data types may be defined using data types from LPPe 1.0 or from LPP.

6.2 LPPe Message Extension

6.2.1 LPP data type imports

LPPe uses as far as possible the data definitions from the [LPP] in order to avoid duplication. This ASN.1 snippet defines the imports from [LPP].

```
-- ASN1START

OMA-LPPE DEFINITIONS AUTOMATIC TAGS ::=
BEGIN

IMPORTS GNSS-ID, GNSS-SignalID, GNSS-SignalIDs, GNSS-SystemTime, SV-ID,
ECID-SignalMeasurementInformation, CellGlobalIdGERAN, CellGlobalIdEUTRA-AndUTRA,
OTDOA-ReferenceCellInfo, OTDOA-NeighbourCellInfoElement, maxFreqLayers, ARFCN-ValueEUTRA,
Ellipsoid-Point, EllipsoidPointWithAltitude, EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,
NetworkTime, GNSS-ID-Bitmap, ARFCN-ValueUTRA, GNSS-ReferenceTime, LPP-Message,
Ellipsoid-PointWithUncertaintyCircle,   EllipsoidPointWithUncertaintyEllipse,   EllipsoidArc,   Polygon,
ARFCN-ValueEUTRA-v9a0, Velocity FROM LPP-PDU-Definitions;

-- ASN1STOP
```

6.2.2 Message extension definitions

6.2.2.1 Extension of LPP

The IE *OMA-LPPe-MessageExtension* carries version information and the actual data carried in the extension. A single *OMA-LPPe-MessageExtension* carries one extension message and all the LPPe information associated with that type. One *OMA-LPPe-MessageExtension* data type is carried within one EPDU-Body OCTET STRING parameter in an LPP message. Note that PER encoding rules in ITU X.691 [X.691] ensure that the encoded data type will be an integer number of octets.

```
-- ASN1START

OMA-LPPe-MessageExtension ::= SEQUENCE {
    lppeCompatibilityLevel          OMA-LPPe-LPPeCompatibilityLevel,
    lppeVersion                     OMA-LPPe-LPPeVersion,
    lppeMode                        OMA-LPPe-LPPeMode,
    messageExtensionBody            OMA-LPPe-MessageExtensionBody,
    ...
}
```

```
OMA-LPPe-LPPeCompatibilityLevel ::= INTEGER (0..15)

OMA-LPPe-LPPeVersion ::= SEQUENCE {
    majorVersion        INTEGER(0..255),
    minorVersion        INTEGER(0..255)
}

OMA-LPPe-LPPeMode ::= ENUMERATED {
    normal,
    reversed,
    ...
}


OMA-LPPe-MessageExtensionBody ::= CHOICE {
        requestCapabilities         OMA-LPPe-RequestCapabilities,
                                    --Shall only be used in the EPDU in LPP RequestCapabilities
        provideCapabilities         OMA-LPPe-ProvideCapabilities,
                                    --Shall only be used in the EPDU in LPP ProvideCapabilities
        requestAssistanceData       OMA-LPPe-RequestAssistanceData,
                                    --Shall only be used in the EPDU in LPP RequestAssistanceData
        provideAssistanceData       OMA-LPPe-ProvideAssistanceData,
                                    --Shall only be used in the EPDU in LPP ProvideAssistanceData
        requestLocationInformation  OMA-LPPe-RequestLocationInformation,
                                    --Shall only be used in the EPDU in LPP RequestLocationInformation
        provideLocationInformation  OMA-LPPe-ProvideLocationInformation,
                                    --Shall only be used in the EPDU in LPP ProvideLocationInformation
        error                       OMA-LPPe-Error, --Shall only be used in the EPDU in LPP Error
        abort                       OMA-LPPe-Abort, --Shall only be used in the EPDU in LPP Abort
        ...
}

-- ASN1STOP
```

***LPPe-Message Extension* field descriptions**
lppeCompatibilityLevel This field provides the compatibility level of the OMA LPP Extensions Release. The compatibility level in this version of LPPe is zero.
majorVersion This field provides the major version of the OMA LPP Extensions Release, i.e. in the version notation x.y the major version is x. The major version in this version of LPPe is one.
minorVersion This field provides the minor version of the OMA LPP Extensions Release, i.e. in the version notation x.y the minor version is y The minor version in this version of LPPe is one.
lppeMode This field qualifies the server and target roles defined in the LPP transaction ID.

6.2.2.2 Broadcast Message Extension (version 1.1)

The IE *OMA-LPPe-ver1-1-BroadcastContainer* is used to encapsulate ciphered or unciphered LPP and LPP/LPPe Provide Assistance Data messages for delivery via broadcast. The use of this container enables transfer of information needed for ciphering support (e.g. cipher key identifier), message authentication (e.g. public key identifier and digital signature) and information that a target can use to quickly identify the types of information being broadcast, the applicable area and time period and whether the data duplicates data already received. A target that identifies a duplicate broadcast message or assistance data that is not of interest, not applicable or not supported can cease reception without the need to receive, decipher, decode and possibly authenticate the encapsulated LPP or LPP/LPPe message. Except for the encapsulated LPP or LPP/LPPe message, the parameters in an *OMA-LPPe-ver1-1-Broadcast-Container* are not ciphered.

```
-- ASN1START


OMA-LPPe-ver1-1-BroadcastContainer ::= SEQUENCE {
    digitalSignature        OMA-LPPe-ver1-1-DigitalSignature    OPTIONAL,
    messageContents         OCTET STRING,
```

```
    ...
}
-- the messageContents octet string contains the encoded content of data type OMA-LPPe-ver1-1-
BroadcastMessage


OMA-LPPe-ver1-1-BroadcastMessage ::= SEQUENCE {
    broadcastControlIEs     OMA-LPPe-ver1-1-BroadcastControlIEs,
    cipheringIEs            OMA-LPPe-ver1-1-CipheringIEs            OPTIONAL,
    broadcastMessage        OCTET STRING,
    ...
}
-- broadcastMessage contains an unciphered LPP-Message as defined in [LPP] or a ciphered LPP-Message

OMA-LPPe-ver1-1-BroadcastControlIEs ::= SEQUENCE {
    serverID                    OMA-LPPe-ver1-1-ServerID,
    messageID                   OCTET STRING (SIZE (4))         OPTIONAL,
    validity-time               OMA-LPPe-ValidityPeriod         OPTIONAL,   --Cond DigitalSignature
    validity-area               OMA-LPPe-ValidityArea           OPTIONAL,
    broadcastADTypes            OMA-LPPe-ver1-1-BroadcastADTypes    OPTIONAL,
    ...
}

OMA-LPPe-ver1-1-CipheringIEs ::= SEQUENCE {
    cipherSetID                 OMA-LPPe-ver1-1-CipherSetID,
    d0                          BIT STRING (SIZE (1..128)),
    ...
}

OMA-LPPe-ver1-1-DigitalSignature ::= SEQUENCE {
    authenticationSetID         OMA-LPPe-ver1-1-AuthenticationSetID,
    signature                   BIT STRING (SIZE (2048)),
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
DigitalSignature	The field is mandatory present if the IE digitalSignature is included in order to protect against replay attacks. Otherwise, the field is optional.

OMA-LPPe-ver1-1-Broadcast-Container **field descriptions**
digitalSignature This parameter applies to LPPe version 1.1 and contains a digital signature for the octet string composing the messageContents. This parameter is optional and is included only when a target needs to authenticate the message contents. The parameter contains the following fields: authenticationSetID identifies the public key authentication set to be used to authenticate the signature signature the digital signature to be authenticated
messageContents This parameter applies to LPPe version 1.1 and contains the broadcast assistance data and control parameters in the form of an octet string.

OMA-LPPe-ver1-1-Broadcast-Container **field descriptions**
broadcastControlIEs
This parameter applies to LPPe version 1.1 and provides the following parameters applicable to broadcast of an LPP or LPP/LPPe Provide Assistance Data message. serverID defines the server that broadcast the message. This parameter is mandatory. messageID a message ID unique to the server. This parameter is optional and when included can be used together with the serverID to identify receipt of a duplicate message. validity-time the validity time for the broadcast assistance data. This parameter is conditional. validity-area the valid geographic area for the broadcast assistance data. This parameter is optional. broadcastADTypes provides a list of the assistance data types in the message referred to by their labels. This parameter is optional. Assistance data that is associated with its own validity time and /or validity area shall be considered as no longer valid when either this validity time/area or the validity time/area for the whole message no longer apply
cipheringIEs
This parameter applies to LPPe version 1.1 and shall be included if and only if ciphering is used. The parameter contains the following fields: cipherSetID this field identifies a cipher set comprising a cipher key value and the first component C0 of the initial counter C1 d0 this field provides the second component for the initial ciphering counter C1. This field is defined as a bit string with a length of 1 to 128 bits. A target shall first pad out the bit string if less than 128 bits with zeroes in more significant bit positions to achieve 128 bits. C1 is then obtained from D0 and C0 (defined by the cipherSetID) as: C1 = (D0 + C0) mod 2**128 (with all values treated as non-negative integers)
broadcastMessage
This parameter applies to LPPe version 1.1 and is encoded as an octet string that contains either a ciphered or unciphered LPP or LPP/LPPe Provide Assistance Data message. Ciphering is used when and only when the parameter cipheringIEs is included. When ciphering is not used, broadcastMessage contains either an unciphered LPP Provide Assistance Data message as defined in [LPP] or an unciphered LPP/LPPe Provide Assistance Data message as defined in this specification. The LPP or LPP/LPPe Provide Assistance Data message is coded using the LPP-Message definition in [LPP]. When ciphering is used, broadcastMessage contains a ciphered LPP or LPP/LPPe Provide Assistance Data message in the form of an octet string with the bit and octet order corresponding to the output bit order from the ciphering operation as described in section 5.2.5.3. The message that is ciphered corresponds to a complete message as defined by the data type LPP-Message in [LPP].

6.3 Message extension IEs

The present chapter details the message extensions provided by LPPe for the 3GPP-defined LPP.

6.3.1 Request Capabilities

The *OMA-LPPe-RequestCapabilities* message extension requests capability information on LPPe-defined assistance data and individual positioning methods.

```
-- ASN1START

OMA-LPPe-RequestCapabilities ::= SEQUENCE {
    commonIEsRequestCapabilities            OMA-LPPe-CommonIEsRequestCapabilities   OPTIONAL,
    agnss-RequestCapabilities               OMA-LPPe-AGNSS-RequestCapabilities      OPTIONAL,
    otdoa-RequestCapabilities               OMA-LPPe-OTDOA-RequestCapabilities      OPTIONAL,
    eotd-RequestCapabilities                OMA-LPPe-EOTD-RequestCapabilities       OPTIONAL,
    otdoa-utra-RequestCapabilities          OMA-LPPe-OTDOA-UTRA-RequestCapabilities OPTIONAL,
    ecid-lte-RequestCapabilities            OMA-LPPe-ECID-LTE-RequestCapabilities   OPTIONAL,
    ecid-gsm-RequestCapabilities            OMA-LPPe-ECID-GSM-RequestCapabilities   OPTIONAL,
    ecid-utra-RequestCapabilities           OMA-LPPe-ECID-UTRA-RequestCapabilities  OPTIONAL,
    wlan-ap-RequestCapabilities             OMA-LPPe-WLAN-AP-RequestCapabilities    OPTIONAL,
    ecid-wimax-RequestCapabilities          OMA-LPPe-ECID-WiMax-RequestCapabilities OPTIONAL,
```

```
    sensor-RequestCapabilities              OMA-LPPe-Sensor-RequestCapabilities     OPTIONAL,
    srn-RequestCapabilities                 OMA-LPPe-SRN-RequestCapabilities        OPTIONAL,
    ...
}

-- ASN1STOP
```

6.3.2 Provide Capabilities

The *OMA-LPPe-ProvideCapabilities* message extension provides capability information on LPPe-defined assistance data and individual positioning methods.

```
-- ASN1START

OMA-LPPe-ProvideCapabilities::= SEQUENCE {
    commonIEsProvideCapabilities            OMA-LPPe-CommonIEsProvideCapabilities       OPTIONAL,
    agnss-ProvideCapabilities               OMA-LPPe-AGNSS-ProvideCapabilities          OPTIONAL,
    otdoa-ProvideCapabilities               OMA-LPPe-OTDOA-ProvideCapabilities          OPTIONAL,
    eotd-ProvideCapabilities                OMA-LPPe-EOTD-ProvideCapabilities           OPTIONAL,
    otdoa-utra-ProvideCapabilities          OMA-LPPe-OTDOA-UTRA-ProvideCapabilities     OPTIONAL,
    ecid-lte-ProvideCapabilities            OMA-LPPe-ECID-LTE-ProvideCapabilities       OPTIONAL,
    ecid-gsm-ProvideCapabilities            OMA-LPPe-ECID-GSM-ProvideCapabilities       OPTIONAL,
    ecid-utra-ProvideCapabilities           OMA-LPPe-ECID-UTRA-ProvideCapabilities      OPTIONAL,
    wlan-ap-ProvideCapabilities             OMA-LPPe-WLAN-AP-ProvideCapabilities        OPTIONAL,
    ecid-wimax-ProvideCapabilities          OMA-LPPe-ECID-WiMax-ProvideCapabilities     OPTIONAL,
    sensor-ProvideCapabilities              OMA-LPPe-Sensor-ProvideCapabilities         OPTIONAL,
    srn-ProvideCapabilities                 OMA-LPPe-SRN-ProvideCapabilities            OPTIONAL,
    ...
}

-- ASN1STOP
```

6.3.3 Request Assistance Data

The *OMA-LPPe-RequestAssistanceData* message extension requests assistance data for the individual positioning methods.

```
-- ASN1START

OMA-LPPe-RequestAssistanceData ::= SEQUENCE {
    commonIEsRequestAssistanceData          OMA-LPPe-CommonIEsRequestAssistanceData     OPTIONAL,
    agnss-RequestAssistanceData             OMA-LPPe-AGNSS-RequestAssistanceData        OPTIONAL,
    otdoa-RequestAssistanceData             OMA-LPPe-OTDOA-RequestAssistanceData        OPTIONAL,
    eotd-RequestAssistanceData              OMA-LPPe-EOTD-RequestAssistanceData         OPTIONAL,
    otdoa-utra-RequestAssistanceData        OMA-LPPe-OTDOA-UTRA-RequestAssistanceData   OPTIONAL,
    ecid-lte-RequestAssistanceData          OMA-LPPe-ECID-LTE-RequestAssistanceData     OPTIONAL,
    ecid-gsm-RequestAssistanceData          OMA-LPPe-ECID-GSM-RequestAssistanceData     OPTIONAL,
    ecid-utra-RequestAssistanceData         OMA-LPPe-ECID-UTRA-RequestAssistanceData    OPTIONAL,
    wlan-ap-RequestAssistanceData           OMA-LPPe-WLAN-AP-RequestAssistanceData      OPTIONAL,
    sensor-RequestAssistanceData            OMA-LPPe-Sensor-RequestAssistanceData       OPTIONAL,
    srn-RequestAssistanceData               OMA-LPPe-SRN-RequestAssistanceData          OPTIONAL,
    ...
}

-- ASN1STOP
```

6.3.4 Provide Assistance Data

The *OMA-LPPe-ProvideAssistanceData* message extension provides assistance data for the individual positioning methods.

```
-- ASN1START

OMA-LPPe-ProvideAssistanceData ::= SEQUENCE {
    commonIEsProvideAssistanceData          OMA-LPPe-CommonIEsProvideAssistanceData     OPTIONAL,
    agnss-ProvideAssistanceData             OMA-LPPe-AGNSS-ProvideAssistanceData        OPTIONAL,
    otdoa-ProvideAssistanceData             OMA-LPPe-OTDOA-ProvideAssistanceData        OPTIONAL,
    eotd-ProvideAssistanceData              OMA-LPPe-EOTD-ProvideAssistanceData         OPTIONAL,
    otdoa-utra-ProvideAssistanceData        OMA-LPPe-OTDOA-UTRA-ProvideAssistanceData   OPTIONAL,
    ecid-lte-ProvideAssistanceData          OMA-LPPe-ECID-LTE-ProvideAssistanceData     OPTIONAL,
    ecid-gsm-ProvideAssistanceData          OMA-LPPe-ECID-GSM-ProvideAssistanceData     OPTIONAL,
    ecid-utra-ProvideAssistanceData         OMA-LPPe-ECID-UTRA-ProvideAssistanceData    OPTIONAL,
    wlan-ap-ProvideAssistanceData           OMA-LPPe-WLAN-AP-ProvideAssistanceData      OPTIONAL,
```

```
    sensor-ProvideAssistanceData            OMA-LPPe-Sensor-ProvideAssistanceData       OPTIONAL,
    srn-ProvideAssistanceData               OMA-LPPe-SRN-ProvideAssistanceData          OPTIONAL,
    ...
}

-- ASN1STOP
```

6.3.5 Request Location Information

The *OMA-LPPe-RequestLocationInformation* requests position estimates and measurements.

```
-- ASN1START

OMA-LPPe-RequestLocationInformation ::= SEQUENCE {
    commonIEsRequestLocationInformation     OMA-LPPe-CommonIEsRequestLocationInformation    OPTIONAL,
    agnss-RequestLocationInformation        OMA-LPPe-AGNSS-RequestLocationInformation       OPTIONAL,
    otdoa-RequestLocationInformation        OMA-LPPe-OTDOA-RequestLocationInformation       OPTIONAL,
    eotd-RequestLocationInformation         OMA-LPPe-EOTD-RequestLocationInformation        OPTIONAL,
    otdoa-utra-RequestLocationInformation   OMA-LPPe-OTDOA-UTRA-RequestLocationInformation  OPTIONAL,
    ecid-lte-RequestLocationInformation     OMA-LPPe-ECID-LTE-RequestLocationInformation    OPTIONAL,
    ecid-gsm-RequestLocationInformation     OMA-LPPe-ECID-GSM-RequestLocationInformation    OPTIONAL,
    ecid-utra-RequestLocationInformation    OMA-LPPe-ECID-UTRA-RequestLocationInformation   OPTIONAL,
    wlan-ap-RequestLocationInformation      OMA-LPPe-WLAN-AP-RequestLocationInformation     OPTIONAL,
    ecid-wimax-RequestLocationInformation   OMA-LPPe-ECID-WiMax-RequestLocationInformation  OPTIONAL,
    sensor-RequestLocationInformation       OMA-LPPe-Sensor-RequestLocationInformation      OPTIONAL,
    srn-RequestLocationInformation          OMA-LPPe-SRN-RequestLocationInformation         OPTIONAL,
    ...
}

-- ASN1STOP
```

6.3.6 Provide Location Information

The *OMA-LPPe-ProvideLocationInformation* provides position estimates and measurements.

```
-- ASN1START

OMA-LPPe-ProvideLocationInformation ::= SEQUENCE {
    commonIEsProvideLocationInformation     OMA-LPPe-CommonIEsProvideLocationInformation    OPTIONAL,
    agnss-ProvideLocationInformation        OMA-LPPe-AGNSS-ProvideLocationInformation       OPTIONAL,
    otdoa-ProvideLocationInformation        OMA-LPPe-OTDOA-ProvideLocationInformation       OPTIONAL,
    eotd-ProvideLocationInformation         OMA-LPPe-EOTD-ProvideLocationInformation        OPTIONAL,
    otdoa-utra-ProvideLocationInformation   OMA-LPPe-OTDOA-UTRA-ProvideLocationInformation  OPTIONAL,
    ecid-lte-ProvideLocationInformation     OMA-LPPe-ECID-LTE-ProvideLocationInformation    OPTIONAL,
    ecid-gsm-ProvideLocationInformation     OMA-LPPe-ECID-GSM-ProvideLocationInformation    OPTIONAL,
    ecid-utra-ProvideLocationInformation    OMA-LPPe-ECID-UTRA-ProvideLocationInformation   OPTIONAL,
    wlan-ap-ProvideLocationInformastion     OMA-LPPe-WLAN-AP-ProvideLocationInformation     OPTIONAL,
    ecid-wimax-ProvideLocationInformastion  OMA-LPPe-ECID-WiMax-ProvideLocationInformation  OPTIONAL,
    sensor-ProvideLocationInformation       OMA-LPPe-Sensor-ProvideLocationInformation      OPTIONAL,
    srn-ProvideLocationInformation          OMA-LPPe-SRN-ProvideLocationInformation         OPTIONAL,
    ...
}

-- ASN1STOP
```

6.3.7 Abort

The *OMA-LPPe-Abort* carries a request to abort the on-going LPPe procedure.

```
-- ASN1START

OMA-LPPe-Abort ::= SEQUENCE {
    commonIEsAbort      OMA-LPPe-CommonIEsAbort     OPTIONAL,
    agnssAbort          OMA-LPPe-AGNSS-Abort        OPTIONAL,
    ...
}


-- ASN1STOP
```

6.3.8 Error

The *OMA-LPPe-Error* carries information regarding the error in the received LPPe message.

```
-- ASN1START

OMA-LPPe-Error ::= SEQUENCE {
    commonIEsError      OMA-LPPe-CommonIEsError     OPTIONAL,
    ...
}


-- ASN1STOP
```

6.4 LPPe common IEs

The present chapter defines common IEs that are applicable to more than one LPP positioning methods.

6.4.1 LPPe Common low level IEs

– *OMA-LPPe-AssistanceContainer-DataSerialNumber*

The *OMA-LPPe-AssistanceContainer-DataSerialNumber* is used to identify the version of the vendor-/operator-specific assistance data.

```
-- ASN1START

OMA-LPPe-AssistanceContainer-DataSerialNumber ::= SEQUENCE {
    dataSerialNumber        INTEGER(0..4294967295),
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AssistanceContainerID*

The *OMA-LPPe-AssistanceContainerID* is used to identify vendor-/operator-specific assistance data.

```
-- ASN1START

OMA-LPPe-AssistanceContainerID ::= SEQUENCE {
    containerID         INTEGER (0..65535),
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AssistanceContainerProvideList*

The *OMA-LPPe-AssistanceContainerProvideList* is a black-box data container meant for carrying vendor-/operator-specific assistance data.

```
-- ASN1START

OMA-LPPe-AssistanceContainerProvideList ::= SEQUENCE (SIZE(1.. maxAssistanceContainerList)) OF
                                                        OMA-LPPe-AssistanceContainerProvide

maxAssistanceContainerList INTEGER ::= 16
OMA-LPPe-AssistanceContainerProvide ::= SEQUENCE  {
    dataIdentifier          OMA-LPPe-VendorOrOperatorAssistanceDataIdentifier,
    checkOrUpdateOrError    ENUMERATED  {
                                targetHasLatestData,
                                targetDataNotLatest,
                                targetDataNotLatestButServerCannotProvideLatestData,
                                targetHasValidData,
                                targetDataInvalidButServerCannotProvideValidData,
                                serverHasRequestedDataButUnableToProvideTemporarily,
                                serverDoesNotHaveRequestedData,
                                serverDoesNotRecognizeRequestedData,
                                undefined,
```

```
                                ... }                               OPTIONAL,    --Cond CheckorUpdate
    dataResult              CHOICE      {
                                simulationResult    INTEGER(0..5000),
                                data                OMA-LPPe-AssistanceContainerData,
                                 ...
                                 }  OPTIONAL,
    errorCode               OMA-LPPe-AssistanceContainerProvideError    OPTIONAL,
    ...
}

OMA-LPPe-AssistanceContainerData ::= SEQUENCE {
    dataSerialNumber        OMA-LPPe-AssistanceContainer-DataSerialNumber          OPTIONAL,
    data                    OCTET STRING,
    validityPeriod          OMA-LPPe-ValidityPeriod         OPTIONAL,
    validityArea            OMA-LPPe-ValidityArea           OPTIONAL,
    ...
}

OMA-LPPe-AssistanceContainerProvideError ::= SEQUENCE {
    serverError     ENUMERATED { assistanceContainerUnknownDataIdentifier,
                                 assistanceContainerUnknownDataSerialNumber,
                                 assistanceContainerDataTemporarilyUnavailable,
                                 assistanceContainerDataNoLongerSupported,
                                 assistanceContainerVendorOrOperatorNotSupported,
                                ...} OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
CheckOrUpdate	The field is mandatory present if the target requested *CheckOrUpdate*, otherwise it is not present.

OMA-LPPe-AssistanceContainerProvideList **field descriptions**
dataIdentifier This field identifies the data being provided.
checkOrUpdateOrError This field is used to carry the result of comparison between the ***dataSerialNumber*** of the target's data and of the server's data. In case updated data shall be provided to the target, the field shall be set either to "targetDataNotLatest" or "targetDataInvalid" depending upon the request parameters.
dataResult This field carries either the size of data (in simulated case) or the actual data (in data-request case). In case of simulated case, the approximate size of the payload rounded upwards is returned. The scale factor is 1024 OCTETS. Thus in case the payload size is x octets, the number to be returned is ceil(x/1024). A value 5000 means >= 5 120 000 OCTETS. In case simulation was requested together with Check-Or-Update, the '*simulationResult*' parameter is used to carry information on the payload size in case the check-or-update request would be fulfilled. Thus, for instance in case the target has the latest data, then the *checkOrUpdate* field indicates '*targetHasLatestData*' and the payload size is 0 octets. On the other hand, for example, in case the target data is invalid, the *checkOrUpdate* field indicates '*targetDataInvalid*' and the '*simulationResult*' indicates the would-be payload size. In a special case that the target requests for updated data and the target data is not the latest, but the server only knows that the data is not the latest but does not have it, the server shall indicate '*targetDataNotLatestButServerCannotProvideLatestData*' in *checkOrUpdate* field and does not provide *dataResult*. Similarly, in case the target requests for updated data in case the target data is invalid, but the server only knows the data is invalid but does not have valid data, the server shall indicate '*targetDataInvalidButServerCannotProvideValidData*' in *checkOrUpdate* field and does not provide *dataResult*..
dataSerialNumber This field is used to indicate the version of the assistance data. When the server updates the assistance data, it labels the data with a new serial number. The combination of *OMA-LPPe-VendorOrOperatorID* , *dataIdentifier* and *dataSerialNumber* should uniquely and precisely identify the assistance data.

***OMA-LPPe-AssistanceContainerProvideList* field descriptions**
data This field contains the actual data.
validityPeriod This field is used to indicate when (in time) the assistance data is valid.
validityArea This field is used to indicate the geographical area where the assistance data is valid. If this field is missing, the validity area is either self-evident from the data (e.g. a local map) or the data is global.

– *OMA-LPPe-AssistanceContainerRequestList*

The *OMA-LPPe-AssistanceContainerRequestList* is used by the target to request for vendor-/operator-specific assistance data.

```
-- ASN1START


OMA-LPPe-AssistanceContainerRequestList ::= SEQUENCE (SIZE(1..maxAssistanceContainerList)) OF
                                                        OMA-LPPe-AssistanceContainerRequest

OMA-LPPe-AssistanceContainerRequest ::= SEQUENCE  {
    dataIdentifier                  OMA-LPPe-VendorOrOperatorAssistanceDataIdentifier,
    simulatedReq                    BOOLEAN,
    checkOrUpdateReq                OMA-LPPe-AssistanceContainerCheckOrUpdateReq    OPTIONAL,
    validityTimeRequest             OMA-LPPe-ValidityPeriod                         OPTIONAL,
    proprietaryRequestParameters    OCTET STRING                                    OPTIONAL,
    ...
}

OMA-LPPe-AssistanceContainerCheckOrUpdateReq ::= SEQUENCE {
    dataSerialNumber    OMA-LPPe-AssistanceContainer-DataSerialNumber,
    checkLatest         ENUMERATED  {returnLatestIfCurrentNotLatest,
                                     returnUpdateOnlyIfCurrentInvalid,
                                     ... },
    ...
}


-- ASN1STOP
```

***OMA-LPPe-AssistanceContainerRequestList* field descriptions**
dataIdentifier This field identifies the data being requested.
simulatedReq This field is used for indicating if the target only requests information of the approximate size of the generic assistance data instead of requesting the actual data set. TRUE means request for data size and FALSE means request for the actual data.
checkOrUpdateReq This field can be used to request comparison of the ***dataSerialNumber*** of the target's current data with the ***dataSerialNumber*** of the server's data.
validityTimeRequest This field can be used for requesting the desired validity period for the data. This field may only be included for assistance data that has limited validity (e.g. shall not be included for a map data request).
proprietaryRequestParameters This field can be used to carry non-standardized extensions to the request parameters. These are vendor/operator-specific and are associated with the ***dataIdentifier***.
dataSerialNumber This field is used to indicate the version of the assistance data. When the server updates the assistance data, it labels the data with a new serial number. The combination of OMA-LPPe-VendorOrOperatorID , dataIdentifier and dataSerialNumber should uniquely and precisely identify the assistance data.

OMA-LPPe-AssistanceContainerRequestList field descriptions
checkLatest
This field can be used to indicate action when comparing the data version of the target's current data with the server's data. The target can choose the option *ReturnLatestIfCurrentNotLatest* to indicate that if there is more recent data available than that of the target's, that latest data shall be returned. On the other hand, option *ReturnUpdateOnlyIfCurrentInvalid* indicates that if the target's data is still valid, no update should be returned, even if the server would have a new issue of the data.

– *OMA-LPPe-CellLocalIdGERAN*

The IE *OMA-LPPe-CellLocalIdGERAN* specifies the local identity of a cell in GERAN.

```
-- ASN1START

OMA-LPPe-CellLocalIdGERAN ::= SEQUENCE {
    locationAreaCode        BIT STRING (SIZE (16)),
    cellIdentity            BIT STRING (SIZE (16)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-CellLocalIdGERAN field descriptions
locationAreaCode
This field is a fixed length code identifying the location area within a PLMN.
cellIdentity
This field specifies the cell identifier which is unique within the context of the GERAN location area.

– *OMA-LPPe-CellNonUniqueIdGERAN*

The IE *OMA-LPPe-CellNonUniqueIdGERAN* specifies a non-unique Cell Identifier for GERAN.

```
-- ASN1START

OMA-LPPe-CellNonUniqueIDGERAN ::= SEQUENCE {
    bsic        INTEGER (0..63),
    bcch        INTEGER (0..1023),
    ...
}


-- ASN1STOP
```

OMA-LPPe-CellNonUniqueIdGERAN field descriptions
bsic
This field identifies the Base Station Identity Code of the cell.
bcch
This field identifies the Absolute Radio Frequency Channel Number (ARFCN) for the Broadcast Control Channel of the cell.

– *OMA-LPPe-CharArray*

The IE *OMA-LPPe-CharArray* is used to specify a character array.

```
-- ASN1START

OMA-LPPe-CharArray ::= VisibleString(FROM ("a".."z" | "A".."Z" | "0".."9" | ".-"))(SIZE (1..31))

-- ASN1STOP
```

OMA-LPPe-CharArray IE field descriptions
charArray This type defines a character array.

– *OMA-LPPe-CivicLocation*

The IE *OMA-LPPe-CivicLocation* provides a civic location based on [RFC4776].

```
-- ASN1START

OMA-LPPe-CivicLocation ::= SEQUENCE {
    countryCode                 OCTET STRING (SIZE (2)),
    civicAddressElementList     OMA-LPPe-CivicAddressElementList,
    ...
}

OMA-LPPe-CivicAddressElementList ::= SEQUENCE (SIZE (1..128)) OF OMA-LPPe-CivicAddressElement

OMA-LPPe-CivicAddressElement ::= SEQUENCE {
    caType      INTEGER(0..511),
    caValue     OCTET STRING (SIZE (1..256)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-CivicLocation field descriptions
countryCode This parameter provides the two-letter ISO 3166 country code in capital ASCII letters, e.g., DE or US.
caType This field defines the civic address type. Values 0 to 255 are defined in [RFC4776], and values greater than 255 are OMA defined civic address types.
caValue This field defines the civic address value, as described in [RFC4776]. As defined in [RFC4776], this shall be encoded as UTF-8 and may employ mixed case.

– OMA-LPPe-CivicLocation-pidf-lo

The IE *OMA-LPPe-CivicLocation-pidf-lo* provides a civic location based on a UTF-8 encoded PIDF-LO XML document.

```
-- ASN1START

OMA-LPPe-CivicLocation-pidf-lo ::= SEQUENCE {
    civicLocation                   OCTET STRING,
    ...
}

-- ASN1STOP
```

OMA-LPPe-CivicLocation-pidf-lo field descriptions
civicLocation This parameter contains a UTF-8 encoded PIDF-LO XML document as defined in [RFC4119]. The document shall only contain a civic address using the namespaces "urn:ietf:params:xml:ns:pidf:geopriv10:civicAddr" defined in [RFC5139] and "urn:ietf:params:xml:ns:pidf:geopriv10:civicAddr:ext" defined in [RFC6848].

– *OMA-LPPe-Duration*

The *OMA-LPPe-Duration* is used to provide information on / request the duration.

```
-- ASN1START

OMA-LPPe-Duration ::= SEQUENCE {
    duration        INTEGER (1..63),
    durationLSB     INTEGER (1..89) OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-Duration field descriptions
duration The scale factor is 15 min. Range [15, 945 min], i.e. upto 16 hours.
durationLSB Finer granularity duration. The scale factor is 10 seconds. Range [10, 890] seconds.

– *OMA-LPPe-FixedAccessTypes*

The IE *OMA-LPPe-FixedAccessTypes* provides a list of fixed access types.

```
-- ASN1START

OMA-LPPe-FixedAccessTypes ::= BIT STRING {  cable       (0),
                                            dsl         (1),
                                            lan         (2),
                                            pstn        (3),
```

```
                                        other       (4) } (SIZE(1..16))

-- ASN1STOP
```

***OMA-LPPe-FixedAccessTypes* field descriptions**
OMA-LPPe-FixedAccessTypes
This field provides a list of one or more fixed access types. A type is present if the associated bit is set one and absent if set to zero.

– *OMA-LPPe-ver1-1-GroundMorphologyModel*

The *OMA-LPPe-ver1-1-GroundMorpholgyModel* is used to provide models for ground altitude and buildings height. Altitude model and buildings height model are encoded in a grid of points, one grid for each kind of information.

```
-- ASN1START

OMA-LPPe-ver1-1-GroundMorphologyModel  ::= SEQUENCE {
    altitudeModel               OMA-LPPe-ver1-1-AltitudeModel                   OPTIONAL,
    buildingsProfileModel       OMA-LPPe-ver1-1-BuildingHeightModel             OPTIONAL,
    ...
    }



OMA-LPPe-ver1-1-AltitudeModel  ::= SEQUENCE {
    northWestCorner             Ellipsoid-Point, -- coordinates of North West corner of rectangle
    northWestCornerAltitude     INTEGER (-500..9000), -- altitude of North West corner of rectangle
    nrows                       INTEGER (2..1012), -- number of rows along West-East direction
    ncols                       INTEGER (2..1012), -- number of columns along North-South direction
    spanX                       INTEGER (6..14),
    spanY                       INTEGER (6..14),
    deltaAltUnits               INTEGER (1..128), -- units in meter
    altitudeGrid                SEQUENCE SIZE (1..10000) OF DeltaAltitudes,
    ...
    }


OMA-LPPe-ver1-1-BuildingHeightModel  ::= SEQUENCE {
    northWestCorner             Ellipsoid-Point, -- coordinates of North West corner of rectangle
    northWestCornerHeight       INTEGER (0..500), -- hight of North West corner of rectangle
    nrows                       INTEGER (2..1012), -- number of rows along West-East direction
    ncols                       INTEGER (2..1012), -- number of columns along North-South direction
    spanX                       INTEGER (6..14),
    spanY                       INTEGER (6..14),
    deltaHeightUnits            INTEGER (1..16), -- units in meter
    buildingsHeightGrid         SEQUENCE SIZE(1..10000) OF DeltaHeight,
    ...
    }


DeltaAltitudes ::= SEQUENCE {
    deltaAlt            INTEGER (-15..16), -- in units of deltaAltUnits
    numGridPoints       INTEGER (0..255),
    ...
    }


DeltaHeight ::= SEQUENCE {
    deltaHeight         INTEGER (-15..16), -- in units of deltaHeightUnits
    numGridPoints       INTEGER (0..255),
    ...
    }


-- ASN1STOP
```

OMA-LPPe-ver1-1-GroundMorphologyModel field descriptions
altitudeModel This structures describes the behavior of ground altitude information in the selected area
buildingsHeightModel This structures describes the behavior of buildings height information in the selected area
northWestCorner This field specifies the coordinates of the North-West corner of the rectangular grid of points.
northWestCornerAltitude This field specifies the altitude [in meters above sea level] of the North-West corner of the rectangular grid of points.
northWestCornerHeight This field specifies the building height [in meters above street level] of the North-West corner of the rectangular grid of points**.**
spanX, spanY These fields specify the width of the rectangular grid for which ground morphology assistance data (altitude or building height) is provided: The grid is oriented according to W-E and N-S directions, *spanX* defines the width in W-E direction, *spanY* defines the width in N-S direction, The North West corner of the grid is centered in *northWestCorner* point. The width of the rectangular grid in both directions expressed in meters is given by the expresion $\dim_x[m] = 2^{spanX}\ m$ $\dim_y[m] = 2^{spanY}\ m$ Admitted values of the grid sides width are comprised between 64 m and 16384 m

nrows, ncols

The ***nrows*** and ***nclos*** fields define the number of points of the ground morphology grid (altitude or building height).

Columns of the ground morphology grids are evenly spaced straight lines in a N-S direction and rows are evenly spaced straight lines in an E-W direction with the most extreme east and west columns and the most extreme north and south rows aligned with the perimeter of the rectangle defined by ***northWestCorner, spanX*** and ***spanY***. Grid points are then defined by the intersection of rows and columns.

The resolution in N-S and W-E directions of the grid is given, in meters, by dividing the width of the rectangle by (ncols-1) and the height of the rectangle by (nrows-1), respectively.

The range of values for ***nrows*** and ***ncols*** is between 2 and 1012.

deltaAltUnits

This field represents the units of deltaAlt in meters. The value range is from 1 to 128.

deltaHeightUnits

This field represents the units of deltaHeight in meters. The value range is from 1 to 16.

altitudeGrid, deltaAlt, numGridPoints

The **altitudeGrid** structure contains altitude information for the defined grid of points. In the proposed encoding scheme the points are ordered from west to east along rows followed by north to south along columns.

For such ordered points, altitude information is encoded with a sequence of pairs **(D,N)** ***(deltaAlt, numGridPoints***), where:

- ***deltaAlt*** represents the increment of altitude expressed in multiples of ***deltaAltUnits*** with respect to the previous (or initial) altitude value, admitted multiple values are integer numbers in the interval between -15 and 16.
- ***numGridPoint*** represents the number of consecutive points of the grid with the same defined altitude value; Admitted value for ***numGridPoint*** are integer number in the interval between 0 and 255.

For the first grid point of the grid (i.e., the north-west corner), the altitude is defined by the value of ***northWestCornerAltitude***. Within each row of the grid, the altitude values for the point sequence in the interval [n, n +NumGridPoints-1] are given by the expression

$$alt_{[n,n+NumGridPo\,int-1]} = alt_{n-1} + deltaAltUnits * deltaAlt$$

A new (D,N) pair is provided at the beginning (most westerly grid point) of each row, the ***deltaAlt*** for the initial pair in each row is relative to the altitude of the first point in the row just above. In the case of the first row, the first increment value is relative to the NW corner altitude value and it provides information starting from the second point of the first row (as the first one is provided by ***northWestCornerAltitude*** field).

If the difference between two consecutive points is greater than the maximum allowed increment value, then one or more pairs (+16/-15, 0), with maximum incremental value for a sequence of zero points, is added before the final pair (D,N). If the number of point in the sequence, assuming the same value, is greater than 255 one or more pairs (0, 255), with increment value equal to zero and number of points D equal to 255, is added before the final pair (N,D).

buildingHeightGrid, deltaHeight, numGridPoints

Building height is defined relative to ground level where a height of zero means the absence of a building at that point. Ground level altitude is given by OMA-LPPe-ver1-1-AltitudeModel when this is provided. The **buildingHeightGrid** structure contains buildings height information for the defined grid of points. In the proposed encoding schema the points are ordered from west to east along rows followed by north to south along columns.

For such ordered points, building height information is encoded with a sequence of pairs **(D,N)** ***(deltaHeight, numGridPoints***), where:

- ***deltaHeight*** represents the increment of building height expressed in multiples of ***deltaHeightUnits*** with respect to the previous (or initial) altitude value, admitted multiple values are integer numbers in the interval between -15 and 16
- ***numGridPoint*** represents the number of consecutive points of the grid with the same defined altitude value; Admitted value for ***numGridPoint*** are integer number in the interval between 0 and 255.

For the first grid point of the grid (i.e., the north-west corner), the building height is defined by the value of ***northWestCornerHeight***. Within each row of the grid, the height values for the point sequence in the interval [n, n +NumGridPoints-1] are given by expression

$$height_{[n,n+NumGridPoint-1]} = height_{n-1} + deltaHeightUnits * deltaHeight$$

A new (D,N) pair is provided at the beginning (most westerly grid point) of each row, this ***deltaHeight*** for the initial pair of each row is relative to the building height for the first point in the row just above. In the case of the first row, the first increment value is relative to the NW corner height value and it provides information starting from the second point of the first row (as the first one is provided by ***northWestCornerHeight*** field).

If the jump between two consecutive points is grater then the maximum allowed increment value, then one or more pairs (+16/-15, 0), with maximum incremental value for a sequence of zero points, is added before the final pair (D,N). If the number of point in the sequence, assuming the same value, is greater than 255 one or more pairs (0, 255), with increment value equal to zero and number of points D equal to the maximum value, is added before the final pair (N,D).

– *OMA-LPPe-ver1-1-CellGlobalID*

The IE *OMA-LPPe-ver1-1-CellGlobalID* applies only to LPPe 1.1 and provides a global cell ID for GSM, WCDMA or LTE.

```
-- ASN1START

OMA-LPPe-ver1-1-CellGlobalID ::=    CHOICE {
                                eUTRA       CellGlobalIdEUTRA-AndUTRA,
                                uTRA            CellGlobalIdEUTRA-AndUTRA,
                                gSM         CellGlobalIdGERAN,
                                ...
}

-- ASN1STOP
```

***OMA-LPPe-CellGlobalID* field descriptions**
OMA-LPPe-CellGlobalID
This parameter provides a global cell ID for a GSM, WCDMA or LTE cell.

– *OMA-LPPe-HighAccuracy3Dposition*

The *OMA-LPPe-HighAccuracy3Dposition* provides the IE to carry high accuracy 3D position information.

```
-- ASN1START

OMA-LPPe-HighAccuracy3Dposition ::= SEQUENCE {
    latitude                INTEGER(-2147483648..2147483647),
    longitude               INTEGER(-2147483648..2147483647),
    cep                     INTEGER(0..255)                     OPTIONAL,   --Cond NoEllipse
    uncertainty-semimajor   INTEGER(0..255)                     OPTIONAL,   --Cond NoCEP
    uncertainty-semiminor   INTEGER(0..255)                     OPTIONAL,   --Cond NoCEP
    offset-angle            INTEGER(0..179)                     OPTIONAL,   --Cond NoCEP
    confidenceHorizontal    INTEGER(0..99)                      OPTIONAL,
    altitude                INTEGER(-64000..1280000),
```

```
    uncertainty-altitude    INTEGER(0..255),
    confidenceVertical      INTEGER(0..99)                      OPTIONAL,
    ...,
    extUncertRange          BOOLEAN                             OPTIONAL
}


-- ASN1STOP
```

Conditional presence	Explanation
NoEllipse	The field is mandatory present, if no uncertainty ellipse is present. The field shall not be present, if uncertainty ellipse present.
NoCEP	The field is mandatory present, if no CEP is present. The field shall not be present, if CEP present.

***OMA-LPPe-HighAccuracy3Dposition* field descriptions**
latitude Latitude based on WGS84 [GPS-ICD-200D] datum. The relation between the latitude X in range [-90°, 90°] and the coded number N is $$N = floor(\frac{X}{90^{\circ}} 2^{31}),$$ where value $N=2^{31}$ is coded as $N=2^{31}-1$. Resolution 4.7 mm.
longitude Longitude based on WGS84 [GPS-ICD-200D] datum. The relation between the longitude X in range [-180°, 180°) and the coded number N is $$N = floor(\frac{X}{180^{\circ}} 2^{31}).$$ Worst-case resolution (at the Equator) 9.3 mm.

***OMA-LPPe-HighAccuracy3Dposition* field descriptions**

cep

Default uncertainty range:

Horizontal uncertainty expressed as Circular Error Probable expressed as the coded number N (with N from 0..255). The relation between the CEP and N is given by:

$CEP = 0.3*((1+0.02)^N-1)$ meters with N=255 meaning CEP > 45.6,

Range [0, 45.6) meters. The following table shows exemplary mappings from the coded number N to the component:

N	component-value, m
0	0
1	0.006
2	0.121
...	...
100	1.8734
...	...
200	15.4455
...	...
254	45.6
255	>45.6

Extended uncertainty range:

Horizontal uncertainty expressed as Circular Error Probable expressed as the coded number N (with N from 0..255). The relation between the CEP and N is given by:

$CEP = 0.3*((1+0.02594)^N-1)$ meters with N=255 meaning CEP > 200m,

Range [0, 200) meters. The following table shows exemplary mappings from the coded number N to the component:

N	component-value, m
0	0
1	0.008
2	0.016
...	...
100	3.58
...	...
200	50.0
...	...
254	200
255	> 200

OMA-LPPe-HighAccuracy3Dposition **field descriptions**
uncertainty-semimajor *Default* uncertainty range: The semi-major axis of the horizontal uncertainty ellipse expressed as the coded number N (with N from 0..255). The relation between the semi-major axis and N is given by: semi-major axis = $0.3*((1+0.02)^N-1)$ meters with N=255 meaning semi-major axis uncertainty > 45.6m, Range [0, 45.6) meters. *Extended* uncertainty range: The semi-major axis of the horizontal uncertainty ellipse expressed as the coded number N (with N from 0..255). The relation between the semi-major axis and N is given by: semi-major axis = $0.3*((1+0.02594)^N-1)$ meters with N=255 meaning semi-major axis uncertainty > 200m, Range [0, 200) meters.
uncertainty-semiminor *Default* uncertainty range: The semi-minor axis of the horizontal uncertainty ellipse expressed as the coded number N (with N from 0..255). The relation between the semi-minor axis and N is given by: semi-minor axis = $0.3*((1+0.02)^N-1)$ meters with N=255 meaning semi-minor axis uncertainty > 45.6m, Range [0, 45.6) meters. *Extended* uncertainty range: The semi-minor axis of the horizontal uncertainty ellipse expressed as the coded number N (with N from 0..255). The relation between the semi-minor axis and N is given by: semi-minor axis = $0.3*((1+0.02594)^N-1)$ meters with N=255 meaning semi-minor axis uncertainty > 200m, Range [0, 200) meters.
offset-angle The angle of semi-major axis measured clockwise with respect to True North in steps of 1 degree.
confidenceHorizontal This field specifies the horizontal confidence percentage associated with the CEP or Uncertainty Ellipse depending upon which is included. In case horizontal confidence is not included, the confidence is either 68% (in case of CEP) or 39% (in case of ellipse). Note that in case the ellipse represents Gaussian 2D error distribution, 39% corresponds to 1σ confidence. Confidence is encoded as a truncated percentage. An encoded value of 0 therefore represents a confidence C where 0% <=C <1% percent. An encoded value of 1 represents a confidence C where 1%<=C<2%, and so on. An encoded value of 99 represents a confidence C where 99%<=C<100%.
altitude Altitude with respect to WGS84 [GPS-ICD-200D] ellipsoid. Scale factor 2^{-7} meters. Range [-500, 10000] meters,

OMA-LPPe-HighAccuracy3Dposition field descriptions
uncertainty-altitude *Default* uncertainty range: The altitude uncertainty expressed as the coded number N (with N from 0..255). The relation between the altitude uncertainty and N is given by: altitude uncertainty= $0.3*((1+0.02)^N-1)$ meters, with N=255 meaning altitude uncertainty is unknown and unlimited Range [0, 45.6) meters. *Extended* uncertainty range: The altitude uncertainty expressed as the coded number N (with N from 0..255). The relation between the altitude uncertainty and N is given by: altitude uncertainty= $0.3*((1+0.02594)^N-1)$ meters, with N=255 meaning altitude uncertainty is unknown and unlimited Range [0, 200) meters.
confidenceVertical This field specifies the confidence percentage associated with the altitude uncertainty. In case vertical confidence is not included, the confidence is 68% corresponding to 1σ value in case of 1D Gaussian error distribution. Confidence is encoded as a truncated percentage. An encoded value of 0 therefore represents a confidence C where 0% <=C <1% percent. An encoded value of 1 represents a confidence C where 1%<=C<2%, and so on. An encoded value of 99 represents a confidence C where 99%<=C<100%.
extUncertRange This field indicates whether the extended uncertainty range is used (TRUE). This field is optional. Absence of this field indicates that the default uncertainty range is used.

– *OMA-LPPe-HighAccuracy3Dvelocity*

The *OMA-LPPe-HighAccuracy3Dvelocity* provides the IE to carry high accuracy 3D velocity information.

```
-- ASN1START

OMA-LPPe-HighAccuracy3Dvelocity ::= SEQUENCE {
    enu-origin                  OMA-LPPe-HighAccuracy3Dposition     OPTIONAL,
    east-component              INTEGER(0..511),
    negative-sign-east          NULL                                OPTIONAL,   --Cond West
    north-component             INTEGER(0..511),
    negative-sign-north         NULL                                OPTIONAL,   --Cond South
    up-component                INTEGER(0..511),
    negative-sign-up            NULL                                OPTIONAL,   --Cond Down
    cep                         INTEGER(0..255)                     OPTIONAL,   --Cond NoEllipse
    uncertainty-semimajor       INTEGER(0..255)                     OPTIONAL,   --Cond NoCEP,
    uncertainty-semiminor       INTEGER(0..255)                     OPTIONAL,   --Cond NoCEP,
    offset-angle                INTEGER(0..179)                     OPTIONAL,   --Cond NoCEP,
    confidenceHorizontal        INTEGER(0..99)                      OPTIONAL,
    uncertainty-up-component    INTEGER(0..255),
    confidenceUp                INTEGER(0..99)                      OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
West	The field is mandatory present, if the speed component is towards West.
South	The field is mandatory present, if the speed component is towards South.
Down	The field is mandatory present, if the speed component is down.
NoEllipse	The field is mandatory present, if no uncertainty ellipse is present. The field shall not be present, if uncertainty ellipse present.
NoCEP	The field is mandatory present, if no CEP is present. The field shall not be present, if CEP present.

***OMA-LPPe-HighAccuracy3Dvelocity* field descriptions**

enu-origin
Origin of the east-north-up coordinate system, in which the velocity is represented.

east-component
Eastward-speed expressed as the coded number N. The relation between the component and the coded number is given by

component =0.04*((1+0.016)^N-1) m/s,

Range [0, 133.24) m/s. The following table shows exemplary mappings from the coded number N to the speed component:

N	component-value, m/s
0	0
1	0.00064
2	0.0013
...	...
100	0.1556
...	...
200	0.9168
...	...
300	4.6392
....	...
400	22.8446
...	...
500	111.8816
...	...
509	129.0692
510	131.1350
511	133.2338

north-component
Northward-speed expressed as the coded number N. The relation between the component and the coded number is given by

component =0.04*((1+0.016)^N-1) m/s,

Range [0, 133.24) m/s.

up-component
Upward-speed expressed as the coded number N. The relation between the component and the coded number is given by

component =0.04*((1+0.016)^N-1) m/s,

Range [0, 133.24) m/s.

cep
Uncertainty of the horizontal speed expressed as Circular Error Probable expressed as the coded number N. The relation between the CEP and the coded number is given by

CEP = 0.02*((1+0.025)^N-1) m/s,

Range [0, 10.84) m/s.

uncertainty-semimajor
The semi-major axis of the horizontal speed uncertainty ellipse expressed as the coded number N. The relation between the semi-major axis and the coded number is given by

semi-major axis =0.02*((1+0.025)^N-1) m/s,

Range [0, 10.84) m/s.

uncertainty-semiminor
The semi-minor axis of the horizontal speed uncertainty ellipse expressed as the coded number N. The relation between the semi-minor axis and the coded number is given by

semi-minor axis =0.02*((1+0.025)^N-1) m/s,

Range [0, 10.84) m/s.

offset-angle
The clock-wise angle of the semi-major axis with respect to True North in steps of 1 degree.

OMA-LPPe-HighAccuracy3Dvelocity **field descriptions**
confidenceHorizontal This field specifies the horizontal confidence percentage associated with the speed CEP or Velocity Uncertainty Ellipse depending upon which is included. In case horizontal confidence is not included, the confidence is either 68% (in case of CEP) or 39% (in case of ellipse). Note that in case the ellipse represents Gaussian 2D error distribution, 39% corresponds to 1σ confidence. Confidence is encoded as a truncated percentage. An encoded value of 0 therefore represents a confidence C where 0% <=C <1% percent. An encoded value of 1 represents a confidence C where 1%<=C<2%, and so on. An encoded value of 99 represents a confidence C where 99%<=C<100%.
uncertainty-up-component The upward speed uncertainty expressed as the coded number N. The relation between the uncertainty and the coded number is given by $\text{uncertainty}=0.02*((1+0.025)^{N}-1)$ m/s, Range [0, 10.84) m/s.
confidenceUp This field specifies the confidence percentage associated with the upward speed uncertainty. In case upward confidence is not included, the confidence is 68% corresponding to 1σ value in case of 1D Gaussian error distribution. Confidence is encoded as a truncated percentage. An encoded value of 0 therefore represents a confidence C where 0% <=C <1% percent. An encoded value of 1 represents a confidence C where 1%<=C<2%, and so on. An encoded value of 99 represents a confidence C where 99%<=C<100%.

– *OMA-LPPe-LocationInformationContainerID*

The *OMA-LPPe-LocationInformationContainerID* is used to identify vendor-/operator-specific location information.

```
-- ASN1START

OMA-LPPe-LocationInformationContainerID ::= SEQUENCE {
    containerID         INTEGER (0..65535),
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-LocationInformationContainer*

The *OMA-LPPe-LocationInformationContainer* is a black-box data container meant for carrying vendor-/operator-specific location information.

```
-- ASN1START

OMA-LPPe-LocationInformationContainer ::= SEQUENCE {
    vendorOrOperatorID                      OMA-LPPe-VendorOrOperatorID,
    locationInformationContainerDataList    OMA-LPPe-LocationInformationContainerDataList,
    ...
}

OMA-LPPe-LocationInformationContainerDataList ::= SEQUENCE
        (SIZE(1..maxLocationInformationContainerDataList)) OF OMA-LPPe-LocationInformationContainerData

OMA-LPPe-LocationInformationContainerData ::= SEQUENCE {
    containerID         OMA-LPPe-LocationInformationContainerID,
    containerData       OCTET STRING,
    ...
}

-- ASN1STOP
```

OMA-LPPe-LocationInformationContainer field descriptions
vendorOrOperatorID This field defines the vendor/operator providing the location data definition.
locationInformationContainerDataList This parameter specifies a list of location information containers for the specified vendor or operator containing proprietary location information.
containerID This field defines the vendor/operator specific location data.
containerData This field contains proprietary location information.

– *OMA-LPPe-LocationInformationContainerRequest*

The *OMA-LPPe-LocationInformationContainerRequest* is used by the server to request for vendor-/operator-specific location information.

```
-- ASN1START

OMA-LPPe-LocationInformationContainerRequest ::= SEQUENCE {
    vendorOrOperatorID                          OMA-LPPe-VendorOrOperatorID,
    locationInformationContainerRequestList     OMA-LPPe-LocationInformationContainerRequestList,
    ...
}

OMA-LPPe-LocationInformationContainerRequestList ::= SEQUENCE
                                                (SIZE (1.. maxLocationInformationContainerDataList)) OF
                                                       OMA-LPPe-LocationInformationContainerRequestItem

maxLocationInformationContainerDataList INTEGER ::= 10

OMA-LPPe-LocationInformationContainerRequestItem ::= SEQUENCE {
    containerID             OMA-LPPe-LocationInformationContainerID,
    additionalInformation   OCTET STRING                        OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-LocationInformationContainerRequest field descriptions
vendorOrOperatorID This field defines the vendor/operator providing the location data definition.
containerID This field defines the vendor/operator specific location data.
additionalInformation This field contains optional additional and proprietary positioning instructions.

– *OMA-LPPe-MapDataReference*

The IE *OMA-LPPe-Map-Data-Reference* provides a reference to map data that can be obtained from the server using the *OMA-LPPe-AssistanceContainerRequest*.

```
-- ASN1START

OMA-LPPe-MapDataReference ::= SEQUENCE {
    dataID                  OMA-LPPe-AssistanceContainerID,
    mapReference            OCTET STRING (SIZE (1..64)),
    mapSize                 INTEGER (1..5000)       OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-MapDataReference field descriptions
dataID This field provides the value for the *assistanceDataID* parameter in *OMA-LPPe-VendorOrOperatorAssistanceDataIdentifier*. The value may be used to indicate that map data is being requested.
mapReference This field indicates the precise map data being requested and provides either the entire content or the first set of octets in the proprietaryRequestParameters field in the *OMA-LPPe-AssistanceContainerRequest*.
mapSize This field indicates the total size of the map data in units of 1024 octets after rounding up to a multiple of 1024. This field shall be provided if available. Value 5000 denotes that the data size ≥ 5 120 000 octets.

– *OMA-LPPe-Orientation*

The *OMA-LPPe-Orientation* is used to provide information on the object orientation in space.

```
-- ASN1START

OMA-LPPe-Orientation ::= CHOICE {
    eulerAngles     SEQUENCE {
                        alpha   INTEGER (0..359),
                        beta    INTEGER (0..180),
                        gamma   INTEGER (0..359),
                        ...
                        },
    ...
}

-- ASN1STOP
```

OMA-LPPe-Orientation field descriptions
alpha, beta, gamma The three Euler angles specifying the object orientation with respect to the global coordinate system. See Appendix C.9 for further information.

– *OMA-LPPe-ReferencePoint*

The IE *OMA-LPPe-ReferencePoint* provides a well defined location and set of associated attributes relative to which other locations may be defined both in indoor and outdoor environments.

```
-- ASN1START

OMA-LPPe-ReferencePoint ::= SEQUENCE {
    referencePointUniqueID              OMA-LPPe-ReferencePointUniqueID     OPTIONAL,
    referencePointGeographicLocation    CHOICE {
        location3D                              EllipsoidPointWithAltitude,
        location3DwithUncertainty               EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,
        locationwithhighaccuracy                OMA-LPPe-HighAccuracy3Dposition,
        ...
        }                                                                       OPTIONAL,
    referencePointCivicLocation         OMA-LPPe-CivicLocation                  OPTIONAL,
    referencePointFloorLevel            INTEGER (-20..235)                      OPTIONAL,
    relatedReferencePoints              SEQUENCE (SIZE (1..8)) OF
                                            OMA-LPPe-ReferencePointRelationship OPTIONAL,
    mapDataInformation                  OMA-LPPe-MapDataInformation             OPTIONAL,
    ...
}

OMA-LPPe-MapDataInformation ::= SEQUENCE (SIZE (1..16)) OF OMA-LPPe-MapDataReferenceElement

OMA-LPPe-MapDataReferenceElement ::= SEQUENCE {
    mapDataUrl      CHOICE {
        mapDataUrl                  OMA-LPPe-Uri,
        mapDataRef                  OMA-LPPe-MapDataReference
    },
    mapProvider     CHOICE {
        sameAsRefPointProvider      NULL,
        notSameAsRefPointProvider   OMA-LPPe-VendorOrOperatorID,
```

```
        ...
    }                                                                       OPTIONAL,
    mapAssociation  CHOICE {
        referencePointUniqueID      NULL,
        otherID                     VisibleString (SIZE (1..64)),
        mapOffset                   OMA-LPPe-RelativeLocation,
        origin                      NULL,
        ...
    },
    mapHorizontalOrientation                INTEGER (0..359)                OPTIONAL,
    ...
}

OMA-LPPe-ReferencePointRelationship ::= SEQUENCE {
    referencePointUniqueID      OMA-LPPe-ReferencePointUniqueID,
    relativeLocation            OMA-LPPe-RelativeLocation,
    ...
}

-- ASN1STOP
```

OMA-LPPe-ReferencePoint field descriptions
referencePointUniqueID This field provides a unique ID for the reference point, which allows reference points to be referred to in different messages and different parts of the same message without repeating the complete definition. This also allows target devices and servers to reliably indicate the same reference point (e.g. when several reference points have almost the same location).
referencePointGeographicLocation This field provides the geodetic location of the reference point. Either *referencePointGeographicLocation* or *referencePointCivicLocation* or both shall be present unless either *referencePointUniqueID* or *relatedReferencePoints* is present and can be used to determine location (e.g. using a separate definition provided or available for the *referencePointUniqueID* or by making use of information provided for another reference point in *relatedReferencePoints*).
referencePointCivicLocation This field provides a civic location information description of the reference point. Either *referencePointGeographicLocation* or *referencePointCivicLocation* or both shall be present unless either *referencePointUniqueID* or relatedReferencePoints is present and can be used to determine location (e.g. using a separate definition provided or available for the *referencePointUniqueID* or by making use of information provided for another reference point in *relatedReferencePoints*).
referencePointFloorLevel This field provide the floor level or basement level of a reference point that is inside a building or other man made structure (e.g. parking garage) that has well defined floor levels. A value of zero corresponds to ground level, positive values are above ground level and negative values below ground level. Note that this information may duplicate part of *referencePointCivicLocation* (if this is provided) for the benefit of a recipient unable to decode the latter.
relatedReferencePoints This parameter provides a list of other reference points that are related to the reference point being defined. For each related reference point, the unique ID is provided and the relative location with respect to the location of the reference point being defined. Related reference points can be used to relate different sets of assistance data that are each provided in association with a distinct reference point or points.
mapDataInformation This field provides a map reference for the reference point. The reference can include one or more URLs.
mapDataUrl This field is formatted in accordance with [RFC3986] and provides a reference to map data information. The map data information could be an image or dataset that represents a map, floor plan, layout of a building or buildings, layout of a town or city, or any other form of representation/data understood by both the sender and recipient. Map data may be 2D or 3D.
mapDataRef This field provides a map reference specific to a particular map provider that may be used to obtain the map directly from the LPPe server.
mapProvider This parameter identifies the map provider which may be the same as the provider of the reference point or not the same. This parameter is optional. If absent, the map provider is not explicitly defined – e.g. but may be provided as part of the map data or may be inferred from the mapDataUrl.
mapAssociation This parameter provides an exact association between the reference point and a particular location on the map. The choices are: **referencePointUniqueID**: a location identified by the unique ID is defined within the map. Note that the conventions for such identification may be specific to the map provider **otherID**: a location corresponding to the provided visible string is defined within the map. The conventions for such identification may be specific to the map provider. **mapOffset**: the relative location is provided of the origin of the map coordinate system from the reference point. **origin**: the reference point coincides with the map origin.
mapHorizontalOrientation This field specifies the orientation (in degrees clockwise from North) of the map coordinate system with respect to North. If this field is absent, the North direction at the reference point coincides with the North direction of the map coordinate system.

– *OMA-LPPe-ReferencePointUniqueID*

The IE *OMA-LPPe-ReferencePointUniqueID* provides a unique ID for a reference point.

```
-- ASN1START

OMA-LPPe-ReferencePointUniqueID ::= SEQUENCE {
    providerID          OMA-LPPe-VendorOrOperatorID,
    providerAssignedID  OCTET STRING,
    version             INTEGER (1..64),
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ReferencePointUniqueID* field descriptions**
providerID This field identifies the vendor or operator or other service provider with jurisdiction over the reference point.
providerAssignedID This field provides a unique ID relative to the particular provider.
version This field provides the version of the reference point. The initial version of any reference point shall be 1. In case data associated with a given reference point is updated, the version shall be incremented by 1. A target device shall delete all data associated with any previous version of a particular reference point when receiving data associated with a more recent version. For reference points without a unique ID, versioning is not applicable and the reference point cannot be uniquely referred to in any context where it is not completely defined.

– *OMA-LPPe-RelativeLocation*

The *OMA-LPPe-RelativeLocation* IE provides a location, referred to here as the subject location, relative to some known reference location. This can be used to define any of the following:

(a) a fixed location (e.g. of a base station) relative to some other known fixed location

(b) a temporary location (e.g. of a target device) relative to a known fixed or known temporary location (e.g. of another target device)

(c) the change in location of a target device in moving from an initial known reference location to a new subject location.

```
-- ASN1START

OMA-LPPe-RelativeLocation ::= SEQUENCE {
    units                   ENUMERATED {cm,dm, m10, ...}                          OPTIONAL,
    arc-second-units        ENUMERATED {as0-0003, as0-003, as0-03, as0-3, ...}  OPTIONAL,
    relativeNorth           INTEGER (-524288..524287),
    relativeEast            INTEGER (-524288..524287),
    relativeAltitude        OMA-LPPe-RelativeAltitude                           OPTIONAL,
    horizontalUncertainty   OMA-LPPe-HorizontalUncertaintyAndConfidence         OPTIONAL,
    ...
}

OMA-LPPe-HorizontalUncertaintyAndConfidence ::= SEQUENCE {
    uncShape    CHOICE {
                        circle          INTEGER (0..127),
                        ellipse         SEQUENCE {
                            semimajor       INTEGER (0..127),
                            semiminor       INTEGER (0..127),
                            offsetAngle     INTEGER (0..179)
                        },
                        ...
    },
    confidence INTEGER (0..99) OPTIONAL,
    ...
}
```

```
OMA-LPPe-RelativeAltitude ::= SEQUENCE {
    geodeticRelativeAltitude    OMA-LPPe-GeodeticRelativeAltitude   OPTIONAL,
    civicRelativeAltitude       OMA-LPPe-CivicRelativeAltitude      OPTIONAL,
    ...
}

OMA-LPPe-GeodeticRelativeAltitude ::= SEQUENCE {
    geodetic-height-depth       INTEGER (-32768..32767),
    geodetic-uncertainty-and-confidence OMA-LPPe-GeodeticUncertaintyAndConfidence   OPTIONAL,
    ...
}

OMA-LPPe-GeodeticUncertaintyAndConfidence ::= SEQUENCE {
    uncertainty     INTEGER (0..127),
    confidence      INTEGER (0..99)         OPTIONAL,
    ...
}

OMA-LPPe-CivicRelativeAltitude ::= SEQUENCE {
    civic-floors        INTEGER (-255..256),
    civic-uncertainty-and-confidence    OMA-LPPe-CivicUncertaintyAndConfidence OPTIONAL,
    ...
}

OMA-LPPe-CivicUncertaintyAndConfidence ::= SEQUENCE {

    uncertainty     INTEGER (0..127),

    confidence      INTEGER (0..99)         OPTIONAL,

    ...
}

-- ASN1STOP
```

***OMA-LPPe-RelativeLocation* field descriptions**
units This field specifies the units for vertical and optionally horizontal distances. The choices are 1 cm, 1 dm, 1 meter and 10 meters. This field is optional. A unit of 1 meter is specified by the absence of the field.
arc-second-unit] If arc-second-units is present, this field provides the difference in the latitude coordinates of the reference and subject locations. Otherwise, the field provides the equivalent distance along any line of longitude over the surface of the WGS 84 ellipsoid between the reference and subject latitude circles. Note that for distances less than 20 kilometers, a straight line approximation may be used since the error will be less than 2 centimeters. A positive value indicates the subject is north of the reference
relativeNorth If arc-second-units is present, this field provides the difference in the latitude coordinates of the reference and subject locations. Otherwise, the field provides the equivalent distance along any line of longitude over the surface of the WGS 84 ellipsoid between the reference and subject latitude circles.. Note that for distances less than 20 kilometers, a straight line approximation may be used since the error will be less than 2 centimeters. A positive value indicates the subject is north of the reference.
relativeEast If arc-second-units is present, this field provides the difference in the longitude coordinates of the reference and subject locations. Otherwise, the field provides the equivalent distance along the line of latitude for the reference location over the surface of the WGS 84 ellipsoid between the reference and subject longitude circles. Note that for distances less than 10 kilometers, a straight line approximation may be used except near the poles (e.g. greater than 80º latitude). A positive value indicates the subject is east of the reference.

***OMA-LPPe-RelativeLocation* field descriptions**
units   This field specifies the units for vertical and optionally horizontal distances. The choices are 1 cm, 1 dm, 1 meter and 10 meters. This field is optional. A unit of 1 meter is specified by the absence of the field.
arc-second-unit]   If arc-second-units is present, this field provides the difference in the latitude coordinates of the reference and subject locations. Otherwise, the field provides the equivalent distance along any line of longitude over the surface of the WGS 84 ellipsoid between the reference and subject latitude circles. Note that for distances less than 20 kilometers, a straight line approximation may be used since the error will be less than 2 centimeters. A positive value indicates the subject is north of the reference
OMA-LPPe-horizontalUncertaintyAndConfidence   This parameter provides the uncertainty in the relative horizontal location and is expressed either as a circle with given radius or as an ellipse with given semi major axis, semi minor axis and offset angle (0-179 degrees) subtended clockwise from North to the semi major axis. The center of the circle or ellipse is given by a location with the provided relative location to the reference location and the area enclosed defines possible values of the actual subject location. The encoded value N for the length L of the radius of the circle or the semi major axis or semi minor axis of the ellipse satisfies: $L = 5*(1.1^N-1)$ units (range is 0-903314 units for N in the range 0-127)   e.g. for 1 meter units, (N=1, L=0.5m), (N=2, L=1.05m), (N=10, L=8.0m), (N=20, L=28.6m), (N=40, L=221m), (N=60, L=1517m)   Associated with the uncertainty is an optional confidence parameter which gives the confidence that the actual subject location lies within the circle or ellipse defined by the horizontalUncertainty. The default value if confidence is absent is 68 %.   Horizontal uncertainty and confidence shall be provided if available.   Confidence is encoded as a truncated percentage. An encoded value of 0 therefore represents a confidence C where 0% <=C <1% percent. An encoded value of 1 represents a confidence C where 1%<=C<2%, and so on. An encoded value of 99 represents a confidence C where 99%<=C<100%.
geodeticRelativeAltitude   This parameter provides the difference in the altitude coordinates of the reference and subject locations and contains these fields.   geodetic-height-depth (GH): altitude of subject less altitude of reference in the given units   uncertainty (U): uncertainty in GH encoded as an integer N (0-127) with: $U = 10*(1.05^N-1)$ units (range is 0-4900 units for N in the range 0-127)   e.g. for 1 meter units, (N=1, U=0.5m), (N=2, U=1.025m), (N=10, U=6.3m), (N=20, U=16.5m), (N=40, U=60.4m), (N=60, U=176.8m)   confidence: confidence that the actual difference GD of altitude is in the range   GH-U ≤ GD ≤ GH+U. The default if confidence is absent is 68%. A confidence value shall be provided if available.   Confidence is encoded as a truncated percentage. An encoded value of 0 therefore represents a confidence C where 0% <=C <1% percent. An encoded value of 1 represents a confidence C where 1%<=C<2%, and so on. An encoded value of 99 represents a confidence C where 99%<=C<100%.
civicRelativeAltitude   This parameter provides the difference in the floor levels between the reference and subject locations and may only be present for a reference location that contains an explicit floor level (either as part of a civic location or as defined separately). It contains these fields.   civic-floors (CF): floor level of subject less floor level of reference in the given units   uncertainty (U): uncertainty in CF in units of floors   confidence: confidence (1-99%) that the actual difference CD of floor level is in the range   CF-U ≤ CD ≤ CF+U. The default if confidence is absent is 68%. A confidence value shall be provided if available.

– *OMA-LPPe-Session-ID*

The *OMA-LPPe-Session-ID* is used to identify a Periodic/Triggered Assistance Data Transfer with Update procedure.

```
-- ASN1START

OMA-LPPe-Session-ID ::= SEQUENCE {
    provider-ID         OMA-LPPe-VendorOrOperatorID,
    server-ID           OCTET STRING (SIZE(4)),
    session-ID          OCTET STRING (SIZE(4)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-Session-ID field descriptions
provider-ID Vendor or operator who owns or operates the server.
server-ID Server ID unique to the provider.
session-ID Session ID unique to the server.

– *OMA-LPPe-Uri*

The IE *OMA-LPPe-Uri* defines a Uniform Resource Identifier (URI) according to [RFC3986]

```
-- ASN1START

OMA-LPPe-Uri ::= VisibleString (FROM ( "a".."z" | "A".."Z" | "0".."9" | ":" | "/" | "?" | "#" | "[" |
"]" | "@" | "!" | "$" | "&" | "'" | "(" | ")" | "*" | "+" | "," | ";" | "=" | "-" | "." | "_" | "~" |
"%"  ))

-- ASN1STOP
```

– *OMA-LPPe-ver1-1-BroadcastSystemID*

The IE *OMA-LPPe-ver1-1-BroadcastSystemID* is used only in LPPe 1.1 and defines a specific broadcast system.

```
-- ASN1START

OMA-LPPe-ver1-1-BroadcastSystemID ::= CHOICE {
    standardSystemID        INTEGER (1..16),
    proprietarySystemID     SEQUENCE    {
                                vendorOrOperator        OMA-LPPe-VendorOrOperatorID,
                                proprietarySystemID     INTEGER (1..16)
                            },
    ...
}

-- ASN1STOP
```

OMA-LPPe-ver1-1-BroadcastSystemID field descriptions
standardSystemID This field identifies a standardized broadcast system using an integer between 1 and 16. Assignments may be included in a later version of this specification and/or in specifications for particular broadcast systems. Assignments will be unique and will be be allocated by OMNA. The up-to-date allocations are available at [OMNA].
proprietarySystemID This field identifies a broadcast system that is proprietary to a particular vendor or operator. Assignments will be made by the particular vendor or operator and will not be included in this specification.

– *OMA-LPPe-ver1-1-BroadcastADTypes*

The IE *OMA-LPPe-ver1-1-BroadcastADTypes* is used only in LPPe 1.1 and defines a set S of assistance data types associated with delivery via broadcast. The assistance data types are defined using the labels and nesting levels defined in Appendix E. The set S is specified by providing a set of labels for LPP and another set of labels for LPPe referred to here as the LPP and LPPe label sets, respectively. Each label set is composed of one or more label subsets where each label subset contain labels with common initial elements and different final elements – e.g. a label subset such as {L1.L2.X1, L1.L2.X2, L1.L2.X3} where L1 and L2 are common initial elements and X1, X2 and X3 are different final elements. The assistance data items D referred to by the labels in any label subset may or may not contain data items at a deeper nesting level. In the former case, to avoid specifying these additional data items using additional label subsets, it is allowed as an option to indicate whether none or all of the additional data items contained within the data items in D are to be included in S. As an example and referring to the previous example above, if there are additional data items with labels {L1.L2.X2.Y1, L1.L2.X2.Y2, L1.L2.X3.Y3}, it can be specified whether none or all of these data items are to be included in S. As a further convention to reduce the number of label subsets that need to be provided, all assistance data items that are parents of assistance data items explicitly included in S are also included by default in S. As an example and referring to the first example above, data items with labels L1 and L1.L2 would then be included in S.

```
-- ASN1START

OMA-LPPe-ver1-1-BroadcastADTypes ::= SEQUENCE {
    lppLabels       SEQUENCE (SIZE (1..maxLPPLabelSets)) OF OMA-LPPe-ver1-1-LabelSet,
    lppeLabels      SEQUENCE (SIZE (1..maxLPPeLabelSets)) OF OMA-LPPe-ver1-1-LabelSet,
    ...
}

OMA-LPPe-ver1-1-LabelSet ::= SEQUENCE {
    level1-element  SEQUENCE {
                    level1-element-value    INTEGER (1..maxLevel1-element),
                    level2-element  SEQUENCE {
                                    level2-element-value    INTEGER (1..maxLevel2-element),
                                    level3-element  SEQUENCE {
                                                    level3-element-value    INTEGER        (1..maxLevel3-
element),
                                                    ...
                                                    }   OPTIONAL,
                    ...
                    }   OPTIONAL,
    ...
    }   OPTIONAL,
    lastElements    BIT STRING (SIZE (1..maxFinal-element)),
    additionalElements  ENUMERATED { none, all, ... }       OPTIONAL,
    ...
}

maxLevel1-element       INTEGER ::= 32

maxLevel2-element       INTEGER ::= 32

maxLevel3-element       INTEGER ::= 32

maxFinal-element        INTEGER ::= 32

maxLPPLabelSets         INTEGER ::= 64

maxLPPeLabelSets        INTEGER ::= 128

-- ASN1STOP
```

***OMA-LPPe-ver1-1-BroadcastADTypes* field descriptions**
lppLabels This parameter defines the LPP label set representing assistance data types for LPP.
lppeLabels This parameter defines the LPPe label set representing assistance data types for LPPe.

***OMA-LPPe-ver1-1-BroadcastADTypes* field descriptions**	
OMA-LPPe-ver1-1-LabelSet	
This parameter defines a label subset containing labels that differ only in their last elements. This parameter contains the following fields:	
Level1-element-value	defines the common first (level 1) element for each label in the label subset; this field shall only be included when defining labels at nesting level 2 or higher
Level2-element-value	defines the common second (level 2) element for each label in the label subset; this field shall only be included when defining labels at nesting level 3 or higher
Level3-element-value	defines the common third (level 3) element for each label in the label subset; this field shall only be included when defining labels at nesting level 4
lastElements	defines the final elements for the labels in the label subset using a bit string where a one value at bit position n (n = 1 to 32) indicates that element n is present and a zero value or absence of bit n indicates the element is absent. The nesting level for the final label elements is 1 if level1-element is not included and is otherwise 1 greater than highest level element (1, 2 or 3) included within label1-element.
additionalElements	in the case that the labels specified by the preceding fields can be suffixed with additional elements to create further valid labels, this field specifies whether none or all of these further labels are to be included in the final label set (and thus whether none or all of the associated data items are to be included in the set S). If this field is not included and if further label subsets do not indicate which of the further labels are to be included and not included, the inclusion of the further labels is undefined in any context where the associated assistance data types refer to target capabilities or broadcast system support. This field shall not be included when the further labels are specified in additional label subsets.
To enable forward compatibility with later versions of LPP and LPPe, a receiver shall ignore any labels containing elements values that it does not recognize and shall act as if these labels were not included.	

– *OMA-LPPe-ver1-1-AccessNetworkID*

The IE *OMA-LPPe-ver1-1-AccessNetworkID* is used only in LPPe 1.1 and defines a particular access network.

```
-- ASN1START

OMA-LPPe-ver1-1-AccessNetworkID ::= CHOICE {
    gSMAccess       OMA-LPPe-ver1-1-MCC-MNC,
    wCDMAAccess     OMA-LPPe-ver1-1-MCC-MNC,
    lTEAccess       OMA-LPPe-ver1-1-MCC-MNC,
    wiMaxAccess     OMA-LPPe-ver1-1-BSID,
    wLANAccess      OMA-LPPe-WLAN-AP-ID,
    ...
}

OMA-LPPe-ver1-1-MCC-MNC ::= SEQUENCE {
    mcc     SEQUENCE (SIZE (3)) OF INTEGER (0..9),
    mnc     SEQUENCE (SIZE (2..3)) OF INTEGER (0..9),
    ...
}

OMA-LPPe-ver1-1-BSID ::= SEQUENCE {
    bsID-MSB      BIT STRING (SIZE(24)),
    bsID-LSB      BIT STRING (SIZE(24)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-ver1-1-AccessNetworkID field descriptions
gsmAccess This parameter provides the operator MCC and MNC values for GSM access.
wCDMAAccess This parameter provides the operator MCC and MNC values for WCDMA access.
lTEAccess This parameter provides the operator MCC and MNC values for LTE access.
wiMaxAccess This parameter provides the operator BSID value for WiMax access.
wLAnAccess This parameter provides the operator WLAN AP ID for WLAN access.

– *OMA-LPPe-ver1-1-AuthenticationSetID*

The IE *OMA-LPPe-ver1-1-AuthenticationSetID* is used only in LPPe 1.1 and uniquely identifies an authentication set comprising an RSA public key value. A server shall not reuse a particular authentication set ID for a new authentication set for a period of at least 24 hours following usage for the last broadcast for a previous authentication set. Note that because authentication public-private key pairs can be expensive to establish, a small number of IDs can suffice.

```
-- ASN1START

OMA-LPPe-ver1-1-AuthenticationSetID ::= INTEGER (0..255)

-- ASN1STOP
```

OMA-LPPe-ver1-1-AuthenticationSetID field descriptions
OMA-LPPe-ver1-1-AuthenticationSetID This parameter provides an authentication set ID as an integer between 0 and 255.

– *OMA-LPPe-ver1-1-AuthenticationSet*

The IE *OMA-LPPe-ver1-1-AuthenticationSet* is used only in LPPe 1.1 and defines an authentication set comprising an authentication ID, an RSA public key value and a salt length for encoding.

```
-- ASN1START

OMA-LPPe-ver1-1-AuthenticationSet ::= SEQUENCE {
    authenticationSetID     OMA-LPPe-ver1-1-AuthenticationSetID,
    rsaPublicKey            SEQUENCE    {
                                modulus         BIT STRING (SIZE (2048)),
                                exponent        BIT STRING (SIZE (2..2048))
                            },
    saltLength              INTEGER (0..32)
    ...
}

-- ASN1STOP
```

OMA-LPPe-ver1-1-AuthenticationSet field descriptions
authenticationSetID This parameter provides the authentication set ID.
rsaPublicKey This parameter provides an RSA public key consisting of a 2048 bit modulus and a 2 to 2048 bit exponent. Integer versions of the modulus and exponent are obtained by truncating any leading zero bits and treating the remaining bits as the binary representation of a positive integer.
saltLength This parameter provides the length in octets of the salt value used for the EMSA-PSS encoding method defined in [PKCS#1].

– *OMA-LPPe-ver1-1-CipherSetID*

The IE *OMA-LPPe-ver1-1-CipherSetID* is used only in LPPe 1.1 and uniquely identifies a cipher set comprising a ciphering key value and first component C0 for the initial ciphering counter C1. A server shall not reuse a particular cipher set ID for a new cipher set for a period of at least 24 hours following usage for the last broadcast for a previous cipher set.

```
-- ASN1START

OMA-LPPe-ver1-1-CipherSetID ::= INTEGER (0..65535)

-- ASN1STOP
```

***OMA-LPPe-ver1-1-CipherSetID* field descriptions**
OMA-LPPe-ver1-1-CipherSetID This parameter provides a cipher set ID as an integer between 0 and 65535.

– *OMA-LPPe-ver1-1-CipherSet*

The IE *OMA-LPPe-ver1-1-CipherSet* is used only in LPPe 1.1 and defines a cipher set comprising a cipher set ID, a ciphering key value and first component C0 for the initial ciphering counter C1.

```
-- ASN1START

OMA-LPPe-ver1-1-CipherSet ::= SEQUENCE {
    cipherSetID             OMA-LPPe-ver1-1-CipherSetID,
    cipherKey               BIT STRING (SIZE (128)),
    c0                      BIT STRING (SIZE (1..128)),
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ver1-1-CipherSet* field descriptions**
cipherSetID This parameter provides the cipher set ID.
cipherKey This parameter provides a cipher key as a bit string of size 128 bits.
c0 This parameter provides the first component of the initial ciphering counter C1. If less than 128 bits, c0 is padded out with zeroes in more significant bit positions to achieve 128 bits.

– *OMA-LPPe-ver1-1-ServerID*

The IE *OMA-LPPe-ver1-1-ServerID* is used only in LPPe 1.1 and defines the identity of a server.

```
-- ASN1START

OMA-LPPe-ver1-1-ServerID ::= SEQUENCE {
    provider-ID         OMA-LPPe-VendorOrOperatorID,
    server-ID           OCTET STRING (SIZE(4)),
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ver1-1-ServerID* field descriptions**
provider-ID This parameter defines the vendor or operator ID.
server-ID This parameter defines the server ID for the particular vendor or operator.

– *OMA-LPPe-ValidityArea*

The IE *OMA-LPPe-ValidityArea* is used to define the area in which the given data (e.g. a local troposphere model or a local ionosphere model) are valid. The validity area is constructed with grid regions using Run-Length Encoding as specified in Appendix C.1. The parameters *areaWidth* and *rleList* are optional. If these parameters are left out, the validity area gets its simplest form: a rectangle in spherical coordinates.

```
-- ASN1START

OMA-LPPe-ValidityArea ::= SEQUENCE {
    regionSizeInv           INTEGER (1..255),
    areaWidth               INTEGER (2..9180)       OPTIONAL,
    codedLatOfNWCorner      INTEGER (0..4589),
    codedLonOfNWCorner      INTEGER (0..9179),
    rleList                 OMA-LPPe-RleList        OPTIONAL,
    ...
}

OMA-LPPe-RleList ::= SEQUENCE (SIZE(1..65535)) OF INTEGER (0..255)

-- ASN1STOP
```

OMA-LPPe-ValidityArea **field descriptions**
regionSizeInv   This field specifies the inverse of the size of each side of the region in degrees.   For value N the size is 10/N degrees.
areaWidth   This field specifies the number of regions in the area in East-West direction. If the field is not present, the value is 1.
codedLatOfNWCorner   This field specifies the latitude of the North-West corner of the area, encoded as explained in Appendix C.1.
codedLonOfNWCorner   This field specifies the longitude of the North-West corner of the area, encoded as explained in Appendix C.1.
rleList   This field lists the regions in which the data is valid. If the field is not present, the data is valid in all the regions in the area. The field is not valid (not included or ignored), when the IE *OMA-LPPe-ValidityArea* is included in the IE *OMA-LPPe-AGNSS-IonoStormIndication*.

– *OMA-LPPe-ValidityPeriod*

The IE *OMA-LPPe-ValidityPeriod* is used to define the validity time of the given assistance data.

```
-- ASN1START

OMA-LPPe-ValidityPeriod ::= SEQUENCE {
    beginTime       GNSS-SystemTime,
    beginTimeAlt    INTEGER (0..2881)   OPTIONAL,
    duration        INTEGER (1..2881),
    ...
}

-- ASN1STOP
```

OMA-LPPe-ValidityPeriod **field descriptions**
beginTime   This field specifies the start time of the validity period.
beginTimeAlt   This field specifies the alternative start time. It may be used by target if it lacks information of the current GNSS-SystemTime. The start time is is relative the time the message was received.   The scale factor is 15 min. Range from 0 minutes to 43215 min = 30 days.
duration   This field specifies the duration of the validity period after the beginTime.   The scale factor is 15 min. Range from 15 minutes to 43215 min = 30 days.

– *OMA-LPPe-VendorOrOperatorAssistanceDataIdentifier*

The *OMA-LPPe-VendorOrOperatorAssistanceDataIdentifier* is used to identify vendor-/operator-specific assistance data.

```
-- ASN1START

OMA-LPPe-VendorOrOperatorAssistanceDataIdentifier ::= SEQUENCE {
    vendorOrOperatorID      OMA-LPPe-VendorOrOperatorID,
    assistanceDataID        OMA-LPPe-AssistanceContainerID,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-VendorOrOperatorAssistanceDataIdentifier* field descriptions**
vendorOrOperatorID This field specifies the identification of the vendor/operator of the proprietary data.
assistanceDataID This field identifies the proprietary data. Data IDs are managed by the vendor/operator.

– *OMA-LPPe-VendorOrOperatorID*

The *OMA-LPPe-VendorOrOperatorID* is used to identify the vendor/operator using the proprietary data content. Two methods are provided. The first is a method, in which the vendor/operator identifier is standardized. The alternative method is not to use the standardized vendor/operator identifier, but the generalized method based on the CRC sum of the vendor/operator name.

```
-- ASN1START

OMA-LPPe-VendorOrOperatorID ::= CHOICE {
    standard-VendorOrOperatorID         INTEGER(1..1024),
    nonStandard-VendorOrOperatorID      OMA-LPPe-NonStandard-VendorOrOperatorID,
    ...
}


OMA-LPPe-NonStandard-VendorOrOperatorID ::= SEQUENCE {
    encodedID                   INTEGER(0..65535),
    visibleIdentification       OMA-LPPe-CharArray  OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-VendorOrOperatorID field descriptions
standard-VendorOrOperatorID This field identifies the vendor/operator of the proprietary data. The ID allocations are maintained by OMNA [OMNA] and the up-to-date allocations are available at http://www.openmobilealliance.org/Tech/OMNA/OMNA-vendor-operator-ID.aspx
nonStandard-VendorOrOperatorID This field provides one method of identifying the vendor/operator in the absence of the standard ID.
encodedID This field specifies the CRC-16 IBM encoded name of the vendor written in lower case. CRC-16 IBM is described in Appendix C.8.
visibleIdentification This field specifies the vendor/operator visible identification.

– *OMA-LPPe-WirelessAccessTypes*

The IE *OMA-LPPe-WirelessAccessTypes* provides a list of wireless access types.

```
-- ASN1START

OMA-LPPe-WirelessAccessTypes ::= BIT STRING {   gsm         (0),
                                                utra        (1),
                                                lte         (2),
                                                wimax       (3),
                                                wifi        (4),
                                                other       (5),
                                                nr          (6) } (SIZE(1..16))

-- ASN1STOP
```

OMA-LPPe-WirelessAccessTypes field descriptions
OMA-LPPe-WirelessAccessTypes This field provides a list of one or more wireless access types. A type is present if the associated bit is set to one and absent if set to zero.

– *OMA-LPPe-WLAN-AP-ID*

The IE *OMA-LPPe-WLAN-AP-ID* defines the identity of a WLAN access point.

```
-- ASN1START

OMA-LPPe-WLAN-AP-ID ::= SEQUENCE {
    apMacAddress            BIT STRING ( SIZE (48) ),
    ...
}

-- ASN1STOP
```

OMA-LPPe-WLAN-AP-ID field descriptions
apMacAddress This field provides the 48-bit MAC address of the WLAN AP.

– *OMA-LPPe-WLAN-AP-Type*

The IE *OMA-LPPe-WLAN-AP-Type* defines the type of a particular WLAN access point.

```
-- ASN1START

OMA-LPPe-WLAN-AP-Type ::= ENUMERATED {
    ieee802-11a,
    ieee802-11b,
    ieee802-11g,
    ieee802-11n,
    ...,
```

```
    ieee802-11ac,
    ieee802-11ad
}

-- ASN1STOP
```

– *OMA-LPPe-WLAN-AP-Type-List*

The IE *OMA-LPPe-WLAN-AP-Type-List* provides a list of one or more WLAN AP types.

```
-- ASN1START

OMA-LPPe-WLAN-AP-Type-List ::= BIT STRING {
    ieee802-11a (0),
    ieee802-11b (1),
    ieee802-11g (2),
    ieee802-11n (3),
    ieee802-11ac (4),
    ieee802-11ad (5)} (SIZE (1..16))

-- ASN1STOP
```

***OMA-LPPe-WLAN-AP-Type-List* field descriptions**
OMA-LPPe-WLAN-AP-Type-List
This field provides a list of one or more WLAN AP types. A type is present if the associated bit is set one and absent if set to zero.

– *OMA-LPPe -WLANFemtoCoverageArea*

The IE *OMA-LPPe-WLANFemtoCoverageArea* provides information on the coverage area of a WLAN AP or Femto. The coverage area may be the coverage area of radio signals from the WLAN AP or Femto or may be defined according to the expected distribution of users within the coverage area.

```
-- ASN1START

OMA-LPPe-WLANFemtoCoverageArea ::= SEQUENCE {
    truncation          INTEGER(-127..128)                                          OPTIONAL,
    areaType            ENUMERATED { gaussian, binaryDistribution, ...}             OPTIONAL,
    confidence          INTEGER (0..99),
    componentList       SEQUENCE (SIZE (1..16)) OF OMA-LPPe-WLANFemtoCoverageAreaElement,
    ...
}

OMA-LPPe-WLANFemtoCoverageAreaElement ::= SEQUENCE {
    refPointAndArea     SEQUENCE {
        referenceLocation   ENUMERATED  {antenna,
                                         referencePoint,
                                         ... },
        referencePoint      OMA-LPPe-ReferencePointUniqueID     OPTIONAL,
        locationAndArea     OMA-LPPe-RelativeLocation,
        ...
        },
    type                    ENUMERATED  {indoor (0),
                                         outdoor (1),
                                         mixed (2),
                                         ... }                  OPTIONAL,
    weight                  INTEGER (0..100)                    OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-WLANFemtoCoverageArea **field descriptions**
truncation This field specifies if the coverage area is truncated using a specified signal strength level (i.e. with any point within the area experiencing a signal level greater than or equal to the truncation level). This field shall be included if a truncation condition has been used. Scale factor 1 dBm.
areaType This field specifies, if the coverage area is described in terms of a bivariate (gaussian) distribution or as a hard boundary (binary) for which no particular distribution of signal strength can be assumed.The default value (if missing) is a uniform binary distribution.
confidence This field gives the confidence level as a percentage that a target device that can detect signals from the WLAN AP or Femto is within the defined coverage area. Confidence is encoded as a truncated percentage. An encoded value of 0 therefore represents a confidence C where 0% <=C <1% percent. An encoded value of 1 represents a confidence C where 1%<=C<2%, and so on. An encoded value of 99 represents a confidence C where 99%<=C<100%.
componentList This field specifies the coverage area components. Each coverage area component is a 2 dimensional area. Different coverage area components may have the same or different altitudes.
refPointAndArea This field provides the coverage area component description in terms of a relative location and area **referenceLocation** indicates if location is relative to the WLAN AP or Femto antenna or relative to a reference point **referencePoint** provides a reference point for location relative to a reference point; if absent, the reference point is the same one used to define the WLAN AP or Femto location **locationAndArea** provides the location of a center point for the area relative to the reference point. The area is defined by the horizontal uncertainty in *OMA-LPPe-RelativeLocation*; horizontal confidence, uncertainty of altitude and confidence of altitude shall not be included.
type This field specifies if the coverage area component is indoors, outdoors or mixed. This field shall be included if available.
weight This field specifies the weight of the coverage area component in percent and provides the probability that a target is within the area component given that it is within one of the area components. The sum of the weights over all the coverage area components for a given AP must be 100%. A weight of 0% signifies a probability of <1% and a weight of 99% signifies a probability of >99%. If weight is missing, an equal weight is assumed for all the components.

6.4.2 LPPe Common Positioning IEs

Common positioning information elements are IEs that are included in the corresponding message extensions.

– *OMA-LPPe-CommonIEsRequestCapabilities*

The *OMA-LPPe-CommonIEsRequestCapabilities* carries common IEs for a Request Capabilities message extension.

```
-- ASN1START

OMA-LPPe-CommonIEsRequestCapabilities ::= SEQUENCE {
    iP-Address-RequestCapabilities              OMA-LPPe-IP-Address-RequestCapabilities     OPTIONAL,
    assistanceContainerSupportReq               OMA-LPPe-AssistanceContainerSupportReq      OPTIONAL,
    locationInformationContainerSupportReq      OMA-LPPe-LocationInformationContainerSupportReq
                                                                                            OPTIONAL,
    relativeLocationChange-RequestCapabilities  OMA-LPPe-RelativeLocationChange-RequestCapabilities
                                                                                            OPTIONAL,
    highAccuracyFormatCapabilitiesReq           OMA-LPPe-HighAccuracyFormatCapabilitiesReq  OPTIONAL,
    segmentedAssistanceData-ReqCapabilities     OMA-LPPe-SegmentedAssistanceData-ReqCapabilities
                                                                                            OPTIONAL,
    referencePointCapabilitiesReq               OMA-LPPe-ReferencePointCapabilitiesReq      OPTIONAL,
    scheduledLocation-RequestCapabilities       OMA-LPPe-ScheduledLocation-RequestCapabilities
                                                                                            OPTIONAL,
```

```
    accessCapabilitiesReq                       OMA-LPPe-AccessCapabilitiesReq              OPTIONAL,
    segmentedLocationInformation-ReqCapabilities
                                                OMA-LPPe-SegmentedLocationInformation-ReqCapabilities
                                                                                            OPTIONAL,
    ...,
-- version 1.1 extension elements
    ver1-1-localCellInformation-ReqCapabilities     OMA-LPPe-ver1-1-localCellInformation-ReqCapabilities
    OPTIONAL,
    ver1-1-broadcast-ReqCapabilities                OMA-LPPe-ver1-1-broadcast-ReqCapabilities   OPTIONAL
}

OMA-LPPe-IP-Address-RequestCapabilities ::= SEQUENCE {
    ...
}

OMA-LPPe-AssistanceContainerSupportReq ::= SEQUENCE {
    vendorOrOperatorIDList                      OMA-LPPe-VendorOrOperatorIDList             OPTIONAL,
    ...
}

OMA-LPPe-LocationInformationContainerSupportReq ::= SEQUENCE {
    vendorOrOperatorIDList                      OMA-LPPe-VendorOrOperatorIDList             OPTIONAL,
    ...
}

OMA-LPPe-VendorOrOperatorIDList ::= SEQUENCE (SIZE(1..maxVendorOrOperatorIDList)) OF
                                                                        OMA-LPPe-VendorOrOperatorID

maxVendorOrOperatorIDList   INTEGER ::= 32

OMA-LPPe-RelativeLocationChange-RequestCapabilities ::= SEQUENCE {
    ...
}

OMA-LPPe-HighAccuracyFormatCapabilitiesReq ::= SEQUENCE {
    ...
}
OMA-LPPe-SegmentedAssistanceData-ReqCapabilities ::= SEQUENCE {
    ...
}

OMA-LPPe-ReferencePointCapabilitiesReq ::= SEQUENCE {
    referencePointProviderSupportListReq   SEQUENCE (SIZE (1..128)) OF
                                                OMA-LPPe-VendorOrOperatorID             OPTIONAL,
    ...
}

OMA-LPPe-ScheduledLocation-RequestCapabilities ::= SEQUENCE {
    ...
}

OMA-LPPe-AccessCapabilitiesReq ::= SEQUENCE {
    ...
}

OMA-LPPe-SegmentedLocationInformation-ReqCapabilities ::= SEQUENCE {
    ...
}

OMA-LPPe-ver1-1-localCellInformation-ReqCapabilities ::= SEQUENCE {
    ...
}

OMA-LPPe-ver1-1-broadcast-ReqCapabilities ::= SEQUENCE {
    broadcastSystems        SEQUENCE (SIZE (1..16)) OF OMA-LPPe-ver1-1-BroadcastSystemID
    OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-CommonIEsRequestCapabilities **field descriptions**
iP-Address-RequestCapabilities This parameter is included by the server to request the target capabilities to report its local IP address(es).
assistanceContainerSupportReq This field is used to request for the proprietary data capabilities. The following parameters may be optionally included with this request: vendorOrOperatorIDList This parameter provides a list of vendor or operators IDs. If present, the target shall only report its capabilities to support assistance containers associated with these vendors and operators. If absent, the target shall report its capabilities to support assistance containers for all vendors and operators.
locationInformationContainerSupportReq This presence of this parameter indicates a request for the level of support by the target for the Location Information Container. The following parameters may be optionally included with this request: vendorOrOperatorIDList This parameter provides a list of vendor or operators IDs. If present, the target shall only report its capabilities to support location information containers associated with these vendors and operators. If absent, the target shall report its capabilities to support location information containers for all vendors and operators.
relativeLocationChange-RequestCapabilities This parameter is included by the server to request the target capabilities to report relative change of location.
highAccuracyFormatCapabilitiesReq This parameter is included by the server to request the target capabilities to report position in high accuracy or civic format.
segmentedAssistanceData-ReqCapabilities This parameter is included by the server to request the target capabilities to support segmented transfer of assistance data.
referencePointCapabilitiesReq This parameter is included by the server to request the reference point capabilities of the target.
scheduledLocation-RequestCapabilities This parameter is included by the server to request the target capabilities to support scheduled location**.**
accessCapabilitiesReq This parameter is included by the server to request the access type capabilities of the target.
segmentedLocationInformation-ReqCapabilities This parameter is included by the server to request the target capabilities to support segmented transfer of location information.
vendorOrOperatorIDList This parameter is used to request vendor-/operator-specific assistance data / location information capabilties.
referencePointProviderSupportListReq This field lists the reference point provider IDs for which the support indication is requested. If absent, a support indication is requested for all reference point provider IDs that are supported by the target.
ver1-1-localCellInformation-ReqCapabilities This parameter applies only to LPPe 1.1 and is included by the server to request the target capabilities to support assistance data containing information for local cells.
ver1-1-broadcast-ReqCapabilities This parameter applies only to LPPe 1.1 and is included by a server to request the target capabilities to support reception of assistance data via broadcast. A server may indicate that it wishes to receive capabilities for certain broadcast systems. In this case, a target shall return its capabilities only for the requested broadcast systems. If the server does not indicate particular broadcast systems, a target should report its capabilities for standard broadcast systems and may report its capabilities for proprietary broadcast systems.

– *OMA-LPPe-CommonIEsProvideCapabilities*

The *OMA-LPPe-CommonIEsProvideCapabilities* carries common IEs for a Provide Capabilities message extension.

```
-- ASN1START

OMA-LPPe-CommonIEsProvideCapabilities ::= SEQUENCE {
    iP-Address-Capabilities                 OMA-LPPe-IP-Address-Capabilities                OPTIONAL,
    assistanceContainerSupport              OMA-LPPe-AssistanceContainerSupport             OPTIONAL,
    locationInformationContainerSupport     OMA-LPPe-LocationInformationContainerSupport    OPTIONAL,
    relativeLocationChange-Capabilities     OMA-LPPe-RelativeLocationChange-Capabilities    OPTIONAL,
    highAccuracyFormatCapabilities          OMA-LPPe-HighAccuracyFormatCapabilities         OPTIONAL,
    segmentedAssistanceData-ProvideCapabs   OMA-LPPe-SegmentedAssistanceData-ProvideCapabs  OPTIONAL,
    referencePointCapabilities              OMA-LPPe-ReferencePointCapabilities             OPTIONAL,
    scheduledLocation-Capabilities          OMA-LPPe-ScheduledLocation-Capabilities         OPTIONAL,
    accessCapabilities                      OMA-LPPe-AccessCapabilities                     OPTIONAL,
    segmentedLocationInformation-ProvideCapabs
                                            OMA-LPPe-SegmentedLocationInformation-ProvideCapabs
                                                                                            OPTIONAL,
    ...,
-- version 1.1 extension elements
    ver1-1-localCellInformation-ProvideCapabilities OMA-LPPe-ver1-1-localCellInformation-
ProvideCapabilities OPTIONAL,
    ver1-1-broadcast-ProvideCapabilities        OMA-LPPe-ver1-1-broadcast-ProvideCapabilities   OPTIONAL
}

OMA-LPPe-IP-Address-Capabilities ::= SEQUENCE {
    iP-Address-support      BIT STRING {    iPv4        (0),
                                            iPv6        (1),
                                            nat         (2) } (SIZE(1..8))      OPTIONAL,
    ...
}


OMA-LPPe-AssistanceContainerSupport     ::=     SEQUENCE     (SIZE(1..maxVendorOrOperatorIDList))     OF
                                                    OMA-LPPe-VendorOrOperatorAssistanceContainerList


OMA-LPPe-VendorOrOperatorAssistanceContainerList ::= SEQUENCE {
    vendorOrOperatorID          OMA-LPPe-VendorOrOperatorID,
    assistanceContainerList     OMA-LPPe-AssistanceContainerList,
    ...
}

OMA-LPPe-AssistanceContainerList ::= SEQUENCE (SIZE(1.. maxAssistanceContainerList))OF
                                                                    OMA-LPPe-AssistanceContainerID

OMA-LPPe-LocationInformationContainerSupport   ::=   SEQUENCE   (SIZE(1..maxVendorOrOperatorIDList))   OF
                                            OMA-LPPe-VendorOrOperatorLocationInformationContainerList

OMA-LPPe-VendorOrOperatorLocationInformationContainerList ::= SEQUENCE {
    vendorOrOperatorID                  OMA-LPPe-VendorOrOperatorID,
    locationInformationContainerList    OMA-LPPe-LocationInformationContainerList,
    ...
}

OMA-LPPe-LocationInformationContainerList  ::=  SEQUENCE  (SIZE(1..maxLocationInformationContainerList))OF
                                                            OMA-LPPe-LocationInformationContainerID

maxLocationInformationContainerList INTEGER ::= 64
OMA-LPPe-RelativeLocationChange-Capabilities ::= SEQUENCE {
    numberOfChanges     INTEGER (1..5)          OPTIONAL,
    ...
}

OMA-LPPe-HighAccuracyFormatCapabilities ::= BIT STRING {    hAposition(0),
                                                            hAvelocity(1),
                                                            pidf-lo (2) } (SIZE(1..8))

OMA-LPPe-SegmentedAssistanceData-ProvideCapabs ::= SEQUENCE {
    maxSegments     INTEGER (2..4096)       OPTIONAL,
    maxSize         INTEGER (1..5000)       OPTIONAL,
```

```
    minSize         INTEGER (1..5000)       OPTIONAL,
    resume          NULL                    OPTIONAL,
    ...
}

OMA-LPPe-ReferencePointCapabilities ::= SEQUENCE {
    relativeLocationReportingSupport    BIT STRING {    geo             (0),
                                                        civic           (1),
                                                        otherProviders  (2)  } (SIZE (1..8)),
    referencePointProviderSupportList   SEQUENCE (SIZE (1..128)) OF
                                            OMA-LPPe-ReferencePointProviderSupportElement   OPTIONAL,
    ...
}

OMA-LPPe-ReferencePointProviderSupportElement ::= SEQUENCE {
    referencePointProvider          OMA-LPPe-VendorOrOperatorID,
    mapDataSupport                  SEQUENCE {
                                        mapDataFormat       OCTET STRING        OPTIONAL,
                                        ...
                                        }       OPTIONAL,
    ...
}

OMA-LPPe-ScheduledLocation-Capabilities ::= SEQUENCE {
    minimumWindow           INTEGER (1..1024)       OPTIONAL,
    gnssTimeReference       GNSS-ID-Bitmap          OPTIONAL,
    networkTimeReference    ENUMERATED {serving,
                                        servingOrNonServing,
                                        ... }       OPTIONAL,
    ...
}

OMA-LPPe-AccessCapabilities ::= SEQUENCE {
    accessTypeUnknown           NULL                            OPTIONAL,
    fixedAccessTypes            OMA-LPPe-FixedAccessTypes       OPTIONAL,
    wirelessAccessTypes         OMA-LPPe-WirelessAccessTypes    OPTIONAL,
    ...
}

OMA-LPPe-SegmentedLocationInformation-ProvideCapabs ::= SEQUENCE {
    maxSegments     INTEGER (2..4096)       OPTIONAL,
    maxSize         INTEGER (1..5000)       OPTIONAL,
    minSize         INTEGER (1..5000)       OPTIONAL,
    resume          NULL                    OPTIONAL,
    ...
}

OMA-LPPe-ver1-1-localCellInformation-ProvideCapabilities ::= SEQUENCE {
    localCellInformation-Support        BIT STRING {gnssTiming          (0),
                                                    networkTiming       (1),
                                                    coverage            (2),
                                                    coordinates         (3),
                                                    frequencyAccuracy   (4)} (SIZE (1..16)),
    ...
}


OMA-LPPe-ver1-1-broadcast-ProvideCapabilities ::= SEQUENCE (SIZE (1..16)) OF OMA-LPPe-ver1-1-
BroadcastSystem-Capabs

OMA-LPPe-ver1-1-BroadcastSystem-Capabs ::= SEQUENCE {
    broadcastSystemID       OMA-LPPe-ver1-1-BroadcastSystemID,
    broadcastADTypes        OMA-LPPe-ver1-1-BroadcastADTypes        OPTIONAL,
    point2pointAD           OMA-LPPe-ver1-1-point2pointAD           OPTIONAL,
    ciphering               OMA-LPPe-ver1-1-Ciphering               OPTIONAL,
    authentication          OMA-LPPe-ver1-1-Authentication          OPTIONAL,
    ...
}

OMA-LPPe-ver1-1-point2pointAD ::= SEQUENCE {
    ...
```

```
}

OMA-LPPe-ver1-1-Ciphering ::= SEQUENCE {
    ...
}

OMA-LPPe-ver1-1-Authentication ::= SEQUENCE {
    ...
}


-- ASN1STOP
```

OMA-LPPe-CommonIEsProvideCapabilities **field descriptions**
iP-Address-Capabilities
This parameter is included to report the capabilities of a target to provide its local IP addresses. The parameter is not included if the target does not support IP address reporting. The parameter contains a bit string, with a one-value at any bit position meaning a particular capability is supported and a zero-value meaning not supported. The assigned bits and corresponding capabilities are as follows. iPv4: the target supports and can report IPv4 addresses iPv6: the target supports and can report IPv6 addresses nat: the target may be able to determine and then report whether an IP address is subject to NAT
assistanceContainerSupport
This field lists the vendor-/operator-specific data IDs for the vendor-/operator-specific assistance data sets that the target supports.
locationInformationContainerSupport
This field lists the vendor-/operator-specific data IDs for the vendor-/operator-specific location information types that the target supports.

***OMA-LPPe-CommonIEsProvideCapabilities* field descriptions**
relativeLocationChange-Capabilities This parameter is included by the target to indicate its capabilities to report relative change of location.
highAccuracyFormatCapabilities This parameter is included by the target to provide the target capabilities to report position in high accuracy or civic format. The assigned bits and corresponding capabilities are: hAposition: the target supports and can report *OMA-LPPe-HighAccuracy3Dposition* hAvelocity: the target supports and can report *OMA-LPPe-HighAccuracy3Dvelocity* pidf-lo: the target supports and can report *OMA-LPPe-CivicLocation-pidf-lo* A bit is set to one to indicate support and is set to zero or omitted to indicate lack of support.
segmentedAssistanceData-ProvideCapabs This parameter is included by the target to indicate support of segmented transfer of assistance data. The target may optionally include the following fields: maxSegments: maximum number of separate LPP messages into which assistance data should be segmented by the server maxSize: maximum overall size of all assistance data that is transferred for segmented transfer that is supported by the target in multiples of 1024 octets after rounding up to a multiple of 1024. A value of 5000 for maxSize indicates that the maximum overall size is not limited. minSize: minimum overall size of all assistance data for which segmented assistance data transfer should be used by the server in preference to sending all assistance data in a single LPP message resume: included if the target can support segmented transfer with the resume capability
referencePointCapabilities This parameter is included if the target supports assistance data or location reporting relative to a reference point.
scheduledLocation-Capabilities This parameter is included by the target to indicate its capabilities to schedule location at a requested time. The following fields can be provided: minimumWindow: minimum time window in units of 10 ms within which the target is capable of scheduling location measurements gnssTimeReference: indicates the target can use GNSS time to schedule location measurements and provides the GNSS IDs that can be supported for this networkTimeReference: indicates the target can use network time to schedule location measurements and indicates whether network time can be supported only relative to a serving cell or relative to a serving or non-serving cell
accessCapabilities This parameter provides the access capabilities of the target device. The following fields can be included: accessTypeUnknown: this field shall be included if the target cannot determine the access types it supports – e.g. if the target is using a separate wireless or wireline modem of unknown type. fixedAccessTypes: this field indicates the fixed access types supported by the target and shall be included if the target can support one or more fixed access types. wirelessAccessTypes: this field indicates the wireless access types supported by the target and shall be included if the target can support one or more wireless access types. Note that the capabilities refer to access types that can be supported by the target device as opposed to access types that may currently be in use.
segmentedLocationInformation-ProvideCapabs This parameter is included by the target to indicate support of segmented transfer of location information. The target may optionally include the following fields: maxSegments: maximum number of separate LPP messages into which location information can be segmented maxSize: maximum overall size of all location information that can be transferred using segmented transfer in multiples of 1024 octets after rounding up to a multiple of 1024. A value of 5000 for maxSize indicates that the maximum overall size is not limited. minSize: minimum overall size of all location information for which segmented transfer is preferred by the target in preference to sending all location information in a single LPP message resume: included if the target can support segmented transfer with the resume capability

OMA-LPPe-CommonIEsProvideCapabilities **field descriptions**
assistanceContainerList This parameter provides a list of the assistance data containers that a target supports for a particular vendor or operator. Each location assistance data container is identified by an integer in the range 0 to 65535. The identification is vendor or operator specific and may refer to a particular type of assistance data, a particular version of assistance data or to a combination of these or to some other characteristics.
locationInformationContainerList This parameter provides a list of the location information containers that a target supports for a particular vendor or operator. Each location information container is identified by an integer in the range 0 to 65535. The identification is vendor or operator specific and may refer to a particular type of location information, a particular version of location information or to a combination of these or to some other characteristics.
numberOfChanges This field indicates the maximum number of relative changes of location that can be reported by the target. The default if absent is one.
relativeLocationReportingSupport This parameter indicates that the target supports location reporting relative to a reference point. The bit map indicates the reference point location type (geographic, or civic) supported for relative location reporting and whether the target is able to support location reporting relative to other reference point providers not listed in referencePointProviderSupportList. A one value at the bit position indicates support and a zero value no support. NOTE: location reporting relative to other providers includes the ability to report information associated with a reference point that is not dependent on proprietary assistance data from the provider of the reference point (e.g. includes an ability to use a reference point simply to report relative location).
referencePointProviderSupportList This parameter provides a list of reference point provider IDs that the target supports for location reporting and associated attributes that the target supports within reference point assistance data for these provider IDs. This parameter shall not be included if no reference point provider IDs are specifically supported.
mapDataSupport This field, if present, indicates whether the target supports map data information for this reference point provider and may include additional information specific to the provider in mapDataFormat about the supported map data format(s). If this field is absent, no map data information is supported for this reference point provider.
ver1-1-localCellInformation-ProvideCapabilities This parameter applies only to LPPe 1.1 and provides the target capabilities to support assistance data containing information for local cells. This is signified using a bit string with the following bit assignments. A bit value of one indicates a capability is supported and a bit value of zero indicates it is not supported. gnssTiming - indicates whether the target supports receipt of cell GNSS timing information without network timing networkTiming - indicates whether the target supports receipt of cell GNSS timing information with network timing coverage - indicates whether the target supports receipt of cell coverage area coordinates - indicates whether the target supports receipt of cell coordinates frequencyAccuracy - indicates whether the target supports receipt of cell frequency accuracy
ver1-1-broadcast-ProvideCapabilities This parameter applies only to LPPe 1.1 and is included by a target to provide its capabilities to receive assistance data via broadcast.
broadcastSystemID This parameter applies only to LPPe 1.1 and specifies a particular broadcast system that is supported by a target.
broadcastADTypes This parameter applies only to LPPe 1.1 and specifies the types of assistance data a target can receive via broadcast using a particular broadcast system.
point2pointAD This parameter applies only to LPPe 1.1 and is included when a target can support receipt of assistance data sent point to point that provides information on a broadcast system used by the server.

***OMA-LPPe-CommonIEsProvideCapabilities* field descriptions**
ciphering
This parameter applies only to LPPe 1.1 and shall be included when the target supports ciphering of LPP/LPPe broadcast messages. The absence of this parameter implies that a target does not support ciphering.
authentication
This parameter applies only to LPPe 1.1 and shall be included when the target supports authentication of LPP/LPPe broadcast messages. The absence of this parameter implies that a target does not support authentication.

– *OMA-LPPe-CommonIEsRequestAssistanceData*

The *OMA-LPPe-CommonIEsRequestAssistanceData* carries common IEs for a Request Assistance Data message extension.

```
-- ASN1START

OMA-LPPe-CommonIEsRequestAssistanceData ::= SEQUENCE  {
    approximate-location            EllipsoidPointWithAltitudeAndUncertaintyEllipsoid   OPTIONAL,
    assistanceContainerRequestList  OMA-LPPe-AssistanceContainerRequestList             OPTIONAL,
    requestPeriodicADwithUpdate     OMA-LPPe-RequestPeriodicADwithUpdate                OPTIONAL,
                                                                    --Cond RequestPeriodicADWithUpdate
    segmentedADpreference           ENUMERATED {useBasic, useResume, ...}               OPTIONAL,
    segmentedADResume               OMA-LPPe-SegmentedADResume                          OPTIONAL,
                                                                    --Cond segmentedTransferResume
    referencePointAssistanceReq     OMA-LPPe-ReferencePointAssistanceReq                OPTIONAL,
    ...,
-- version 1.1 extension elements
    ver1-1-localCellInformationReq  OMA-LPPe-ver1-1-LocalCellInformationReq         OPTIONAL,
    ver1-1-BroadcastAssistanceDataReq       OMA-LPPe-ver1-1-BroadcastAssistanceDataReq      OPTIONAL,
    ver1-1-AccessNetwork                    OMA-LPPe-ver1-1-AccessNetworkID             OPTIONAL,
    ver1-1-groundMorphologyModelReq         OMA-LPPe-ver1-1-GroundMorphologyModelReq    OPTIONAL
}

OMA-LPPe-RequestPeriodicADwithUpdate ::= SEQUENCE {
    periodicAD-session-ID           OCTET STRING (SIZE(4)),
    typeOfADRequest     TypeOfADRequest,
    ...
}

TypeOfADRequest ::= ENUMERATED {
    initialRequest,
    updateAndContinueIfUpdateFails,
    updateAndAbortIfUpdateFails,
    ...
}

OMA-LPPe-SegmentedADResume ::= SEQUENCE {
    segmentedAD-session-ID              OMA-LPPe-Session-ID,
    next-segment-number     INTEGER (1..4096)
}

OMA-LPPe-ReferencePointAssistanceReq ::= SEQUENCE {
    referencePointReq           SEQUENCE (SIZE (1..16)) OF OMA-LPPe-ReferencePointAssistanceReqElement,
    ...
}

OMA-LPPe-ReferencePointAssistanceReqElement ::= SEQUENCE {
    referencePointProvider      OMA-LPPe-VendorOrOperatorID,
    mapDataReq                  OCTET STRING                        OPTIONAL,
    ...
}

OMA-LPPe-ver-1-1-GroundMorphologyModelReq ::= SEQUENCE {
    modelsReq BIT STRING {altitude(0), buildings(1)}    (SIZE  (1..8)),
    refAreaParam            SEQUENCE {
        northWestCorner     Ellipsoid-Point OPTIONAL,
        spanX               INTEGER (6..14),
        spanY               INTEGER (6..14),
        ...
        }           OPTIONAL,
    ...
```

```
}


OMA-LPPe-ver1-1-LocalCellInformationReq ::= SEQUENCE {
    localCellInformationReq         BIT STRING {gnssTiming          (0),
                                                networkTiming       (1),
                                                coverage            (2),
                                                coordinates         (3),
                                                frequencyAccuracy   (4)} (SIZE (1..16)),
    localCellID                     OMA-LPPe-ver1-1-CellGlobalID        OPTIONAL,    --    Cond    ver1-1
cellVisible
    numberOfCells                   INTEGER (0..7)          OPTIONAL,
    ...
}

OMA-LPPe-ver1-1-BroadcastAssistanceDataReq ::= SEQUENCE {
    broadcastSystem     OMA-LPPe-ver1-1-BroadcastSystem     OPTIONAL,
    ...
}

OMA-LPPe-ver1-1-BroadcastSystem ::= SEQUENCE {
    broadcastSystemID       OMA-LPPe-ver1-1-BroadcastSystemID,
    cipherSets              SEQUENCE (SIZE (1..16)) OF OMA-LPPe-ver1-1-CipherSetID  OPTIONAL,
    authenticationSets      SEQUENCE (SIZE(1..4)) OF OMA-LPPe-ver1-1-AuthenticationSetID    OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
RequestPeriodicADWithUpdate	The parameter shall be present in a new request or modified request for Periodic/Triggered Assistance Data Transfer with Target Update. The field shall be omitted in other cases.
segmentedTransfeResume	This parameter shall be included when the target requests resumption of a segmented transfer of assistance data. No other assistance data shall then be requested.
ver1-1-cellVisible	This parameter shall be included when the target has a serving cell, or is able to receive and decode signals in a cell, that is either GSM, WCDMA or LTE.

***OMA-LPPe-CommonIEsRequestAssistanceData* field descriptions**
approximate-location This parameter provides an approximate location for the target device.
assistanceContainerRequestList This field is used by the target to request proprietary assistance data.

OMA-LPPe-CommonIEsRequestAssistanceData **field descriptions**
requestPeriodicADwithUpdate This field is used to request periodic/triggered assistance data session (accompanied by the request for the actual data).
periodicAD-session-ID This field provides the periodic/triggered session ID assigned to the Periodic/Triggered Assistance Data Transfer with Update procedure.
segmentedADpreference This field shall be included if the target prefers the server to use segmented transfer of assistance data. Values can indicate "use the basic method" or "use the basic method with resume capability".
segmentedADResume The parameter is used to request resumption of an LPPe segmented transfer of assistance data following realease or failure and later restoration of the connection and any location session between the server and the target. The parameter includes the following fields: segmentedAD-session-ID session ID assigned by the server for the segmented transfer next-segment-number segment number of next expected LPP Provide Assistance Data
referencePointAssistanceReq This field is used by the target to specify the target preference for particular types of reference point in any subsequent assistance data sent by the server that includes one or more reference points.
typeOfADRequest This field indicates whether this is an initial request for a new procedure, an update request where the previously agreed assistance delivery will continue if the request cannot be supported or an update request where the previously agreed assistance data delivery will be aborted if the request cannot be supported.
referencePointReq This field provides a list of reference point types, in the order of preference. The first reference point type in the list is the most preferred type, etc.
referencePointProvider This field defines the preferred reference point provider.
mapDataReq This field, if present, indicates that map data is requested for any reference point assistance data provided later by the server to the target for the indicated provider. The content of the field is specific to the reference point provider and may indicate additional information on the map format or data requested.
ver1-1-localCellInformationReq This parameter applies only to LPPe 1.1 and is included by the target to request information for local cells. The requested types of information are indicated using a bit string with the following bit assignments. A bit value of one indicates the information type is requested and a bit value of zero indicates it is not requested. gnssTiming indicates whether the target requests receipt of GNSS timing information without network timing networkTiming indicates whether the target requests receipt of GNSS timing information with cell network timing. Note that when gnssTiming and networkTiming are both requested, a server shall provide network timing if available and supported. coverage indicates whether the target requests receipt of cell coverage area coordinates indicates whether the target requests receipt of cell coordinates frequencyAccuracy indicates whether the target requests receipt of cell frequency accuracy Other fields that may be included in this parameter are: localCellID this field provides the global cell ID for the serving cell or primary serving cell for the target if this is GSM, WCDMA or LTE. If the target is not served by a GSM, WCDMA or LTE network, the field provides the global cell ID of the GSM, WCDMA or LTE cell with the strongest signal that the target can receive and decode. This field shall be omitted when the target cannot receive and decode signals from a local GSM, WCDMA or LTE cell. numberOfCells number of cells for which information is requested coded as an exponent N in the range 0 to 7, where the number of cells is 2**N. Information is always assumed to be requested for the cell identified by localCellID when included.

***OMA-LPPe-CommonIEsRequestAssistanceData* field descriptions**
ver1-1-BroadcastAssistanceDataReq
This parameter applies only to LPPe 1.1 and is included by the target to request assistance data associated with broadcast of (other) assistance data. The target may include information related to a particular broadcast system of interest in which case the server shall return information for this broadcast system if supported including an updated list of cipher sets for any target that supports ciphering and that the target is authorized to receive according to any subscription or service agreement. If the target does not specify a broadcast system, the server may return information for any supported broadcast system consistent with the target capabilities, location and serving network.
broadcastSystem
This parameter applies only to LPPe 1.1 and identifies a particular broadcast system. A target shall include in this parameter the IDs for the most recent list of cipher sets and/or authentication sets previously received from the server for this broadcast system if any of the cipher sets and/or authentication sets, respectively, are currently being used (e.g. have not yet expired). A server may use the list to deduce service previously provided to the target without the need to keep records which may assist charging.
ver1-1-AccessNetwork
This parameter applies only to LPPe 1.1. and provides the identity of the access network that the target is currently using or wishes to be associated with the assistance data being requested.
ver1-1-groundMorphologyModelReq
This field is used to request ground morphology model assistance. Ground morphology information includes ground altitude and building heights information; this information can be used to increase accuracy of position estimation. The morphology information is provided for a 2D grid of points.
refAreaParam
This structure is used by the target to define the rectangular area for which ground morphology assistance data is requested. This field may be omitted if the target has no information on its reference location.
northWestCorner
This field specifies the North-West corner of the rectangular area for which the morphology information is requested. If the target does not know its reference location this parameter is not included.
spanX, spanY
These fields specify the width of the rectangular areafor which ground morphology assistance is requested : The rectangle is oriented according to W-E and N-S directions, *spanX* defines the width in W-E direction, *spanY* defines the width in N-S direction,The North West corner of the rectangle is centered in *northWestCorner* point. The width of the rectangle in both directions expressed in meters is given by the expression $\dim_x[m] = 2^{spanX}\, m$ $\dim_y[m] = 2^{spanY}\, m$ Admitted values of the grid width in both dimensions are comprised between 64 m and 16384 m.

– *OMA-LPPe-CommonIEsProvideAssistanceData*

The *OMA-LPPe-CommonIEsProvideAssistanceData* carries common IEs for a ProvideAssistance Data message extension.

```
-- ASN1START

OMA-LPPe-CommonIEsProvideAssistanceData ::= SEQUENCE  {
    assistanceContainerList             OMA-LPPe-AssistanceContainerProvideList     OPTIONAL,
    providePeriodicADwithUpdate         OMA-LPPe-ProvidePeriodicADwithUpdate        OPTIONAL,
                                                        --Cond ProvidePeriodicADWithUpdate,
    segmentedADTransfer                 OMA-LPPe-SegmentedADTransfer                OPTIONAL,
                                                        --Cond segmentedTransferWithResume
    default-reference-point             OMA-LPPe-ReferencePoint                     OPTIONAL,
    ...,
-- version 1.1 extension element
    ver1-1-localCellInformation         OMA-LPPe-ver1-1-LocalCellInformation        OPTIONAL,
    ver1-1-BroadcastAssistanceData      OMA-LPPe-ver1-1-BroadcastAssistanceData     OPTIONAL,
    ver1-1-groundMorphologyModel        OMA-LPPe-ver1-1-GroundMorphologyModel           OPTIONAL
}

OMA-LPPe-ProvidePeriodicADwithUpdate ::= SEQUENCE {
    periodicAD-session-ID           OCTET STRING (SIZE(4)),
```

```
    typeOfADProvide     OMA-LPPe-TypeOfADProvide,
    ...
}

OMA-LPPe-TypeOfADProvide ::= ENUMERATED {
    responseToInitialRequest,
    providePeriodicAD,
    responseToTargetUpdateRequest,
    serverUpdate,
    ...
}

OMA-LPPe-SegmentedADTransfer ::= SEQUENCE {
    segmentedAD-session-ID          OMA-LPPe-Session-ID,
    segment-number      INTEGER (1..4096),
    ...
}

OMA-LPPe-ver1-1-LocalCellInformation ::= SEQUENCE {
    ver1-1-timingInformation            SEQUENCE (SIZE (1..maxCellSets)) OF GNSS-ReferenceTime
    OPTIONAL,
    ver1-1-other-CellInformation        SEQUENCE (SIZE (1..maxCells)) OF OMA-LPPe-ver1-1-CellInformation
    OPTIONAL,
    ...
}

maxCellSets INTEGER ::= 8

maxCells INTEGER ::= 128

OMA-LPPe-ver1-1-CellInformation ::= SEQUENCE {
    cellID                  OMA-LPPe-ver1-1-CellGlobalID,
    coverage                CHOICE {
                            circle      Ellipsoid-PointWithUncertaintyCircle,
                            ellipse     EllipsoidPointWithUncertaintyEllipse,
                            arc         EllipsoidArc,
                            polygon     Polygon,
                            ...
                            }                       OPTIONAL,
    coordinates             EllipsoidPointWithAltitudeAndUncertaintyEllipsoid   OPTIONAL,
    frequencyAccuracy       INTEGER (1..6)          OPTIONAL,
    ...
}

OMA-LPPe-ver1-1-BroadcastAssistanceData ::= SEQUENCE {
    broadcastSystem         OMA-LPPe-ver1-1-BroadcastSystemID,
    accessNetworks          SEQUENCE (SIZE (1..16)) OF OMA-LPPe-ver1-1-AccessNetworkID,
    coverageArea            CHOICE {
                                    circle      Ellipsoid-PointWithUncertaintyCircle,
                                    ellipse     EllipsoidPointWithUncertaintyEllipse,
                                    polygon     Polygon,
                                    ...
                                    }       OPTIONAL,
    broadcastADTypes        OMA-LPPe-ver1-1-BroadcastADTypes        OPTIONAL,
    broadcastMode               CHOICE {
                                        unencapsulated      NULL,
                                        encapsulated        OMA-LPPe-ver1-1-EncapsulatedMode,
                                        ...
                                        },
    ...
}
```

```
OMA-LPPe-ver1-1-EncapsulatedMode ::= SEQUENCE {
    serverID                    OMA-LPPe-ver1-1-ServerID,
    cipherSets                  SEQUENCE (SIZE (1..16)) OF OMA-LPPe-ver1-1-CipherSet    OPTIONAL,
    authentication              SEQUENCE (SIZE (1..4)) OF OMA-LPPe-ver1-1-AuthenticationSet OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
ProvidePeriodicADWithUpdate	The parameter shall be present in a Provide Assistance Data for Periodic/Triggered Assistance Data Transfer with Update. The field shall be omitted in other cases.
segmentedTransferWithResume	This parameter shall be present in each LPP Provide Assistance Data message sent to a target when a segmented transfer of assistance data with resume capability is either started or resumed.

***OMA-LPPe-CommonIEsProvideAssistanceData* field descriptions**
assistanceContainerList
This field is used to deliver the requested vendor-/operator-specific assistance data.

OMA-LPPe-CommonIEsProvideAssistanceData **field descriptions**
providePeriodicADwithUpdate This field is used in the periodic/triggered assistance data procedure to provide the session ID and the reason for providing the assistance data.
segmentedADTransfer This parameter provides the following fields to support segmented transfer of assistance data with a resume capability. segmentedAD-session-ID session ID assigned by the server which should be unique across all servers segment-number segment number starting from 1 and incremented by 1 in each successive LPP Provide Assistance Data message
default-reference-point This field includes a default reference point applicable to other assistance data for which a reference point is associated. Usage of the default reference point is specified in the description of other applicable assistance data. The default reference point can also be provided to support location reporting relative to a reference point.
periodicAD-session-ID This field provides the session ID assigned to the Periodic/Triggered Assistance Data Transfer with Update procedure.
typeOfADProvide This field indicates whether this is a response to an initial request for a new procedure, normal delivery of periodic/triggered assistance data, a response to an update request from the target or an unsolicited server update.
ver1-1-localCellInformation This field applies only to LPPe 1.1 and provides timing and other information for up to 128 GSM, WCDMA and/or LTE cells,
ver1-1-timingInformation This field applies only to LPPe 1.1 and provides either GNSS timing information alone or GNSS timing associated with network timing for up to 8 sets of cells. For each set of cells in the latter case, GNSS timing information is provided for up to 16 individual cells according to the data type GNSS-ReferenceTime defined for LPP [LPP].
ver1-1-other-cellInformation This field applies only to LPPe 1.1 and provides the following information for one cell: cellID Global Cell ID and cell type (GSM, WCDMA or LTE) coverage Engineered coverage area of the cell as given by the location uncertainty area for a particular geographic shape. Confidence if included for a geographic shape shall be ignored coordinates Location coordinates and accuracy for the cell tower antenna frequencyAccuracy Frequency accuracy for the cell encoded as follows: 1: <= 25 ppb 2: 50 ppb 3: 100 ppb 4: 250 ppb 5: 500 ppb 6: >=1000 ppb
OMA-LPPe-ver1-1-BroadcastAssistanceData This parameter applies only to LPPe 1.1 and provides information on assistance data available via broadcast for a particular broadcast system. The following information can be included. broadcastSystem the broadcast system for which information is provided accessNetworks the access network or networks supporting this broadcast system in the vicinity of the target coverageArea a continuous broadcast coverage area that includes or is close to the location of the target broadcastADTypes the types of assistance data being broadcast broadcastMode identifies whether unencapsulated or encapsulated LPP and LPP/LPPe messages are broadcast

OMA-LPPe-CommonIEsProvideAssistanceData field descriptions
cipherSets
This parameter applies only to LPPe 1.1 and to encapsulated mode and provides a list of 1 to 16 cipher sets each containing information relevant to ciphering for some or all assistance data being broadcast using a particular broadcast system. A target shall replace any previous cipher sets from a particular server with any new sets from the same server. A cipher set may refer to ongoing ciphering or to ciphering that is scheduled for a later time as well as to ciphering applicable to the target location or to other locations. A target that supports ciphering should request new assistance data from a server when it detects use of a cipher set by the server that it does not possess. To help avoid periods when a target does not have the right cipher set, a target may request new broadcast assistance data once it detects that a particular cipher set used previously has not been used for a period of one hour. A server should, if possible, use a cipher set over the entire area supported by the server for a period of at least 2 hours and should stagger the change to a new cipher set by introducing the new set over the entire area a piece at a time in order to avoid all targets in the area requesting new assistance data all at the same time. When this parameter is not included, a target may continue to use any cipher sets previously received from the server.
authentication
This parameter applies only to LPPe 1.1 and is included when a server requires a target to authenticate every assistance data broadcast message received via the indicated broadcast system. Any broadcast assistance data message received via the indicated broadcast system that cannot be authenticated (e.g. that does include a digital signature) or that fails authentication or that is received after the end of its validity period shall be discarded by a target. This parameter provides protection to a target against broadcast messages that may be unauthorized or fraudulent. This parameter provides a list of 1 to 4 authentication sets each containing information relevant to authentication for some or all assistance data being broadcast using a particular broadcast system. A target shall replace any previous authentication sets from a particular server with any new sets from the same server. An authentication set may refer to ongoing authentication or to authentication that is scheduled for a later time as well as to authentication applicable to the target location or to other locations. A target that supports authentication should request new assistance data from a server for any broadcast system for which authentication has been mandated when it detects use of an authentication set by the server that it does not possess. To help avoid periods when a target does not have the right authentication set, a target may request new broadcast assistance data once it detects that a particular authentication set used previously has not been used for a period of one hour. A server should, if possible, use an authentication set over the entire area supported by the server for a period of at least 24 hours and should stagger the change to a new cipher set by introducing the new set over the entire area a piece at a time in order to avoid all targets in the area requesting new assistance data all at the same time. When this parameter is not included, a target may continue to use any authentication sets previously received from the server.

– *OMA-LPPe-CommonIEsRequestLocationInformation*

The *OMA-LPPe-CommonIEsRequestLocationInformation* carries common IEs for a Request Location Information message extension.

```
-- ASN1START

OMA-LPPe-CommonIEsRequestLocationInformation ::= SEQUENCE  {
    iP-Address-Request                  OMA-LPPe-IP-Address-Request                          OPTIONAL,
    locationInformationContainerRequest OMA-LPPe-LocationInformationContainerRequest        OPTIONAL,
    requestPeriodicLocInfoWithUpdate    OMA-LPPe-RequestPeriodicLocInfoWithUpdate           OPTIONAL,
                                                    --Cond RequestPeriodicLocInfoWithUpdate
    relativeLocationChange-Request      OMA-LPPe-RelativeLocationChange-Request             OPTIONAL,
    localPositionRequest                OMA-LPPe-LocalPositionRequest                       OPTIONAL,
    scheduledLocation-Request           OMA-LPPe-ScheduledLocation-Request                  OPTIONAL,
    accessTypeRequest                   OMA-LPPe-AccessTypeRequest                          OPTIONAL,
    segmentedLIpreference               ENUMERATED {useBasic, useResume, ...}               OPTIONAL,
    segmentedLIResume                   OMA-LPPe-SegmentedLIResume                          OPTIONAL,
                                                    --Cond segmentedTransferResume
    ...,
    civicLocation-Request               OMA-LPPe-CivicLocation-Request                       OPTIONAL
}

OMA-LPPe-IP-Address-Request ::= SEQUENCE {
    ...
}

OMA-LPPe-RequestPeriodicLocInfoWithUpdate ::= SEQUENCE {
    session-ID                  OCTET STRING (SIZE(4)),
    typeOfLocInfoRequest        OMA-LPPe-TypeOfLocInfoRequest,
    ...
}

OMA-LPPe-TypeOfLocInfoRequest ::= ENUMERATED {
    initialRequest,
    updateAndContinueIfUpdateFails,
    updateAndAbortIfUpdateFails,
    ...
}

OMA-LPPe-RelativeLocationChange-Request ::= SEQUENCE {
    numberOfChanges     INTEGER (1..5)          OPTIONAL,
    ...
}

OMA-LPPe-LocalPositionRequest ::= SEQUENCE {
    typeOfRequest                   ENUMERATED { localOptional, localMandatory, localOnly, ... },
    referencePointReq               SEQUENCE (SIZE (1..8)) OF
                                            OMA-LPPe-ReferencePointUniqueID         OPTIONAL,
    ...
}

OMA-LPPe-ScheduledLocation-Request ::= SEQUENCE {
    gnssTime            GNSS-SystemTime         OPTIONAL,       --Cond AtLeastOne
    networkTime         NetworkTime             OPTIONAL,       --Cond AtLeastOne
    relativeTime        INTEGER (1..1024)       OPTIONAL,       --Cond AtLeastOne
    windowSize          INTEGER (1..1024)       OPTIONAL,
    ...
}

OMA-LPPe-AccessTypeRequest ::= SEQUENCE {
    ...
}

OMA-LPPe-SegmentedLIResume ::= SEQUENCE {
    segmentedLI-session-ID      INTEGER (1..256),
    next-segment-number         INTEGER (1..4096)}

OMA-LPPe-CivicLocation-Request ::= SEQUENCE {
    format              ENUMERATED {pidf-lo, ... },
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
RequestPeriodicLocInfoWithUpdate	The parameter shall be present in a new request or modified request for Periodic/Triggered Location Information Transfer with Target Update. The field shall be omitted in other cases.
AtLeastOne	At least one of these parameters shall be present
segmentedTransferResume	This parameter shall be included when the server requests resumption of a segmented transfer of location information. No other location information shall then be requested.

***OMA-LPPe-CommonIEsRequestLocationInformation* field descriptions**
iP-Address-Request This parameter is included by the server to request the target to report its local IP addresses.
locationInformationContainerRequest This parameter specifies the list of location information containers for a specified vendor or operator that the target should provide.

OMA-LPPe-CommonIEsRequestLocationInformation **field descriptions**
requestPeriodicLocInfoWithUpdate This field is used to request periodic/triggered location information session (accompanied by the request for the actual location information).
relativeLocationChange-Request This parameter is included by the server to request the target to report its relative change of location.
localPositionRequest This field is included by the server to request or permit the target to report its location relative to a reference point. This request only applies when the target has information on one or more reference points and is reporting a location estimate and shall be ignored by the target when the target has no information on reference points or reports location measurements but not a location estimate.
scheduledLocation-Request This parameter is included by the server to request the target to perform all requested location measurements and obtain any other requested location information (except for information that can be computed from other information) within a scheduled time window (see note) defined by the following parameters: gnssTime absolute GNSS time of the start of the time window networkTime network time of the start of the time window relativeTime relative Time in seconds from current time to the start of the time window. Current time is defined as the time the message was received. windowSize width of the time window in units of 10 ms; absence of this parameter implies best effort to perform all measurements as close to the start time as possible This parameter should not be included by the server and shall if present be ignored by the target if other LPP or LPPe parameters are present that require repeated (e.g. periodic or triggered) location information reporting by the target or if qos is present containing responseTime in *CommonIEsRequestLocationInformation* in the LPP Request Location Information. When gnssTime and networkTime are both present, the target shall give precedence to gnssTime if the referenced GNSS time is known to within 1ms but shall other otherwise give precedence to networkTime. The target shall give lowest preference to relativeTime when another start time is present that can be used (e.g. gnssTime is present and the target knows the associated GNSS time). NOTE: it is required that measurement time be within the scheduled window. Measurement time refers to the time or times at which a measurement is valid – e.g. the time a measurement was completed or the time to which a measurement can reliably and accurately be adjusted.
accessTypeRequest This parameter is included by the server to request the access type or types currently in use by the target device.
segmentedLIpreference This field shall be included if the server prefers the target to use segmented transfer of location information. Values can indicate "use the basic method" or "use the basic method with resume capability".
segmentedLIResume The parameter is used to request resumption of an LPPe segmented transfer of location information following realease or failure and later restoration of the connection and any location session between the server and the target. The parameter includes the following fields: segmentedLI-session-ID session ID assigned by the target for the segmented transfer next-segment-number segment number of next expected LPP Provide Location Information
session-ID This field provides the periodic/triggered session ID assigned to the Periodic/Triggered Location information Transfer with Update procedure.
typeOfLocInfoRequest This field indicates whether this is an initial request for a new procedure, an update request where the previously agreed location information delivery will continue if the request cannot be supported or an update request where the prevuiously agreed location information delivery will be aborted if the request cannot be supported.
numberOfChanges This field indicates the number of relative changes of location to be reported by the target. The default if absent is one. The target shall report the indicated number of changes if available or, if not available, the number of changes that are available.

OMA-LPPe-CommonIEsRequestLocationInformation **field descriptions**
typeOfRequest
This field indicates whether local position reporting is an optional addition to reporting of absolute location, a mandatory addition to reporting of absolute location, or a mandatory alternative to absolute location (which shall then not be reported).
referencePointReq
This field, if included, specifies a list of desired reference points relative to which the subject location is requested in the order of preference. The first reference point in the list is the most preferred reference point, etc. Details of the reference points would have been provided to the target in previous assistance data. If no reference points are specified, the target may reports its location using any available reference point.
civicLocation-Request
This field, if included, indicates a request for the civic location of the target. The format field indicates the requested format as follows: pidf-lo the requested format is OMA-LPPe-CivicLocation-pidf-lo

– *OMA-LPPe-CommonIEsProvideLocationInformation*

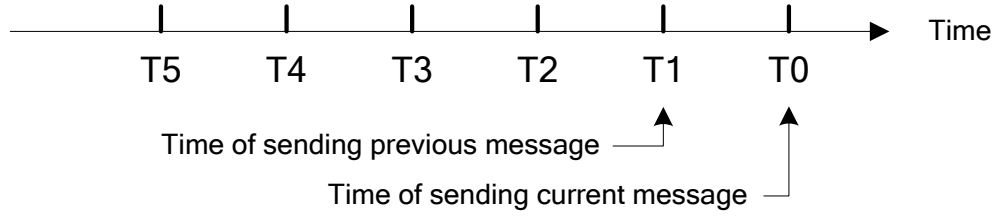
The *OMA-LPPe-CommonIEsProvideLocationInformation* carries common IEs for a Provide Location Information message extension.

```
-- ASN1START

OMA-LPPe-CommonIEsProvideLocationInformation ::= SEQUENCE {
    highAccuracy3Dposition              OMA-LPPe-HighAccuracy3Dposition             OPTIONAL,
                                                    --Cond HighAccuracy
    localPosition                       OMA-LPPe-LocalPosition                      OPTIONAL,
    highAccuracy3Dvelocity              OMA-LPPe-HighAccuracy3Dvelocity             OPTIONAL,
                                                    --Cond HighAccuracy
    iP-Address-List                     OMA-LPPe-IP-Address-List                    OPTIONAL,
    locationInformationContainer        OMA-LPPe-LocationInformationContainer       OPTIONAL,
    providePeriodicLocInfoWithUpdate    OMA-LPPe-ProvidePeriodicLocInfowithUpdate   OPTIONAL,
                                                     --Cond ProvidePeriodicLocInfoWithUpdate
    relativeLocationChangeList          OMA-LPPe-RelativeLocationChangeList         OPTIONAL,
    scheduledLocation                   OMA-LPPe-ScheduledLocation                  OPTIONAL,
                                                    --Cond ScheduledLocationRequested
    accessTypes                         OMA-LPPe-AccessTypes                        OPTIONAL,
    segmentedLITransfer                 OMA-LPPe-SegmentedLITransfer                OPTIONAL,
                                                    --Cond segmentedTransferWithResume
    locationInformationTimeStamp        OMA-LPPe-TimeStamp                          OPTIONAL,
    ...,
    locationSource                      OMA-LPPe-LocationSource                     OPTIONAL,
                                                    --Cond LocationSource
    civicLocation-pidf-lo               OMA-LPPe-CivicLocation-pidf-lo              OPTIONAL
                                                    --Cond CivicLocationRequest-pidf-lo
}

OMA-LPPe-LocalPosition ::= SEQUENCE {
    referencePoint              OMA-LPPe-ReferencePointUniqueID,
    subjectLocation             OMA-LPPe-RelativeLocation                   OPTIONAL,
    ...
}

OMA-LPPe-IP-Address-List ::= SEQUENCE (SIZE (1..maxIPAddress)) OF OMA-LPPe-IP-Address

maxIPAddress INTEGER ::= 5

OMA-LPPe-IP-Address ::= SEQUENCE {
    local-IP-Address    CHOICE  {
        iPv4    BIT STRING (SIZE(32)),
        iPv6    BIT STRING (SIZE(128)),
        ...
        },
    bearer      OMA-LPPe-Bearer,
    nat         BOOLEAN             OPTIONAL,
    ...
}

OMA-LPPe-Bearer ::= ENUMERATED {
    unknown,
```

```
    gsm,
    utran,
    lte,
    wlan,
    wimax,
    dsl,
    pktcable,
    other,
    ...,
    nr
}

OMA-LPPe-ProvidePeriodicLocInfowithUpdate ::= SEQUENCE {
    session-ID                  OCTET STRING (SIZE(4)),
    typeOfLocInfoProvide        OMA-LPPe-TypeOfLocInfoProvide,
    ...
}

OMA-LPPe-TypeOfLocInfoProvide ::= ENUMERATED {
    responseToInitialRequest,
    providePeriodicLocInfo,
    responseToServerUpdateRequest,
    targetUpdate,
    ...
}

OMA-LPPe-RelativeLocationChangeList ::= SEQUENCE (SIZE (1..maxRelativeLocation)) OF
                                                                    OMA-LPPe-RelativeLocationChange

OMA-LPPe-RelativeLocationChange ::= SEQUENCE {
    relativeTime                INTEGER (0..65535)      OPTIONAL,
    transactionID               INTEGER (0..255)        OPTIONAL,
    relativeLocation            OMA-LPPe-RelativeLocation,
    ...
}

maxRelativeLocation     INTEGER ::= 5

OMA-LPPe-ScheduledLocation ::= SEQUENCE {
    disposition     ENUMERATED {withinWindow,
                                outsideWindowOrNoWindow,
                                notSupportedDueToNoCapability,
                                notSupportedDueToNoTimeReference,
                                notSupportedDueToConflictWithAnotherRequest,
                                notSupportedForOtherReasons,
                                ... },
    actualWindow    SEQUENCE {
        start       INTEGER (-512..511),
        duration    INTEGER (0..2047)
    }                                       OPTIONAL,
    ...
}

OMA-LPPe-AccessTypes ::= SEQUENCE {
    accessTypeUnknown           NULL                            OPTIONAL,
    fixedAccessTypes            OMA-LPPe-FixedAccessTypes       OPTIONAL,
    wirelessAccessTypes         OMA-LPPe-WirelessAccessTypes    OPTIONAL,
    ...
}

OMA-LPPe-SegmentedLITransfer ::= SEQUENCE {
    segmentedLI-session-ID          INTEGER (1..256),
    segment-number      INTEGER (1..4096),
    ...
}

OMA-LPPe-TimeStamp ::= CHOICE {
    gnssTime            GNSS-SystemTime,
    networkTime         NetworkTime,
    relativeTime        INTEGER (0..1024),
    ...
}
```

```
OMA-LPPe-LocationSource ::= SEQUENCE {
    agnss               NULL    OPTIONAL,
    otdoa               NULL    OPTIONAL,
    eotd                NULL    OPTIONAL,
    otdoaUTRA           NULL    OPTIONAL,
    ecidLTE             NULL    OPTIONAL,
    ecidGSM             NULL    OPTIONAL,
    ecidUTRA            NULL    OPTIONAL,
    wlanAP              NULL    OPTIONAL,
    srn                 NULL    OPTIONAL,
    sensors             NULL    OPTIONAL,
    ...,
    nr-dl-tdoa          NULL    OPTIONAL,
    nr-dl-aod           NULL    OPTIONAL,
    ecidNR              NULL    OPTIONAL,
    bt                  NULL    OPTIONAL,
    mbs                 NULL    OPTIONAL,
    baro-sensor         NULL    OPTIONAL,
    motion-sensor       NULL    OPTIONAL
}

-- ASN1STOP
```

Conditional presence	Explanation
HighAccuracy	This field shall be present, when providing high accuracy position/velocity, i.e. when the *highAccuracyMethodRequested* is set true in *AGNSS-PositioningInstructions*.
ProvidePeriodicLocInfoWithUpdate	The parameter shall be present in a Provide Location Information for Periodic/Triggered Assistance Data Transfer with Target Update. The field shall be omitted in other cases.
ScheduledLocationRequested	The parameter shall be present in the first or only response to an LPP Request Location Information if *scheduledLocation-Request* was included by the server in *OMA-LPPe-CommonIEsRequestLocationInformation*.
segmentedTransferWithResume	This parameter shall be present in each LPP Provide Location Information message sent to a server when a segmented transfer of location information with resume capability is either started or resumed.
LocationSource	This parameter shall be present in each LPP Provide Location Information message sent to a server when a location estimate is sent in either low accuracy format in LPP (as part of LPP *CommonIEsProvideLocationInformation*) or in high accuracy format in LPPe (as part of LPPe *OMA-LPPe-CommonIEsProvideLocationInformation*).
CivicLocationRequest-pidf-lo	This parameter shall be present if available when the civic location of the target is requested by the server with the format pidf-lo. This parameter is optional in other cases.

OMA-LPPe-CommonIEsProvideLocationInformation **field descriptions**
highaccuracy3Dposition This field provides a high accuracy location estimate. This field shall be used to deliver the location estimate in case the server requested high accuracy GNSS method.
localPosition This field provides a subject location in a local coordinate system, whose origin is defined by a reference point. This field may only be included when a target provides a location estimate (e.g. shall not be provided when a target provides location measurements). The field may be provided in addition to or instead of an absolute location estimate as specified in an *OMA-LPPe-CommonIEsRequestLocationInformation* message in the case of a solicited response.
highaccuracy3Dvelocity This field provides a high accuracy velocity estimate. This field shall be used to deliver the velocity estimate in case the server requested high accuracy GNSS method.
iP-Address-List This parameter provides a list of one or more local IP addresses assigned to the target for a particular bearer.
locationInformationContainer This parameter carries vendor-/operator-specific location information.
providePeriodicLocInfoWithUpdate This field is used to provide periodic/triggered location information session (accompanied by the provide for the actual data).
relativeLocationChangeList This parameter provides a list of one or more consecutive relative changes in the location of the target device. The changes are relative to the times T0, T1, T2, T3 etc. when the target previously sent LPP Provide Location Information messages to the server. Here T0 represents the time of sending of the most recent LPP Provide Location Information message – i.e. the one carrying the relative changes in location; T1 represents the time of sending of the previous LPP Provide Location Information message – i.e. the one sent by the target immediately prior to T0; T2 represents the time of sending of the LPP Provide Location message sent by the target immediately prior to T1 etc.. A segmented series of LPP Location Information messages sent by the target at almost the same time counts as one message and one time. The list of location changes sent by the target is ordered with the first change giving the target location at T0 relative to the reference location of the target at T1, the second change giving the target location at T1 relative to the reference location of the target at T2 etc. This information can be used by the server to obtain or improve the absolute location of the target – e.g. when the target is unable to provide other location information for some temporary duration. LocChangeList=(LocChange (T0-T1), LocChange (T1-T2), ...)   

OMA-LPPe-CommonIEsProvideLocationInformation **field descriptions**
scheduledLocation This parameter indicates the degree to which a scheduled location request was supported and contains the following fields. disposition indicates whether all returned location information was obtained within the requested time window or was obtained outside the window (including the case where no window was provided) or whether the request could not be supported due to no capability, no available time reference, conflict with another request or for some other reason. actualWindow indicates the precise window within which all measurements and location were actually obtained when a disposition value of "outsideWindowOrNoWindow" is provided. The window is defined by a start time relative to the requested start time in units of 10 ms and a duration rounded up to a multiple of 10 ms with zero indicating interpolation or extrapolation to the exact start time. This field shall be provided if applicable and available and if the actual window can be accurately encoded. The field shall be omitted if the window start time or duration falls outside the allowed range.
accessTypes This parameter provides the access type or types currently being used by the target device. The following fields can be included: accessTypeUnknown this field shall be included if the target cannot determine the access type in use – e.g. if the target is using a separate wireless or wireline modem of unknown type. fixedAccessTypes this field indicates the fixed access type or types currently in use by the target and shall be included if the target is using one or more fixed access types wirelessAccessTypes this field indicates the wireless access type or types currently in use by the target and shall be included if the target is using one or more wireless access types
segmentedLITransfer This parameter provides the following fields to support segmented transfer of location information with a resume capability. segmentedLI-session-ID session ID assigned by the target which should be unique within the target segment-number segment number starting from 1 and incremented by 1 in each successive LPP Provide Location Information message
referencePoint This field identifies the reference point for the subject location.
subjectLocation This field defines the subject location relative to the reference point. If this field is absent, the subject location coincides with the reference point location.
local-IP-Address This parameter provides a local IPv4 or IPv6 address assigned to the target.
bearer This parameter provides the bearer associated with a particular IP address.
nat This parameter indicates whether Network Address Translation (NAT) is used or may be used for a particular IP address (TRUE) or whether NAT is not used (FALSE). The default if not included is FALSE.
session-ID This field provides the periodic/triggered session ID assigned to the Periodic/Triggered Location Information Transfer with Update procedure.
typeOfLocInfoProvide This field indicates whether this is a response to an initial request for a new procedure, normal delivery of periodic/triggered location information, a response to an update request from the server or a unsolicited target update.
relativeTime This field indicates the timespan in units of 0.1 seconds over which a reported relative change in location is measured. When multiple relative changes in location are reported, the corresponding timespans shall be contiguous (i.e. each time span shall begin at the instant that the previous timespan ends).

OMA-LPPe-CommonIEsProvideLocationInformation field descriptions
transactionID This field provides the LPP transaction ID that was used for the first or only LPP Provide Location Information message that was sent by the target when it occupied the reference location for a reported relative change in location. The indicated LPP Provide Location Information may have provided the server with the absolute value of this reference location (either directly or via measurements). Providing the transaction ID may help the server identify the particular Provide Location Information message (and hence the reference location) if there may otherwise be ambiguity. This parameter is optional and shall be provided if available.
relativeLocation This parameter provides the relative change in location,
locationInformationTimestamp This parameter provides the time or, when a time period is applicable, the most recent time for which the provided measurements or location estimate are valid. The parameter allows the following alternatives listed in priority order (highest priority first) with the highest priority alternative that is available being provided: gnssTime absolute GNSS time networkTime network time for network known by the target to be associated with the server. In all other cases network time shall have lowest priority. relativeTime time interval in seconds between the measurement(s) and the transmission of this information by the target This parameter should not be included when all the included measurements and/or location estimate include their own timestamp(s). If the parameter is included and an included measurement or location estimate has its own timestamp, the latter shall have precedence. If the parameter is not included and an included measurement or location estimate does not have its own timestamp, the timestamp shall be assumed to be the time of location information transmission from the target.
locationSource This parameter indicates the positioning technologies involved in calculating a UE-based position estimate sent by the target to the server. The parameter is encoded as a bitmap and lists the following positioning technologies: agnss: Assisted-GNSS otdoa: OTDOA on LTE eotd: E-OTD (GSM) otdoaUTRA: OTDOA on UTRA ecidLTE: E-CID on LTE ecidGSM: E-CID on GSM ecidUTRA: E-CID on UTRA wlanAP: WLAN AP srn: SRN sensors: Sensors nr-dl-tdoa: DL-TDOA for NR nr-dl-aod: DL-AoD for NR ecidNR: E-CID on NR bt: BT mbs: MBS baro-sensor: Barometric sensor motion-sensor: Motion sensor If more than one positioning technology is indicated, the target calculated a final position result reported to the server by appropriately combining individual position results (hybrid positioning). NOTE: sensors can refer to barometric sensors and motion sensors for backward compatibility and should be included whenever baro-sensor, motion-sensor or both are included.
civicLocation-pidf-lo This parameter provides the civic location of the target with the format pidf-lo.

– *OMA-LPPe-CommonIEsAbort*

The *OMA-LPPe-CommonIEsAbort* carries common IEs for an Abort message extension.

```
-- ASN1START

OMA-LPPe-CommonIEsAbort ::= SEQUENCE {
```

```
    abortCause ENUMERATED   {periodicADsessionStop,
                        periodicADprocedureNotSupported,
                        periodicADprocedureNotAccepted,
                        periodicLocInfoSessionStop,
                        periodicLocInfoProcedureNotSupported,
                        periodicLocInfoProcedureNotAccepted,
                        ...
                        }                                       OPTIONAL,
    periodicSessionIDtoAbort    OCTET STRING (SIZE(4))          OPTIONAL,   --Cond periodicWithUpdate
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
periodicWithUpdate	The parameter shall be present when a procedure for either Periodic/Triggered Transfer of Assistance Data with Update or Periodic/Triggered Transfer of Location Information with Update is aborted.

– *OMA-LPPe-CommonIEsError*

The *OMA-LPPe-CommonIEsError* carries common IEs for an Error message extension.

```
-- ASN1START

OMA-LPPe-CommonIEsError ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5 Positioning method IEs

Positioning method information elements are IEs included in the positioning method specific IEs in the corresponding messages.

6.5.1 AGNSS Positioning

6.5.1.1 AGNSS Assistance Data

– *OMA-LPPe-AGNSS-ProvideAssistanceData*

The *OMA-LPPe-AGNSS-ProvideAssistanceData* is used to provide assistance for UE-based and UE-assisted AGNSS-based methods.

```
-- ASN1START

OMA-LPPe-AGNSS-ProvideAssistanceData ::= SEQUENCE {
    commonAssistData        OMA-LPPe-AGNSS-CommonAssistData         OPTIONAL,
    genericAssistData       OMA-LPPe-AGNSS-GenericAssistData        OPTIONAL,
    error                   OMA-LPPe-AGNSS-Error                    OPTIONAL,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-CommonAssistData*

The *OMA-LPPe-AGNSS-CommonAssistData* is used to provide GNSS-independent assistance for UE-based and UE-assisted AGNSS-based methods.

```
-- ASN1START

OMA-LPPe-AGNSS-CommonAssistData::= SEQUENCE {
    ionosphericModel            OMA-LPPe-AGNSS-IonosphericModel         OPTIONAL,
    troposphereModel            OMA-LPPe-AGNSS-TroposphereModel         OPTIONAL,
    altitudeAssistance          OMA-LPPe-AGNSS-AltitudeAssistanceList   OPTIONAL,
```

```
    solarRadiation              OMA-LPPe-AGNSS-SolarRadiation           OPTIONAL,
    ccpAssistCommonProvide      OMA-LPPe-AGNSS-CCPassistCommonProvide   OPTIONAL,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-GenericAssistData*

The *OMA-LPPe-AGNSS-GenericAssistanceData* is used to provide GNSS-dependent assistance for UE-based and UE-assisted AGNSS-based methods.

```
-- ASN1START

OMA-LPPe-AGNSS-GenericAssistData ::= SEQUENCE (SIZE (1..16)) OF OMA-LPPe-AGNSS-GenericAssistDataElement

OMA-LPPe-AGNSS-GenericAssistDataElement ::= SEQUENCE {
    gnss-ID                         GNSS-ID,
    wideAreaIonoSurfacePerSVlist    OMA-LPPe-AGNSS-WideAreaIonoSurfacePerSVlist OPTIONAL,
    mechanicsForAllSVs              OMA-LPPe-AGNSS-MechanicsForAllSVs           OPTIONAL,
    dcbsForAllSVs                   OMA-LPPe-AGNSS-DCBsForAllSVs                OPTIONAL,
    navModelDegradationModel        OMA-LPPe-AGNSS-NavModelDegradationModelList OPTIONAL,
    ccpAssistProvide                OMA-LPPe-AGNSS-CCPassistGenericProvide      OPTIONAL, --Cond CCP
    navModelList                    OMA-LPPe-AGNSS-NavModelList             OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
CCP	The field is mandatory present, when providing continuous carrier phase assistance and reference time is included in the IE *AGNSS-CCPassistCommonProvide*. Otherwise the field shall not be present.

***OMA-LPPe-AGNSS-GenericAssistData* field descriptions**
gnss-ID This field specifies the GNSS ID of the satellite system for which data is being provided.

6.5.1.2 AGNSS Assistance Data Elements

– *OMA-LPPe-AGNSS-IonosphericModel*

The IE *OMA-LPPe-AGNSS-IonosphericModel* is used by the location server to provide local 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. The well-known Klobuchar ionospheric model is supported with the fields for the spatial and temporal validity. The parameters of the model can be localized where appropriate. The ionospheric storm indication reports the level of ionospheric activity in the region.

Periodic models, on the other hand, are based on the real-time GNSS observations and thus updated frequently to the target. The supported models include Wide Area Ionosphere Surface corrections that are provided to the target using the periodic AD procedure.

```
-- ASN1START

OMA-LPPe-AGNSS-IonosphericModel ::= CHOICE {
    staticModels    SEQUENCE {
                        localKlobucharModelList OMA-LPPe-AGNSS-LocalKlobucharModelList      OPTIONAL,
                        ionoStormIndication     OMA-LPPe-AGNSS-IonoStormIndication          OPTIONAL,
                        ...
                        },
    waIono          CHOICE {
                        controlParameters   OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersProvide,
                        commonProvide       OMA-LPPe-AGNSS-WideAreaIonoSurfaceCommon,
                        ...
                        },
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-IonosphericModel field descriptions
localKlobucharModelList This field carries parameters related to localized Klobuchar model.
ionoStormIndication This field carries information on the ionosphere conditions in the area.
waIono This field carries the periodic wide area ionosphere corrections. The field carries controlParameters: Control parameters of the periodic wide area ionosphere correction surface. This is a response to the IE *OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersRequest* or a server-side update to the control parameters. commonProvide: Common part of the WA Iono assistance data

– *OMA-LPPe-AGNSS-LocalKlobucharModelList*

The *OMA-LPPe-AGNSS-LocalKlobucharModelList* consists of multiple local Klobuchar models. The list can consist of up to 16 models. For instance, seven subsequent models, each with validity time of one hour, would result in totally seven hours of valid ionospheric model.

The local ionospheric model is given for the last known location of the target. It's possible that there are several valid models for the target location, or that the target location uncertainty area is so large that the area includes more than one model. In this case, the server can provide the target with multiple models, and the target makes the decision which model to use.

```
-- ASN1START

OMA-LPPe-AGNSS-LocalKlobucharModelList ::= SEQUENCE (SIZE(1..16)) OF
                                              OMA-LPPe-AGNSS-LocalKlobucharModelElement

OMA-LPPe-AGNSS-LocalKlobucharModelElement ::= SEQUENCE {
    validityArea    OMA-LPPe-ValidityArea,
    klobucharModel  SEQUENCE (SIZE(1..8)) OF OMA-LPPe-AGNSS-LocalKlobucharModel,
    ...
}

OMA-LPPe-AGNSS-LocalKlobucharModel ::= SEQUENCE {
    validityPeriod  OMA-LPPe-ValidityPeriod,
    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
```

OMA-LPPe-AGNSS-LocalKlobucharModel field descriptions
validityArea This field specifies the validity area of the local Klobuchar model parameters. Representation of the validity area is described in Appendix C.1. The interpretation of the validity area is such that in case the target is within the validity area, the target may utilize the model.
validityPeriod This field specifies the start time and duration of the model validity period.
alpha0 This field specifies the α_0 parameter of the Klobuchar model. Scale factor 2^{-30} seconds.
alpha1 This field specifies the α_1 parameter of the Klobuchar model. Scale factor 2^{-27} seconds/semi-circle.

OMA-LPPe-AGNSS-LocalKlobucharModel **field descriptions**
alpha2 This field specifies the α_2 parameter of the Klobuchar model. Scale factor 2^{-24} seconds/semi-circle^2.
alpha3 This field specifies the α_3 parameter of the Klobuchar model. Scale factor 2^{-24} seconds/semi-circle^3.
beta0 This field specifies the β_0 parameter of the Klobuchar model. Scale factor 2^{11} seconds.
beta1 This field specifies the β_1 parameter of the Klobuchar model. Scale factor 2^{14} seconds/semi-circle.
beta2 This field specifies the β_2 parameter of the Klobuchar model. Scale factor 2^{16} seconds/semi-circle^2.
beta3 This field specifies the β_3 parameter of the Klobuchar model. Scale factor 2^{16} seconds/semi-circle^3.

– *OMA-LPPe-AGNSS-IonoStormIndication*

The IE *OMA-LPPe-AGNSS-IonoStormIndication* provides the capability to carry ionospheric activity warnings to the target. In the IE *OMA-LPPe-AGNSS-IonoStormIndication* the area is given as a grid, coded in the same way as the IE *OMA-LPPe-ValidityArea*, but instead of valid/non-valid –indications for the regions, the level of ionospheric activity in the region is indicated. The usage and the NOAA scale are explained in Appendix C.2. The ionospheric storm indication should be given for a sufficiently large area around the target.

In case the server provides several models, each for a different time period, the validity area stays the same.

```
-- ASN1START

OMA-LPPe-AGNSS-IonoStormIndication ::= SEQUENCE {
    area        OMA-LPPe-ValidityArea,
                                --rleList shall not be included and is replaced by the stormList below
    stormList   OMA-LPPe-AGNSS-StormList,
    ...
}

OMA-LPPe-AGNSS-StormList ::= SEQUENCE (SIZE(1..16)) OF OMA-LPPe-AGNSS-StormElement

OMA-LPPe-AGNSS-StormElement ::= SEQUENCE {
    validityPeriod                  OMA-LPPe-ValidityPeriod,
    rleListIono                     OMA-LPPe-AGNSS-RleListIono,
    ...
}

OMA-LPPe-AGNSS-RleListIono ::= SEQUENCE (SIZE(1..65535)) OF OMA-LPPe-AGNSS-RleIonoElement

OMA-LPPe-AGNSS-RleIonoElement ::= SEQUENCE {
    regionCount     INTEGER (0..255),
    ionoIndex       CHOICE {
                            noaaScales      OMA-LPPe-AGNSS-NoaaScales,
                            ...
                            },
    ...
}

OMA-LPPe-AGNSS-NoaaScales ::=   ENUMERATED{ g1,g2, g3, g4, g5, unknown, none, ... }

-- ASN1STOP
```

OMA-LPPe-AGNSS-IonoStormIndication field descriptions
area This field specifies the area for which ionosphere storm indications are given. See Appendix C.1. and C.2 for further information.
stormlist This field provides information on the ionospheric activity in the area defined by ***area***.
validityPeriod This field specifies the time interval over which the storm data is valid.
rleListIono This field specifies the ionospheric activity in the region.
ionoIndex This field specifies the level of ionospheric activity as explained in Appendix C.2.
regionCount This field indicates the number of subsequent regions with the same level of ionospheric activity. See Appendix C.2 for further information.

– *OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersProvide*

The IE *OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersProvide* carries the control parameters of the periodic Wide Area ionosphere surface corrections.

Wide Area Ionosphere correction surface is another approach for providing ionosphere correction data to the target. Here real time ionosphere corrections are estimated by, say, a wide area reference station network. Ionosphere delay is calculated for each satellite by all the stations and a second-order interpolation model is estimated. The model is exploited by the target to estimate the ionosphere delay at the target position. The wide area corrections approach reduces the ionosphere residual to the decimetre-level.

The wide area ionosphere corrections are provided using the periodic AD framework. The framework handles the periodic AD session control by the inclusion of periodic AD session ID in each LPPe provide/request AD message that carries periodic AD. The WA Iono level control, on the other hand, provides the request mechanism as well the provision of the duration of the session, rate of the deliveries, the model reference position and the validity area.

The model is provided to the vicinity of the target so that the model reference position is as close to the last known location of the target as possible. The target location must at least lie within the validity area of the model. In case the target is moving out of the validity area, the target may update its location to the server, in which case the server may update the WA iono model control parameters to the target using the update procedure.

```
-- ASN1START

OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersProvide ::= SEQUENCE {
    duration                OMA-LPPe-Duration       OPTIONAL,   --Cond FirstOrDurModify
    rate                    INTEGER(1..64)          OPTIONAL,   --Cond FirstOrRateModify
    referencePosition       Ellipsoid-Point         OPTIONAL,   --Cond FirstOrPosModify
    validityArea            OMA-LPPe-ValidityArea   OPTIONAL,   --Cond FirstOrAreaModify
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
FirstOrDurModify	This field is mandatory present, when providing a first message of a new WA Iono AD session or when providing the modification of the duration. Otherwise it is not present.
FirstOrRateModify	This field is mandatory present, when providing a first message of a new WA Iono AD session or when providing the modification of the rate. Otherwise it is not present.
FirstOrPosModify	This field is mandatory present, when providing a first message of a new WA Iono AD session or when providing the modification of the reference position. Otherwise it is not present.
FirstOrAreaModify	This field is mandatory present, when providing a first message of a new WA Iono AD session or when providing the modification of the validity area. Otherwise it is not present.

OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersProvide **field desccription**
duration This field specifies the length of the continuous periodic assistance session.
rate This field specifies the interval between the assistance data deliveries in seconds.
referencePosition This field specifies the reference postion of ionospheric delay model according to WGS84 coordinates system
validityArea This field specifies the validity area of the ionospheric interpolation model estimated by a wide area reference network. The interpretation of the validity area is such that in case the target is within the validity area, the target may utilize the model.

– *OMA-LPPe-AGNSS-WideAreaIonoSurfaceCommon*

The IE *OMA-LPPe-AGNSS-WideAreaIonoSurfaceCommon* carries the common parameters of the periodic Wide Area ionosphere surface AD.

```
-- ASN1START

OMA-LPPe-AGNSS-WideAreaIonoSurfaceCommon ::= SEQUENCE {
    validityPeriod                 OMA-LPPe-ValidityPeriod,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-WideAreaIonoSurfaceCommon **field desccription**
validityPeriod This field defines the validity period of the widea area ionosphere correction.

– *OMA-LPPe-AGNSS-WideAreaIonoSurfacePerSVlist*

The *OMA-LPPe-AGNSS-WideAreaIonoSurfacePerSVlist* consist of second order correction surface coefficients for each visible SV. The use of the model is explained in Appendix C.3. For more information on the usage, refer to *OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersProvide.* Calculating the delay using the parameters and the formula presented in Appendix C.3, yields the slant delay directly, i.e. there is no need to apply further scaling factors.

Wide Area Ionosphere Correction Surface is provided for each visible SV in each GNSS constellation for which corrections are requested. Visible in this context means an SV that can be observed within the validity area of the correction surface.

This IE is always accompanied by the IE *OMA-LPPe-AGNSS-WideAreaIonoSurfaceCommon* in the common part of the AGNSS AD delivery.

```
-- ASN1START

OMA-LPPe-AGNSS-WideAreaIonoSurfacePerSVlist ::=
                            SEQUENCE (SIZE (1..64)) OF OMA-LPPe-AGNSS-WideAreaIonoSurfacePerSVelement

OMA-LPPe-AGNSS-WideAreaIonoSurfacePerSVelement ::= SEQUENCE {
    svID    SV-ID,
    a0      INTEGER (0..8191),
    e1      INTEGER (-4096..4095),
    n1      INTEGER (-4096..4095),
    e2      INTEGER (-4096..4095) OPTIONAL, --Cond SecondOrder
    n2      INTEGER (-4096..4095) OPTIONAL, --Cond SecondOrder
    en      INTEGER (-4096..4095) OPTIONAL, --Cond SecondOrder
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
SecondOrder	The field is mandatory present if the 2nd-order model is being provided, otherwise it is not present.

***OMA-LPPe-AGNSS-WideAreaIonoSurfacePerSVelement* field desccription**
svID This field specifies the SV for which correction is applicable.
a0 This parameter specifies the ionospheric delay for the SVat the reference position. Scale factor 0.1 TECU.
e1 This parameter describes the ionosphere first order dependency eastward from the origin. Scale factor 0.001 TECU/km.
n1 This parameter describes the ionosphere first order dependency northward from the origin. Scale factor 0.001 TECU/km.
e2 This parameter describes the ionosphere second order dependency eastward from the origin. Scale factor 10^{-5} TECU/km^2.
n2 This parameter describes the ionosphere second order dependency northward from the origin. Scale factor 10^{-5} TECU/km^2.
en This parameter describes the ionosphere second order dependency cross-term. Scale factor 10^{-5} TECU/km^2.

– *OMA-LPPe-AGNSS-TroposphereModel*

The IE *OMA-LPPe-AGNSS-TroposphereModel* is used by the location server to provide local parameters to model the propagation delay of the GNSS signals through the troposphere. Proper use of these fields allows a GNSS receiver to remove parts of the tropospheric delay from the pseudorange measurements.

There are two different parameter set options: One that provides the zenith troposphere delay components determined in a given location and the needed parameters to adjust the delay to the target's altitude. The other parameter set provides the surface pressure and optionally temperature that allow the target to compute the tropospheric delay using one of the known atmosphere models, such as the Hopfield or Saastamoinen model. Both parameter sets include the mapping function parameters that are used to map the zenith delay into the slant delay according to the satellite elevation angle.

Up to 64 parameter sets can be provided. For instance, if the target indicates that it supports multiple grid points, data can be provided for four different grid points around the target, and for four different time periods for each of the locations. If only one grid point is provided, it shall be the grid point that is closest to the last known position of the target. For the case of multiple grid points, the server chooses the points in the order of growing distance from the last known position.

```
-- ASN1START

OMA-LPPe-AGNSS-TroposphereModel ::= SEQUENCE {
    troposphereDelayList            OMA-LPPe-AGNSS-LocalTropsphereDelayList        OPTIONAL,
    surfaceParametersList           OMA-LPPe-AGNSS-LocalSurfaceParametersList       OPTIONAL,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-LocalTropsphereDelayList*

The IE *OMA-LPPe-AGNSS-LocalTropospherDelayList* is used to remove the troposphere delay from the pseudorange measurements. The main component of the local troposphere delay is the hydrostatic zenith delay. Optionally, also wet zenith delay and parameters to adjust these delay components to the user level can be given to provide a higher accuracy. Also gradients to North- and East- directions can be provided to compensate for azimuthal asymmetry of the tropospheric delay. The use of the parameters and of the mapping function are explained in Appendix C.4.

```
-- ASN1START

OMA-LPPe-AGNSS-LocalTroposphereDelayList ::= SEQUENCE (SIZE(1..8)) OF
                                                 OMA-LPPe-AGNSS-LocalTroposphereDelayAreaElement

OMA-LPPe-AGNSS-LocalTroposphereDelayAreaElement ::= SEQUENCE {
    validityArea                OMA-LPPe-ValidityArea,
    refAltitude                 INTEGER (-1000..8192)   OPTIONAL,
    gradientReferencePosition   Ellipsoid-Point         OPTIONAL,

    delayList                   SEQUENCE (SIZE(1..8)) OF

                                        OMA-LPPe-AGNSS-LocalTroposphereDelayTimeElement,
    ...
}


OMA-LPPe-AGNSS-LocalTroposphereDelayTimeElement ::= SEQUENCE {
    validityPeriod              OMA-LPPe-ValidityPeriod,
    zh0                         INTEGER (0..4095),
    eh                          INTEGER (0..4095)       OPTIONAL,
    zw0                         INTEGER (0..4095)       OPTIONAL,
    ew                          INTEGER (0..4095)       OPTIONAL,
    gN                          INTEGER (-8192..8191)   OPTIONAL,
    gE                          INTEGER (-8192..8191)   OPTIONAL,
    mappingFunctionParameters   OMA-LPPe-AGNSS-MappingFunctionParameters,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-LocalTroposphereDelayList* field descriptions**
validityArea This field specifies the geographical validity area of the local troposphere model parameters.
refAltitude This field specifies the reference altitude (from nominal sea level, [EGM96]) at which the delay measurements are made. The field is optional, and if it is not included, the reference altitude is the zero nominal sea level. The scale factor is 1m.
gradientReferencePosition This field specifies the origion for the spatial gradients *gN* and *gE*. If absent, the origin is taken as the middle point of the validity area.
delayList This field species the troposphere delays.
validityPeriod This field specifies the start time and duration of the local troposphere parameters validity period.
zh0 Parameter Z_{h0} is the hydrostatic zenith delay (meters), measured at the reference altitude level. The scale factor is 2^{-10} m.
eh Parameter e_h is the exponential fit parameter (1/m) for scaling Z_{h0} to the target altitude. The scale factor is 2^{-20} (1/m).
zw0 Parameter Z_{w0} is the wet zenith delay (meters), measured at the reference altitude level. The scale factor is 2^{-10} m.
ew Parameter e_w is the exponential fit parameter (1/m) for scaling Z_{w0} to the target altitude. The scale factor is 2^{-20} (1/m).
gN G_N is the gradient parameter (m) in North direction of the azimuthally asymmetric part of the tropospheric slant delay. The scale factor is 2^{-7} m.

OMA-LPPe-AGNSS-LocalTroposphereDelayList field descriptions
gE G_E is the gradient parameter (m) in East direction of the azimuthally asymmetric part of the tropospheric slant delay. The scale factor is 2^{-7} m.
mappingFunctionParameters Coefficients of the mapping functions.

– *OMA-LPPe-AGNSS-LocalSurfaceParametersList*

The IE *OMA-LPPe-AGNSS-LocalSurfaceParametersList* is used for providing the target with the surface atmospheric pressure and optionally temperature at a location close to the target. These parameters are the input to a chosen troposphere delay model, such as the Hopfield or Saastamoinen model, to calculate the zenith tropospheric delay. The mapping function parameters are used as described in Appendix C.4.

```
-- ASN1START

OMA-LPPe-AGNSS-LocalSurfaceParametersList ::= SEQUENCE (SIZE(1..8)) OF
                                                OMA-LPPe-AGNSS-LocalSurfaceParametersAreaElement

OMA-LPPe-AGNSS-LocalSurfaceParametersAreaElement ::= SEQUENCE {
    validityArea               OMA-LPPe-ValidityArea,
    refAltitude                INTEGER (-1000..8192)   OPTIONAL,
    gradientReferencePosition  Ellipsoid-Point         OPTIONAL,
    parameterList              SEQUENCE (SIZE(1..8)) OF
                                       OMA-LPPe-AGNSS-LocalSurfaceParametersTimeElement,
    ...
}

OMA-LPPe-AGNSS-LocalSurfaceParametersTimeElement ::= SEQUENCE {
    validityPeriod             OMA-LPPe-ValidityPeriod,
    pressure                   INTEGER (-1024..1023),
    pressureRate               INTEGER (-128..127),
    gN-pressure                INTEGER (-128..127)     OPTIONAL,
    gE-pressure                INTEGER (-128..127)     OPTIONAL,
    temperature                INTEGER (-64..63)       OPTIONAL,
    temperatureRate            INTEGER (-16..16)       OPTIONAL,
    gN-temperature             INTEGER (-8..7)         OPTIONAL,
    gE-temperature             INTEGER (-8..7)         OPTIONAL,
    mappingFunctionParameters  OMA-LPPe-AGNSS-MappingFunctionParameters,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-LocalSurfaceParametersList field descriptions
validityArea This field specifies the geographical validity area of the local troposphere model parameters.
refAltitude This field specifies the reference altitude (from nominal sea level, [EGM96]) at which the surface measurements are made. The field is optional, and if it is not included, the reference altitude is the zero nominal sea level [EGM96]. The scale factor is 1m.
gradientReferencePosition This field specifies the origion for the spatial gradients gN and gE. If absent, the origin is taken as the middle point of the validity area.
parameterList This field species the surface parameters.
validityPeriod This field specifies the start time and duration of the surface parameter validity period.
pressure Local atmospheric pressure measurement (hPa) at the altitude given by *refAltitude*. The scale factor is 0.1 hPa. The value is added to the nominal pressure of 1013hPa.
pressureRate Rate of change of pressure. When calculating the pressure, the origin of time is the begin time of the validity period. The scale factor is 10 Pa/hour,
gN-pressure This field specifies the northward gradient of the atmospheric pressure. If this field is present, but gE is not given, the Eastward gradient is zero. Scale factor 10 Pa/km.
gE-pressure This field specifies the eastward gradient of the atmospheric pressure. If this field is present, but gN is not given, the Nothward gradient is zero. Scale factor 10 Pa/km.
temperature Local temperature measurement at the reference altitude *refAltitude*. The scale factor 1K. The value is added to 273K.
temperatureRate Local temperature change rate. The scale factor 1K/hour.
gN-temperature This field specifies the northward gradient of the temperature. If this field is present, but gE is not given, the Eastward gradient is zero. Scale factor 1 K/km.
gE-temperature This field specifies the eastward gradient of the temperature. If this field is present, but gN is not given, the Nothward gradient is zero. Scale factor 1 K/km.
mappingFunctionParameters Coefficients of the mapping functions.

– *OMA-LPPe-AGNSS-MappingFunctionParameters*

The IE *OMA-LPPe-AGNSS-MappingFunctionParameters* is used for scaling the tropospheric zenith delay to the slant delay given by the satellite elevation angle. The mapping function parameters are used as described in Appendix C.4.2.

```
-- ASN1START

OMA-LPPe-AGNSS-MappingFunctionParameters ::= SEQUENCE {
    ah                          INTEGER (0..16383),
    bh                          INTEGER (0..16383)      OPTIONAL,
    ch                          INTEGER (0..16383)      OPTIONAL,
    aw                          INTEGER (0..16383)      OPTIONAL,
    bw                          INTEGER (0..16383)      OPTIONAL,
    cw                          INTEGER (0..16383)      OPTIONAL,
    ...
```

```
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-MappingFunctionParameters* field descriptions**
ah a_h is the a-coefficient of the hydrostatic mapping function. Scale factor 2^{-14}.
bh b_h is the b-coefficient of the hydrostatic mapping function. Scale factor 2^{-14}.
ch c_h is the c-coefficient of the hydrostatic mapping function. Scale factor 2^{-14}.
aw a_w is the a-coefficient of the wet mapping function. Scale factor 2^{-14}.
bw b_w is the b-coefficient of the wet mapping function. Scale factor 2^{-14}.
cw c_w is the c-coefficient of the wet mapping function. Scale factor 2^{-14}.

– *OMA-LPPe-AGNSS-AltitudeAssistanceList*

The IE *OMA-LPPe-AGNSS-AltitudeAssistanceList* is used for providing the target device with the surface atmospheric pressure and reference altitude measured in a location close to the target. A target device equipped with a barometer can use these values to deduce its own altitude. When multiple Area Elements are provided, they shall all have different validity areas (overlap of validity areas is allowed, though) or shall carry pressure assistance for different validity periods.

```
-- ASN1START

OMA-LPPe-AGNSS-AltitudeAssistanceList ::= SEQUENCE (SIZE(1..8)) OF
                                                    OMA-LPPe-AGNSS-AltitudeAssistanceAreaElement

OMA-LPPe-AGNSS-AltitudeAssistanceAreaElement ::= SEQUENCE {
    validityArea                OMA-LPPe-ValidityArea,
    gradientReferencePosition   EllipsoidPointWithAltitudeAndUncertaintyEllipsoid   OPTIONAL,
    refAltitude                 INTEGER (-1000..8192)                               OPTIONAL,
    pressureAssistanceList      SEQUENCE (SIZE(1..16)) OF OMA-LPPe-AGNSS-PressureAssistanceElement,
    ...
}

OMA-LPPe-AGNSS-PressureAssistanceElement ::= SEQUENCE{
    validityPeriod              OMA-LPPe-ValidityPeriod,
    pressure                    INTEGER (-1024..1023),
    pressureRate                INTEGER (-128..127)     OPTIONAL,
    gN                          INTEGER (-128..127)     OPTIONAL,
    gE                          INTEGER (-128..127)     OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-AltitudeAssistanceList field descriptions
validityArea This field specifies the geographical validity area of the altitude assistance.
gradientReferencePosition This field specifies the origin for the spatial gradients gN and gE. If absent, the origin is taken as the middle point of the validity area.
refAltitude This field specifies the reference altitude (from nominal sea level, [EGM96]) at which the surface measurements are made. The field is optional, and if it is left out, the reference altitude is the zero nominal sea level. The scale factor is 1m.
pressureAssistanceList This field specifies the set of pressure assistance elements for different periods of time.
validityPeriod This field specifies the start time and duration of the altitude assistance validity period.
pressure Local atmospheric pressure measurement (hPa) at the altitude given by ***refAltitude***. The scale factor is 10 Pa. The value is added to the nominal pressure of 1013hPa.
pressureRate Rate of change of pressure. When calculating the pressure, the origin of time is the begin time of the validity period. The scale factor is 10 Pa/hour,
gN This field specifies the northward gradient of the atmospheric pressure. Scale factor 10 Pa/km.
gE This field specifies the eastward gradient of the atmospheric pressure. Scale factor 10 Pa/km.

– *OMA-LPPe-AGNSS-SolarRadiation*

The IE *OMA-LPPe-AGNSS-SolarRadiation* is used to provide information on the solar radiation intensity.

```
-- ASN1START

OMA-LPPe-AGNSS-SolarRadiation ::= SEQUENCE {
    solarRadiation              INTEGER(1000..2000),
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-SolarRadiation field descriptions
solarRadiation This field specifies the solar radiation at one AU from the Sun. Scale factor 1 Wm^{-2}.

– *OMA-LPPe-AGNSS-MechanicsForAllSVs*

The *OMA-LPPe-AGNSS-MechanicsForAllSVs* information element lists the satellite antenna phase center offsets for each of the SVs in the GNSS defined by *GNSS-ID*. Information on the use of phase center offsets can be found in Appendix C.5. The SV mass and effective combined reflectivity-area may be used for the orbit prediction purposes. Further information can be found in Appendix C.7.

```
-- ASN1START

OMA-LPPe-AGNSS-MechanicsForAllSVs::= SEQUENCE (SIZE(1..64)) OF OMA-LPPe-AGNSS-MechanicsElement


OMA-LPPe-AGNSS-MechanicsElement ::= SEQUENCE {
    svid                        SV-ID,
    mass                        INTEGER(1..4095)            OPTIONAL,
    effectiveReflectivityArea   INTEGER(1..511)             OPTIONAL,
    pco                         OMA-LPPe-AGNSS-PCOelement   OPTIONAL,
    svInfo                      SEQUENCE {
```

```
                                    svType      OMA-LPPe-AGNSS-SVtype,
                                    svNumber    INTEGER(0..1000),
                                    ...
                                    } OPTIONAL,
    ...
}

OMA-LPPe-AGNSS-PCOelement ::= SEQUENCE{
    xOffsetSBF                  INTEGER(-30000..30000),
    yOffsetSBF                  INTEGER(-30000..30000),
    zOffsetSBF                  INTEGER(-30000..30000),
    ...
}

OMA-LPPe-AGNSS-SVtype ::= ENUMERATED {
                                    gpsIIR, gpsIIRM, gpsIIF, gpsIII,
                                    glonassM, glonassK1, glonassK2, glonassKM,
                                    unknown,
                                    ...}


-- ASN1STOP
```

***OMA-LPPe-AGNSS-MechanicsForAllSVs* field descriptions**
svid This field indicates the satellite id for which the information provided applies.
mass This field specifies the SV mass. Scale factor 1 kg. See Appendix C.7 for further information.
effectiveReflectivityArea This field specifies the effective combined SV solar panel reflectivity and area. Scale factor 0.1 m^2. See Appendix C.7 for further information.
pco This field specifies the SV phase center offset. See Appendix C.5 for further information.
svInfo This field carries information on the satellite.
svType This field carries information on the satellite type.
svNumber This field carries information on the SV number. The change in the number is interpreted as the change of satellite. For GPS SVs the number is the SVN (SV Number). For GLONASS SVs the number is the GLONASS Number.
xOffsetSBF This field specifies the x-coordinate offset from the SV center of mass to the SV antenna phace center in satellite body fixed coordinate frame. The coordinate frame is described in Appendix C.5. The scale factor is 0.0001 m.
yOffsetSBF This field specifies the y-coordinate offset from the SV center of mass to the SV antenna phace center in satellite body fixed coordinate frame. The coordinate frame is described in Appendix C.5. The scale factor is 0.0001 m.
zOffsetSBF This field specifies the z-coordinate offset from the SV center of mass to the SV antenna phace center in satellite body fixed coordinate frame. The coordinate frame is described in Appendix C.5. The scale factor is 0.0001 m.

– *OMA-LPPe-AGNSS-DCBsForAllSVs*

The *OMA-LPPe-AGNSS-DCBsForAllSVs* lists the differential code biases for each of the SVs in the GNSS. For each satellite, one of the signals is chosen as a reference, and the differential code biases are given with respect to this reference.

```
-- ASN1START

OMA-LPPe-AGNSS-DCBsForAllSVs ::= SEQUENCE (SIZE(1..64)) OF OMA-LPPe-AGNSS-DCBlistElement


OMA-LPPe-AGNSS-DCBlistElement ::= SEQUENCE {
    svid            SV-ID,
    reference       SEQUENCE{
                        signal  GNSS-SignalID,
                        pd      ENUMERATED { pilot, data, notapplicable, ... },
                        ...
                        },
    dcbList         OMA-LPPe-AGNSS-DCBlist,
    ...
}

OMA-LPPe-AGNSS-DCBlist ::= SEQUENCE (SIZE(1..16)) OF OMA-LPPe-AGNSS-DCBelement

OMA-LPPe-AGNSS-DCBelement ::= SEQUENCE {
    signal                  GNSS-SignalID,
    pd                      ENUMERATED{ pilot, data, notapplicable, ... },
    dcb                     INTEGER (-4096..4095),
    ...
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-DCBsForAllSVs* field descriptions**
svid This field indicates the satellite id for which the information provided applies.
reference The signal with respect to which the differential code biases of the other signals are given.
dcbList The list of differential code biases of the signals with respect to the reference signal.
signal This field indicates the signal id. The interpretation of the signal id depends on the GNSS as explained in 3GPP TS 36.355.
pd This field indicates whether the signal is pilot signal, data signal or if this indication is not applicable in this case.
dcb This field specifies the differential code bias of the signal with respect to the reference signal. The scale factor is 2^{-35} seconds.

– *OMA-LPPe-AGNSS-NavModelDegradationModelList*

The *OMA-LPPe-AGNSS-NavModelDegradationModelList* information element contains a list of elements that each have two degradation models: clock model degradation model and orbit model degradation model. Each of the elements is related to a specific SV. Navigation model degradation model is requested and provided only if the LPP message *GNSS-NavigationModel* is also requested. The degradation models are provided to the same set of satellites for which navigation models are provided in the LPP proper in the IE *GNSS-NavigationModel*. These degradation models are applicable to the navigation models delivered in the LPP simultaneously with the degradation models. The degradation models characterize the 1-sigma error.

```
-- ASN1START

OMA-LPPe-AGNSS-NavModelDegradationModelList ::= SEQUENCE (SIZE(1..64)) OF
                                                    OMA-LPPe-AGNSS-NavModelDegradationModelElement

OMA-LPPe-AGNSS-NavModelDegradationModelElement ::= SEQUENCE {
    svid                            SV-ID,
    clockDegradationModel           OMA-LPPe-AGNSS-ClockModelDegradationModel,
    orbitDegradationModel           OMA-LPPe-AGNSS-OrbitModelDegradationModel,
    ...
}

OMA-LPPe-AGNSS-ClockModelDegradationModel ::= SEQUENCE {
```

```
    clockRMS0                       INTEGER(0..31),
    clockRMS1                       INTEGER(0..7)               OPTIONAL,
    ...
}

OMA-LPPe-AGNSS-OrbitModelDegradationModel ::= SEQUENCE {
    orbitRMS0                       INTEGER(0..31),
    orbitRMS1                       INTEGER(0..7)               OPTIONAL,
    ...
}


-- ASN1STOP
```

***OMA-LPPe-AGNSS-NavModelDegradationModelList* field descriptions**
svid Specifies the SV for which degradation models are provided.
clockDegradationModel This field provides the degradation model for the clock model.
orbitDegradationModel This field provides the degradation model for the orbit model.
clockRMS0 This field specifies the constant term of the clock model degradation model by $cRMS_0=((1+0.1)^{clockRMS0}-1)$ meters, where ***clockRMS0*** = 31 denotes 'Use At Own Risk'. The range is [0, 16.45) meters. Exemplary values:

clockRMS0	$cRMS_0$ (meters)
0	0
1	0.10
2	0.21
...	...
5	0.61
...	...
10	1.59
...	...
20	5.73
...	...
30	16.45
31	N/A

The clock model polynomial is described in Appendix C.6.1. The clock model degradation polynomial is used as described in Appendix C.6.1.
clockRMS1 This field specifies the first order term of the clock model degradation model, $cRMS_1$. Scale factor 2^{-14} m/s. Range [0, 4.3e-4) m/s. The clock model degradation polynomial is used as described in Appendix C.6.1.
orbitRMS0 This field specifies the constant term of the orbit model degradation model by $oRMS_0=((1+0.1)^{orbitRMS0}-1)$ meters, where ***orbitRMS0*** = 31 denotes 'Use At Own Risk'. The range is [0, 16.45) meters. The orbit model degradation polynomial is used as described in Appendix C.6.2.

orbitRMS1
This field specifies the first order term of the orbit model degradation model, $oRMS_1$.

Scale factor 2^{-14} m/s. Range [0, 4.3e-4) m/s.
The orbit model degradation polynomial is used as described in Appendix C.6.2.

– *OMA-LPPe-AGNSS-CCPassistCommonProvide*

The *OMA-LPPe-AGNSS-CCPassistCommonProvide* is used to provide information that is common to the CCP assistance data for all the GNSSs. This includes alternatively the CCP AD reference time (provided always together with CCP Generic AD) or CCP Control Parameters.

The CCP support area may be provided to the target based on the request or based on the server decision unsolicitedly, in case the CCP is not supported in the target area. Similarly to the neighbour list, it may be provided upon request or unsolicitedly. Before requesting the neighbour list the target should update its location to the server using unsolicited LPP Provide Location Information -procedure.

The CCP Reference Station list carries information on all the reference stations for which CCP assistance is provided. The server shall provide an updated reference station list, whenever there is a change to the set of reference stations for which AD is being provided for.

```
-- ASN1START

OMA-LPPe-AGNSS-CCPassistCommonProvide ::= CHOICE {
    ccpProvideCommonParameters      OMA-LPPe-AGNSS-CCPprovideCommonParameters,
    ccpProvideControlParameters     OMA-LPPe-AGNSS-CCPprovideControlParameters,
    ...
}

OMA-LPPe-AGNSS-CCPprovideCommonParameters ::= SEQUENCE {
    ccpReferenceTime                GNSS-SystemTime,
    ...
}

OMA-LPPe-AGNSS-CCPprovideControlParameters ::= SEQUENCE {
    ccpSupportArea          OMA-LPPe-AGNSS-CCPsupportArea           OPTIONAL,
    ccpNeighborList         OMA-LPPe-AGNSS-CCPreferenceStationList  OPTIONAL,
    duration                OMA-LPPe-Duration                       OPTIONAL, --Cond FirstOrDurModify
    rate                    INTEGER(1..64)                          OPTIONAL, --Cond FirstOrRateModify
    ccpReferenceStationList OMA-LPPe-AGNSS-CCPreferenceStationList  OPTIONAL, --Cond FirstOrRefModify
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
FirstOrDurModify	This field is mandatory present, when initiating a new CCP AD session or when modifying the duration. Otherwise it is not present.
FirstOrRateModify	This field is mandatory present, when initiating a new CCP AD session or when modifying the rate. Otherwise it is not present.
FirstOrRefModify	This field is mandatory present, when initiating a new CCP AD session or when modifying the list of the active reference stations (new reference stations or after stopping CCP AD for a set of reference stations). This field is included always, when there are changes to the active set of reference stations for which CCP AD is provided. Otherwise it is not present.

OMA-LPPe-AGNSS-CCPassistCommonProvide field descriptions
ccpProvideCommonParameters This field defines the CCP-specific common parameters.
ccpProvideControlParameters This field defines the CCP-specific control parameters.
ccpReferenceTime This field defines the reference time for the CCP assistance data delivery. This field shall be accompanied by ccpAssistProvide in the generic part of the AGNSS AD for at least one GNSS.
ccpSupportArea This field provides information on the area, in which CCP is supported.
ccpNeighborList This field provides information on the possible neighbour reference stations.
duration This field specifies the length of the continuous periodic assistance session.
rate This field specifies the interval between the assistance data deliveries in seconds.
ccpReferenceStationList This field provides the locations of the reference stations for which CCP assistance is being provided. The set of reference stations shall be static during the CCP AD session unless the target explicitly requests for new reference stations or requests removing stations from the active set. The reference stations shall be static.

– *OMA-LPPe-AGNSS-CCPsupportArea*

The *OMA-LPPe-AGNSS-CCPsupportArea* is used to provide information on the area to which CCP assistance can be provided and for which GNSS signals in the area the assistance can be provided.

```
-- ASN1START

OMA-LPPe-AGNSS-CCPsupportArea ::= SEQUENCE {
    areaDescription     OMA-LPPe-ValidityArea,
    signalSupport       SEQUENCE (SIZE(1..8)) OF OMA-LPPe-AGNSS-CCPsignalSupport,
    ...
}

OMA-LPPe-AGNSS-CCPsignalSupport ::= SEQUENCE {
    gnss        GNSS-ID,
    signals     GNSS-SignalIDs,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-CCPsupportArea field descriptions
areaDescription This field provides the description of the area.
signalSupport This field provides the GNSS signal support information.
gnss This field specifies the GNSS.
signals This field specifies the GNSS signal types for which CCP assistance can be provided in the area. This is represented by a bit string in *GNSS-SignalIDs*, with a one-value at the bit position means CCP assistance for the particular GNSS signal type is supported; a zero-value means not supported.

– *OMA-LPPe-AGNSS-CCPreferenceStationList*

The *OMA-LPPe-AGNSS-CCPreferenceStationList* is used to provide the locations and ID numbers of the reference stations for which CCP assistance is provided or information on the nearby reference stations for the purposes of reference station change.

In order to receive a valid neighbour list the target should update its location to the server in case the target moves. The server

shall generate the neighbour list based on the last known location of the target.

Note that the empty neighbour list does not imply the server being unable to change the reference station (there might not be neighbour list in case the server generates reference stations dynamically). Neither does the non-empty neighbour list imply the server being able to provide CCP AD for multiple reference station to the target simultaneously (required for the reference station change).

```
-- ASN1START

OMA-LPPe-AGNSS-CCPreferenceStationList ::= SEQUENCE (SIZE(0..maxReferenceStations)) OF
                                                    OMA-LPPe-AGNSS-CCPreferenceStationElement

OMA-LPPe-AGNSS-CCPreferenceStationElement ::= SEQUENCE {
    referenceStationID          OMA-LPPe-AGNSS-CCPreferenceStationID,
    referenceStationLocation    OMA-LPPe-HighAccuracy3Dposition,
    antennaDescription          OMA-LPPe-AGNSS-AntennaDescription       OPTIONAL, --Cond IfPhysical
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
IfPhysical	The field is mandatory present, if the reference station is a physical one. It is not present, if the reference station is a virtual one.

***OMA-LPPe-AGNSS-CCPreferenceStationList* field descriptions**
referenceStationID This field defines the ID of the reference station.
referenceStationLocation This field defines the location of the reference station, of which ID is *referenceStationID*.
antennaDescription This field specifies the antenna type used at the reference station.

– *OMA-LPPe-AGNSS-CCPassistGenericProvide*

The IE *OMA-LPPe-AGNSS-CPPassistGenericProvide* is used by the location server to provide continuous carrier phase reference measurement assistance to the target device for a specific GNSS. Reference assistance can be provided for multiple reference stations (for the purposes of multi-baseline solution or reference station change, see Appendix D.1.5) and for up to 8 signals per GNSS and for up to 64 SVs in each constellation. CCP Assistance is provided only for the visible satellites. The IE supports a straightforward mapping from RTCM 10403.1.

```
-- ASN1START

OMA-LPPe-AGNSS-CCPassistGenericProvide ::= SEQUENCE (SIZE(1..maxReferenceStations)) OF
                                                    OMA-LPPe-AGNSS-CCPassistGenericProvideElement

OMA-LPPe-AGNSS-CCPassistGenericProvideElement::= SEQUENCE {
    referenceStationID  OMA-LPPe-AGNSS-CCPreferenceStationID,
    ccpPerSignalList    SEQUENCE (SIZE(1..8)) OF OMA-LPPe-AGNSS-CCPperSignalElement,
    ...
}

OMA-LPPe-AGNSS-CCPperSignalElement ::= SEQUENCE {
    signal-ID       GNSS-SignalID,
    ccpPerSVlist    SEQUENCE (SIZE(1..64)) OF OMA-LPPe-AGNSS-CCPperSVelement,
    ...
}

OMA-LPPe-AGNSS-CCPperSVelement::= SEQUENCE {
    svID                SV-ID,
    integerCodePhase    INTEGER(0..255)                 OPTIONAL, --Cond IfAvailable
    codePhase           INTEGER(0.. 14989622),
    codePhaseError      OMA-LPPe-AGNSS-CodePhaseError   OPTIONAL, --Cond IfAvailable
    phaseRangeDelta     INTEGER(-524288.. 524287),
    phaseRangeRMSerror  INTEGER(0..127)                 OPTIONAL, --Cond IfAvailable
    lockIndicator       BOOLEAN,
    ...
}

OMA-LPPe-AGNSS-CodePhaseError ::= CHOICE {
    codePhaseRMSError   INTEGER(0..63),
    cnr                 INTEGER(0..255),
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
IfAvailable	The server shall make the best effort to include the information.

***OMA-LPPe-AGNSS-CCPassistGenericProvide* field descriptions**
referenceStationID This field defines the ID of the reference station to which the CCP assistance is provided. The ID shall match with one of the reference station IDs provided in cc*pReferenceStationList* in *OMA-LPPe-AGNSS-CCPassistCommonProvide*.
svID This field identifies the SV for which CCP assistance is being provided.
integerCodePhase This field indicates the integer milli-second part of the code phase.
codePhase This field contains the sub-millisecond part of the code phase observation for the particular satellite signal at the reference time (in *AGNSS-CCPassistCommonProvide*). Scale factor 0.02 meters. Range [0, 299792.44] meters, The target shall reconstruct the full pseudorange by Pseudorange = (Integer Code Phase) + (Code Phase) after the appropriate scaling. If (Integer Code Phase) is not available, the target shall reconstruct the integer code phase using the knowledge on the reference station location.

OMA-LPPe-AGNSS-CCPassistGenericProvide field descriptions
phaseRangeDelta This field defines the (Phase Range – Pseudorange). Scale factor 0.5 mm. Range [-262.144, 262.1435] meters.
phaseRangeRMSerror This field contains the RMS error of the continuous carrier phase. Scale factor 2^{-10} meters, in the range [0, 0.12403) meters.
lockIndicator This field is set to true if the carrier phase tracking has been continuous between the previous and the current assistance data delivery. If false, a cycle slip has occurred.
codePhaseRMSError This field contains the pseudorange RMS error value. This parameter is specified according to a floating-point representation defined in the corresponding table in 3GPP TS 36.355 in section "*GNSS-MeasurementList*".
cnr Carrier-to-noise ratio. Scale factor 0.25 dB-Hz. Range [0, 63.75] dB-Hz.

– *OMA-LPPe-AGNSS-NavModelList*

The IE *OMA-LPPe-AGNSS-NavModelList* provides navigation models for SVs.

```
-- ASN1START

OMA-LPPe-AGNSS-NavModelList ::= SEQUENCE {
    coordinateBased     OMA-LPPe-AGNSS-NavModel-CoordinateBased OPTIONAL, --Cond ModelId-1
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
ModelId-1	This field shall be included, if the target requests Navigation Model with ID=1 and the server can provide that. Otherwise it is not present.

– *OMA-LPPe-AGNSS-NavModel-CoordinateBased*

The *OMA-LPPe-AGNSS-NavModel-CoordinateBased* is used to provide the SV position, velocity and clock information at discrete points in time. The format supports a straightforward mapping from [RFC3986]. Up to 97 discrete PVT records may be provided – given 15-minute spacing between the records, 97 records are sufficient for providing information for 24 hours. The server shall provide velocity and clock rate records to the target, if the server has the records available. However, the availability cannot be guaranteed and, thus, the target must also be capable of autonomously deriving the velocity and clock rate information from the position and clock records.

```
-- ASN1START

OMA-LPPe-AGNSS-NavModel-CoordinateBased ::= SEQUENCE {
    fixedInterval   SEQUENCE {
                        beginTime   GNSS-SystemTime,
                        interval    INTEGER(1..30),
                        ...
                        } OPTIONAL, --Cond FixedInterval
    bases           SEQUENCE {
                        baseForPosVel   INTEGER(-100000000..100000000)      OPTIONAL,
                        baseForCcRate   OMA-LPPe-AGNSS-NavModel-BigNumber   OPTIONAL,
                        ...
                        }   OPTIONAL, --Cond DefaultsNotApplicable
    referencedTo    ENUMERATED { centerOfMass, antennaPhaseCenter, ... },
    pointList       SEQUENCE (SIZE (1..97)) OF OMA-LPPe-AGNSS-NavModel-CoordinateBasedElement,
    ...
}

OMA-LPPe-AGNSS-NavModel-CoordinateBasedElement::= SEQUENCE {
    time-of-record  GNSS-SystemTime     OPTIONAL, --Cond NoFixedInterval
    svIdList        SEQUENCE (SIZE (1..64)) OF OMA-LPPe-AGNSS-NavModel-PVTelement,
    ...
}
```

```
OMA-LPPe-AGNSS-NavModel-PVTelement ::= SEQUENCE {
    svID              SV-ID,
    svClockOffset     OMA-LPPe-AGNSS-NavModel-BigNumber,
    ecefPositionX     OMA-LPPe-AGNSS-NavModel-BigNumber,
    ecefPositionY     OMA-LPPe-AGNSS-NavModel-BigNumber,
    ecefPositionZ     OMA-LPPe-AGNSS-NavModel-BigNumber,
    clockPosSTD       OMA-LPPe-AGNSS-NavModel-STDmatrix,
    rateRecord        SEQUENCE {
                            svClockRate         OMA-LPPe-AGNSS-NavModel-BigNumber,
                            ecefVelocityX       OMA-LPPe-AGNSS-NavModel-BigNumber,
                            ecefVelocityY       OMA-LPPe-AGNSS-NavModel-BigNumber,
                            ecefVelocityZ       OMA-LPPe-AGNSS-NavModel-BigNumber,
                            clockRateVelSTD     OMA-LPPe-AGNSS-NavModel-STDmatrix,
                            ...
                            } OPTIONAL, --Cond RateAvailable
    ...
}

OMA-LPPe-AGNSS-NavModel-BigNumber::= SEQUENCE {
    msb     INTEGER(-1000000000..1000000000),
    lsb     INTEGER(1..100)                     OPTIONAL,
    ...
}

OMA-LPPe-AGNSS-NavModel-STDmatrix ::= SEQUENCE {
    e11     INTEGER(0..1000),
    e22     INTEGER(0..1000),
    e33     INTEGER(0..1000),
    e44     INTEGER(0..1000000),
    e12     INTEGER(0..10000000)    OPTIONAL, --Cond CrossTermAvailable
    e13     INTEGER(0..10000000)    OPTIONAL, --Cond CrossTermAvailable
    e14     INTEGER(0..10000000)    OPTIONAL, --Cond CrossTermAvailable
    e23     INTEGER(0..10000000)    OPTIONAL, --Cond CrossTermAvailable
    e24     INTEGER(0..10000000)    OPTIONAL, --Cond CrossTermAvailable
    e34     INTEGER(0..10000000)    OPTIONAL, --Cond CrossTermAvailable
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
FixedInterval	This field shall be included, when the records are distributed evenly in time. Otherwise it is not present.
NoFixedInterval	This field shall be included, when the records are not distributed evenly in time. Otherwise it is not present.
DefaultsNotApplicable	This field shall be included, in case the default scaling factors need to be overridden. Otherwise it is not present.
RateAvailable	This field shall be included, in case the server can provide velocity and clock rate records to the target. Otherwise it is not present.
CrossTermAvailable	This field shall be included, in case the server can provide the non-diagonal components. Otherwise it is not present.

***OMA-LPPe-AGNSS-NavigationModelCoordinateBased* field descriptions**
beginTime In case the position-velocity records have constant intervals, this field is used to provide the time of the first record.
interval In case the position-velocity records have constant intervals, this field is used to provide the interval between the records. Scale factor 1 minute. In case the records are given at fixed temporal intervals, the time of the record can be deduced by time-of-record = begin time + (index of the record in the point list sequence) * interval, where it has been assumed that the indexing begins from zero.
baseForPosVel The default scaling factors for position and velocity are 10^{-6} km (mm) and 10^{-6} dm/s, respectively. This field can be used to override the default scaling factors. In case the field is included, scaling the value with 10^{-7} results in the scaling factor for position records in millimetres. Likewise scaling the value with 10^{-7} results in the scaling factor for velocity records in the units of 10^{-6} dm/s. For instance, if the value in the ***baseForPosVel*** field is 1250000, scaling the value with 10^{-7} results in 1.25. Thus the scaling factor for position records will be 1.25 mm and 1.25 * 10^{-6} dm/s for the velocity records, respectively.
baseForCcRate The default scaling factors for clock and clock rate are 10^{-6} μs (ps) and 10^{-10} μs/s (10^{-4} ps/s), respectively. This field can be used to override the default scaling factors. In case the field is included, the new scaling factors for clock and clock rate are given by clock: (value_MSB *10^{-7} + value_LSB * 10^{-9}) 10^{-6} μs (ps) clock rate: (value_MSB *10^{-7} + value_LSB * 10^{-9}) 10^{-10} μs/s (10^{-4} ps/s) For instance, if the value in the ***baseForCcRate*** field is 1250000 (only MSB part used), scaling the value with 10^{-7} results in 1.25. Thus the scaling factor for the clock record will be 1.25 ps and 1.25 * 10^{-4} ps/s for the clock rate record,
referencedTo Indicated, if the navigation model is referenced to the SV center-of-mass or the antenna phase center.
time-of-record In case the records do not have constant intervals, this field is used to indicate the epoch time.
svID Identifies the satellite for which data is being provided.
svClockOffset This field specifies the SV clock offset. The default scaling factor for the MSB part is 10^{-4} μs and for the LSB part 10^{-6} μs. The total clock offset is given by value_MSB * 10^{-4} μs + value_LSB * 10^{-6} μs. The scaling factors are affected by ***baseForCcRate***.
ecefPositionX, ecefPositionY, ecefPositionZ This field specifies the satellite position in the WGS84 ECEF system. The default scaling factor for the MSB part is 10^{-4} km and for the LSB part 10^{-6} km. The position is given by value_MSB * 10^{-4} km + value_LSB * 10^{-6} km. The scaling factors are affected by ***baseForPosVel***.
clockPosSTD This field specifies the Clock-Position STD Matrix in the following manner: $\begin{bmatrix} & \text{x pos} & \text{y pos} & \text{z pos} & \text{clock} \\ \text{x pos} & e_{11} & e_{12} & e_{13} & e_{14} \\ \text{y pos} & e_{12} & e_{22} & e_{23} & e_{24} \\ \text{z pos} & e_{13} & e_{23} & e_{33} & e_{34} \\ \text{clock} & e_{14} & e_{24} & e_{34} & e_{44} \end{bmatrix}$ Scaling factor for positioning components is mm and for clock component ps. The scaling factor for the cross-components is mm*ps, respectively. Scaling factors are not affected by ***baseForPosVel*** and ***baseForCcRate***.
svClockRate This field specifies the rate of the SV clock offset. The default scaling factor for the MSB part is 10^{-8} μs/s and for the LSB part 10^{-10} μs/s. The total clock offset is given by value_MSB * 10^{-8} μs/s + value_LSB * 10^{-10} μs/s. The scaling factors are affected by ***baseForCcRate***.

OMA-LPPe-AGNSS-NavigationModelCoordinateBased **field descriptions**
ecefVelocityX, ecefVelocityY, ecefVelocityZ This field specifies the satellite position in the WGS84 ECEF system. The default scaling factor for the MSB part is 10^{-4} dm/s and for the LSB part 10^{-6} dm/s. The velocity is given by value_MSB * 10^{-4} dm/s + value_LSB * 10^{-6} dm/s. The scaling factors are affected by ***baseForPosVel***.
clockRateVelSTD This field specifies the Clock Rate - Velocity STD Matrix in the following manner: $\begin{bmatrix} & \text{x vel} & \text{y vel} & \text{z vel} & \text{clock rate} \\ \text{x vel} & e_{11} & e_{12} & e_{13} & e_{14} \\ \text{y vel} & e_{12} & e_{22} & e_{23} & e_{24} \\ \text{z vel} & e_{13} & e_{23} & e_{33} & e_{34} \\ \text{clock rate} & e_{14} & e_{24} & e_{34} & e_{44} \end{bmatrix}$ Scaling factor for velocity components is 10^{-4} mm/s and for clock component 10^{-4} ps/s. The scaling factor for the cross-components is 10^{-4} mm/s *10^{-4} ps/s, respectively. Scaling factors are not affected by ***baseForPosVel*** and ***baseForCcRate***.

6.5.1.3 AGNSS Assistance Data Request

– *OMA-LPPe-AGNSS-RequestAssistanceData*

The *OMA-LPPe-AGNSS-RequestAssistanceData* is used to request assistance for UE-based and UE-assisted AGNSS-based methods.

```
-- ASN1START

OMA-LPPe-AGNSS-RequestAssistanceData ::= SEQUENCE {
    commonAssistDataReq     OMA-LPPe-AGNSS-CommonAssistanceDataReq      OPTIONAL,
    genericAssistDataReq    OMA-LPPe-AGNSS-GenericAssistanceDataReq     OPTIONAL,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-CommonAssistanceDataReq*

The *OMA-LPPe-AGNSS-CommonAssistanceDataReq* is used to request GNSS-independent assistance for UE-based and UE-assisted AGNSS-based methods.

```
-- ASN1START

OMA-LPPe-AGNSS-CommonAssistanceDataReq ::= SEQUENCE {
    ionosphericModelReq             OMA-LPPe-AGNSS-IonosphericModelReq          OPTIONAL,
    troposphereModelReq             OMA-LPPe-AGNSS-TroposphereModelReq          OPTIONAL,
    altitudeAssistanceReq           OMA-LPPe-AGNSS-AltitudeAssistanceReq        OPTIONAL,
    solarRadiationRequest           OMA-LPPe-AGNSS-SolarRadiationReq            OPTIONAL,
    ccpRequestControlParameters     OMA-LPPe-AGNSS-CCPrequestControlParameters  OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-CommonAssistanceDataReq field descriptions
ionosphereModelReq This field is used to request for ionosphere models.
troposphereModelReq This field is used to request troposphere models.
altitudeAssistanceReq This field is used to request altitude assistance for improved availability.
solarRadiationReq This field is used to request for solar radiation intensity.
ccpRequestControlParameters This field is used to request for the control parameters of the CCP AD session. The field shall be accompanied by the field ccpAssistGenericReq in the generic part of the AGNSS request.

– *OMA-LPPe-AGNSS-GenericAssistanceDataReq*

The *OMA-LPPe-AGNSS-GenericAssistanceDataReq* is used to request GNSS-dependent assistance for UE-based and UE-assisted AGNSS-based methods.

```
-- ASN1START

OMA-LPPe-AGNSS-GenericAssistanceDataReq ::= SEQUENCE (SIZE (1..16)) OF
                                                    OMA-LPPe-AGNSS-GenericAssistDataReqElement

OMA-LPPe-AGNSS-GenericAssistDataReqElement ::= SEQUENCE {
    gnss-ID                         GNSS-ID,
    waIonoSurfaceReq                OMA-LPPe-AGNSS-WaIonoSurfaceRequest OPTIONAL, --Cond WAiono
    mechanicsReq                    OMA-LPPe-AGNSS-MechanicsReq                   OPTIONAL,
    dcbReq                          OMA-LPPe-AGNSS-DCBreq                         OPTIONAL,
    navModelDegradationModelReq     OMA-LPPe-AGNSS-NavModelDegradationModelReq     OPTIONAL,
    ccpAssistGenericReq             OMA-LPPe-AGNSS-CCPassistGenericReq  OPTIONAL, --Cond CCPreq
    navigationModelReq              OMA-LPPe-AGNSS-NavigationModelReq              OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
WAiono	The field shall be present only, when initiating the periodic AD session for WA Ionosphere Corrections, i.e. it is not possible to change the GNSSs for which corrections are provided intra-session.
CCPreq	The field shall be present, when requesting a new CCP assistance data session, i.e. when requesting a reference station (based on position or ID) for the first time during the AD session. The field shall not be present, when requesting an update to the AD session or CCP control parameters, i.e. it is not possible to change the requested GNSSs and signals during the CCP session.

OMA-LPPe-AGNSS-GenericAssistanceDataReq field descriptions
waIonoSurfaceReq This field specifies, if wide area ionosphere correction surface is requested for the SVs of this GNSS. The GNSS-independent request parameters for the wide area model are carried in *OMA-LPPe-AGNSS-IonosphericModelReq.*
mechanicsReq This field is used for requesting the SV mechanics information.
dcbReq This field is used for requesting the differential code biases to gain higher accuracy.
navModelDegradationModelReq This field is used for requesting the accuracy models for the SV orbit and clock models to get a better understanding of the accuracy of the computed position.
ccpAssistGenericReq This field is used to request for the CCP reference assistance data for high accuracy.

OMA-LPPe-AGNSS-GenericAssistanceDataReq field descriptions
navigationModelReq This field is used to request for the navigation models defined in LPPe.

6.5.1.4 AGNSS Assistance Data Request Elements

– *OMA-LPPe-AGNSS-IonosphericModelReq*

The IE *OMA-LPPe-AGNSS-IonosphericModelReq* is used by the target device to request for the ionospheric model from the location server.

```
-- ASN1START

OMA-LPPe-AGNSS-IonosphericModelReq ::=  CHOICE {
    staticModels    SEQUENCE {
        ionoreq             BIT STRING  {klobucharModel (0),
                                         ionoStormWarning (1) } (SIZE  (1..8)),
        requestBeginTime    GNSS-SystemTime         OPTIONAL,
        duration            OMA-LPPe-Duration,
        ...
    },
    periodicModels  SEQUENCE {
        waIonoSurface       OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersRequest,
        ...
    },
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-IonosphericModelReq field descriptions
staticModels This field is used to request for the one-shot ionosphere models.
ionoreq This field specifies, which ionosphere models are being requested for. If bit 0 is set, the local Klobuchar model, as specified in *OMA-LPPe-AGNSS-LocalKlobucharModel***,** is requested. If bit 1 is set, ionosphere storm warnings, as specified in *OMA-LPPe-AGNSS-IonoStormIndication*, are requested.
requestBeginTime This field specifies the first time instant when an ionosphere model is needed. The field is optional, and if it is missing, the begin time is the current time.
duration This field specifies for how long period the ionospheric model is requested.
periodicModels This field is used to request for periodic ionosphere models. These ionosphere model types utilizes the periodic AD procedure and thus their use mandates the inclusion of periodic AD control parameters in the common part of the AD request.
waIonoSurface This field is used for requesting Wide Area ionosphere surface corrections as specified in Appendix C.3. When initiating the WA Ionosphere session, the field is accompanied by the corrections request for specific GNSSs in the generic part of the AGNSS AD request. WA Ionosphere AD is periodic AD type and is thus also accompanied by periodic/triggered session ID in the common AD request parameters.

– *OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersRequest*

The IE *OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersRequest* is used by the target device to request for the periodic ionosphere corrections from the location server.

```
-- ASN1START

OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersRequest ::=  SEQUENCE {
    duration            OMA-LPPe-Duration   OPTIONAL,   --Cond FirstOrDurModify
    rate                INTEGER(1..64)      OPTIONAL,   --Cond FirstOrRateModify
    ...
}
```

```
-- ASN1STOP
```

Conditional presence	Explanation
FirstOrDurModify	This field is mandatory present, when initiating a new WA Iono AD session or when requesting for the modification of the duration. Otherwise it is not present.
FirstOrRateModify	This field is mandatory present, when initiating a new WA Iono AD session or when requesting for the modification of the rate. Otherwise it is not present.

OMA-LPPe-AGNSS-WideAreaIonoSurfaceControlParametersRequest field descriptions
duration This field specifies the length of the continuous periodic assistance session.
rate This field specifies the interval between the assistance data deliveries in seconds.

– *OMA-LPPe-AGNSS-TroposphereModelReq*

The IE *OMA-LPPe-AGNSS-TroposphereModelReq* is used by the target device to request the local *OMA-LPPe-AGNSS-TroposphereModel* assistance from the location server.

```
-- ASN1START

OMA-LPPe-AGNSS-TroposphereModelReq ::=  SEQUENCE {
    troposphereModelReq             BIT STRING  {delay (0),
                                                 surface (1) }      (SIZE (1..8)),
    supportForMultipleGridPoints    BOOLEAN,
    requestBeginTime                GNSS-SystemTime         OPTIONAL,
    duration                        OMA-LPPe-Duration,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-TroposphereModelReq* field descriptions**
troposphereModelReq   This bit string field specifies the desired model or models. One-value at bit position 0 indicates that the *OMA-LPPe-AGNSS-TroposphereDelayList* -model is requested, and one-value at bit position 1 indicates the request for the *OMA-LPPe-AGNSS-LocalSurfaceParameterList* –model.
supportForMultipleGridPoints   This field indicates if the target is requesting parameter sets originating from multiple locations around it (value 1). Value 0 means that only the nearest grid point parameters are requested.
requestBeginTime   This field specifies the first time instant when a valid troposphere model is needed. The field is optional, and if it is missing, the begin time is the current time.
duration   This field specifies how long time the tropospheric model is requested for.

– *OMA-LPPe-AGNSS-AltitudeAssistanceReq*

The IE *OMA-LPPe-AGNSS-AltitudeAssistanceReq* is used by the target device to request the local *OMA-LPPe-AGNSS-AltitudeAssistanceList* from the location server.

```
-- ASN1START

OMA-LPPe-AGNSS-AltitudeAssistanceReq ::=    SEQUENCE {
    requestBeginTime                GNSS-SystemTime         OPTIONAL,
    duration                        OMA-LPPe-Duration       OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-AltitudeAssistanceReq* field descriptions**
requestBeginTime   This field specifies the first time instant when altitude assistance is needed. The field is optional, and if it is missing, the begin time is the current time.
duration   This field specifies how long time the altitude assistance is requested for. In case the parameter is omitted,altitude assistance is requested for the current moment.

– *OMA-LPPe-AGNSS-SolarRadiationReq*

The IE *OMA-LPPe-AGNSS-SolarRadiation* is used by the target device to request the Solar radiation intensity.

```
-- ASN1START

OMA-LPPe-AGNSS-SolarRadiationReq ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-WaIonoSurfaceRequest*

The IE *OMA-LPPe-AGNSS-WaIonoSurfaceRequest* is used by the target device to request the wide area ionosphere correction surface.

```
-- ASN1START

OMA-LPPe-AGNSS-WaIonoSurfaceRequest ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-NavModelDegradationModelReq*

The IE *OMA-LPPe-AGNSS-NavModelDegradationModelReq* is used by the target device to request the navigation model degradation models for the SVs.

```
-- ASN1START

OMA-LPPe-AGNSS-NavModelDegradationModelReq ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-DCBreq*

The *OMA-LPPe-AGNSS-DCBreq* is used to request differential code bias assistance.

```
-- ASN1START

OMA-LPPe-AGNSS-DCBreq ::= SEQUENCE {
    reference       SEQUENCE{
                        signal  GNSS-SignalID,
                        pd      ENUMERATED { pilot, data, notapplicable, ... },
                        ...
                        }           OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-DCBreq* field descriptions**
reference The signal with respect to which the differential code biases of the other signals are requested.
signal This field indicates the signal id. The interpretation of the signal id depends on the GNSS as explained in 3GPP TS 36.355 [LPP].
pd This field indicates whether the signal is pilot signal, data signal or if this indication is not applicable in this case.

– *OMA-LPPe-AGNSS-MechanicsReq*

The *OMA-LPPe-AGNSS-MechanicsReq* is used to request SV mechanical information including phase-center offset, mass and effective area-reflectivity information. The SVs mechanics information can be used for extending the orbit information applicability in the target. See Appendix C.7 for further information.

```
-- ASN1START

OMA-LPPe-AGNSS-MechanicsReq::= SEQUENCE {
    massRequest                         BOOLEAN,
    effectiveReflectivityAreaRequest    BOOLEAN,
    pcoRequest                          BOOLEAN,
    svInfoRequest                       BOOLEAN,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-MechanicsReq field descriptions
massRequest This field is used to request for the mass information for all the SVs.
effectiveReflectivityAreaRequest This field is used to request for the effective combined reflectivity-area information for all the SVs.
pcoRequest This field is used to request for the phase-center offset information for all the SVs.
svInfoRequest This field is used to request for the satellite type information for all the SVs.

– *OMA-LPPe-AGNSS-CCPrequestControlParameters*

The *OMA-LPPe-AGNSS-CCPrequestControlParameters* is used to request continuous carrier phase assistance or an update to the CCP control parameters. Continuous carrier phase information together with the knowledge on the reference station position allows for deducing the high accuracy baseline between the target and the reference station by solving the full cycle integer ambiguities. Using the control parameters the target may request for the information on the area, in which CCP is supported, information on the neighbouring reference stations and request for a new reference station or stopping a CCP assistance data delivery to a given reference station.

The periodic AD procedures related to the CCP AD are illustrated in Appendix D.1 for reference.

```
-- ASN1START

OMA-LPPe-AGNSS-CCPrequestControlParameters ::= SEQUENCE {
    ccpSupportAreaRequest       NULL                OPTIONAL,
    ccpNeighborListRequest      NULL                OPTIONAL,
    ccpCommonRequest            SEQUENCE {
                    duration            OMA-LPPe-Duration   OPTIONAL,   --Cond FirstOrDurModify
                    rate                INTEGER(1..64)      OPTIONAL,   --Cond FirstOrRateModify
                    refStation          CHOICE {
                        posBasedReferenceStationRequest     SEQUENCE {
                            requestedReferenceStationLocation   OMA-LPPe-HighAccuracy3Dposition,
                            qor                                 OMA-LPPe-AGNSS-QoR,
                            ...
                            },
                        idBasedReferenceStationRequest      OMA-LPPe-AGNSS-ReferenceStationIDlist,
                        referenceStationKillList            OMA-LPPe-AGNSS-ReferenceStationIDlist,
                        ...
                        } OPTIONAL, --Cond FirstOrRefModify
        ...
        },
    ...
}


OMA-LPPe-AGNSS-ReferenceStationIDlist ::= SEQUENCE (SIZE(1..maxReferenceStations)) OF
                                                            OMA-LPPe-AGNSS-CCPreferenceStationID

OMA-LPPe-AGNSS-QoR ::=  ENUMERATED {m10, km1,km10,km100, ...}

-- ASN1STOP
```

Conditional presence	Explanation
FirstOrDurModify	This field is mandatory present, when initiating a new CCP AD session or when requesting for the modification of the duration. Otherwise it is not present.
FirstOrRateModify	This field is mandatory present, when initiating a new CCP AD session or when requesting for the modification of the rate. Otherwise it is not present.
FirstOrRefModify	This field is mandatory present, when initiating a new CCP AD session or when requesting for the modification of the active reference station list (new reference stations or stopping CCP AD for a set of reference stations). Otherwise it is not present.

OMA-LPPe-AGNSS-CCPRequestControlParameters field descriptions
ccpSupportAreaRequest This field specifies, if the target requests for the information on the CCP assistance availability in the target area.
ccpNeighborListRequest This field specifies, if the target requests for the information on the reference stations in the vicinity of the target. The neighbour list information is used for the purposes of changing the reference station.
ccpCommonRequest This field is used to request for a new reference station or stopping CCP AD delivery for a reference station.
duration This field specifies the length of the continuous periodic assistance session.
rate This field specifies the interval between the assistance data deliveries in seconds.
refStation This field specifies the request/modification of the active reference station set. The modification is used, when requesting CCP assistance for a new reference station for the reference station change and, after the reference station change, stopping the CCP assistance for the old reference station.
requestedReferenceStationLocation This field is used to request for a new reference station based on the position. The position may or may not be the target position.
qor This field (Quality-of-Reference station) defines how close to the requested location the closest reference station must be. In case the closest reference station is within the uncertainty area of the target location, the QoR parameter is neglected. Note: Fulfilling QoR=10 m requires that a virtual reference receiver is generated at the requested location. Baselines up to 10 km are feasible with single frequency receivers and longer baselines require multi-frequency receivers
idBasedReferenceStationRequest This field allows for requesting CCP AD for a new reference station based on the reference station ID.
referenceStationKillList This field allows the target to terminate CCP AD deliveries for selected reference stations based on their reference station IDs.

– *OMA-LPPe-AGNSS-CCPassistGenericReq*

The *OMA-LPPe-AGNSS-CCPassistGenericReq* is used to request Continuous Carrier Phase assistance for the set of signals for a specified GNSS.

```
-- ASN1START

OMA-LPPe-AGNSS-CCPassistGenericReq ::= SEQUENCE {
    ccpAssist-SignalsReq            GNSS-SignalIDs,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-CCPassistGenericReq field descriptions
ccpAssist-SignalsReq This field specifies the GNSS signal types for which the CCP assistance is requested by the target device. This is represented by a bit string in *GNSS-SignalIDs*, with a one-value at the bit position means CCP assistance for the particular GNSS signal type is requested; a zero-value means not requested.

– *OMA-LPPe-AGNSS-NavigationModelReq*

The *OMA-LPPe-AGNSS-NavigationModelReq* is used to request SV navigation models.

```
-- ASN1START

OMA-LPPe-AGNSS-NavigationModelReq ::= SEQUENCE {
    navModelID-PrefList     SEQUENCE (SIZE(1..8)) OF INTEGER(1..8) OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-NavigationModelReq field descriptions
navModelID-PrefList
This field is used to request the navigation models in the order of decreasing preference, i.e. the model-ID in the first slot is the most preferred one. The server shall respect the preference list.

Model-ID	Type
1	Coordinate-based

In case preference lists are also included in the LPP proper, they shall be handled first. Only if the target cannot be served based on request in the LPP proper, the preference list in LPPe shall be considered.
The LPPe side navigation model delivery shall also obey the list of the SVs, for which navigation models are being requested, in the LPP proper.

6.5.1.5 AGNSS Location Information

– *OMA-LPPe-AGNSS-ProvideLocationInformation*

The *OMA-LPPe-AGNSS-ProvideLocationInformation* is used to provide AGNSS-based position estimate (UE-based) and measurements (UE-assisted).

```
-- ASN1START

OMA-LPPe-AGNSS-ProvideLocationInformation ::= SEQUENCE {
    highAccuracyReferenceTime   GNSS-SystemTime                         OPTIONAL, --Cond HighAccuracy
    highAccuracyMeasurements    OMA-LPPe-AGNSS-HAgnssProvide            OPTIONAL,
    ionosphereMeasurements      OMA-LPPe-AGNSS-IonosphereMeasurements   OPTIONAL,
    localSurfaceMeasurements    OMA-LPPe-AGNSS-LocalSurfaceMeasurements OPTIONAL,
    error                       OMA-LPPe-AGNSS-Error                    OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
HighAccuracy	This field shall be present, when providing high accuracy position/velocity estimates. Otherwise it is not present.

OMA-LPPe-AGNSS-ProvideLocationInformation field descriptions
highAccuracyReferenceTime
This field indicates the GNSS system time at which the high accuracy position/velocity estimate provided in the IE *OMA-LPPe-CommonIEsProvideLocationInformation* is valid.

6.5.1.6 AGNSS Location Information Elements

– *OMA-LPPe-AGNSS-HAgnssProvide*

The *OMA-LPPe-AGNSS-HAgnssProvide* is used to provide periodic high accuracy AGNSS measurements from the target device to the server. Unless otherwise instructed in LPP proper *CommonIEsRequestLocationInformation*, the target shall report its position and reference time information. However, in case the target is allowed to report only measurements (locationMeasurementsRequired and onlyReturnInformationRequested in LPP proper *CommonIEsRequestLocationInformation)*, position and reference time are not included. Appendix D.1 shows a few examples of periodic HA GNSS sessions.

```
-- ASN1START

OMA-LPPe-AGNSS-HAgnssProvide ::= CHOICE {
    controlParameters   SEQUENCE {
        duration                OMA-LPPe-Duration,
        rate                    INTEGER(1..64),
        antennaDescription      OMA-LPPe-AGNSS-AntennaDescription       OPTIONAL, --Cond HAantenna
        ...
    },
    measurements    SEQUENCE {
        position        EllipsoidPointWithAltitudeAndUncertaintyEllipsoid   OPTIONAL,
                                                                                --Cond NotForbidden
        referenceTime   GNSS-SystemTime,
        localPressure   SEQUENCE {
                            pressure                INTEGER(-1024..1023),
                            pressureUncertainty     INTEGER(0..127),
                            ...
                        } OPTIONAL, --Cond HApressure
        antennaOrientation      OMA-LPPe-Orientation    OPTIONAL, --Cond HAantOrientation
        signalMeasurements      SEQUENCE (SIZE(1..16)) OF OMA-LPPe-AGNSS-HAgnssMeasurementElement,
        ...
        },
    ...
}

OMA-LPPe-AGNSS-HAgnssMeasurementElement::= SEQUENCE {
    gnss-ID                 GNSS-ID,
    haGNSSperSignalList     SEQUENCE (SIZE(1..8)) OF OMA-LPPe-HAgnssPerSignalElement,
    ...
}

OMA-LPPe-HAgnssPerSignalElement ::= SEQUENCE {
    signal-ID               GNSS-SignalID,
    haGNSSperSVlist         SEQUENCE (SIZE(1..64)) OF OMA-LPPe-HAgnssPerSVelement,
    ...
}


OMA-LPPe-HAgnssPerSVelement ::= SEQUENCE {
    svID                SV-ID,
    integerCodePhase    INTEGER (0..255)    OPTIONAL, --Cond IfAvailable
    codePhase           INTEGER (0..14989622),
    codePhaseRMSError   INTEGER (0..63),
    multipathDetection  ENUMERATED  {low,
                                     moderate,
                                     high,
                                     notMeasured,
                                     ...},
    cnr                 INTEGER(0..255),
    adr                 INTEGER (0..536870911),
    adrRMSerror         INTEGER (0..127),
    lockIndicator       BOOLEAN,
    ...
}
```

```
-- ASN1STOP
```

Conditional presence	Explanation
HAantenna	This field shall be included in case the server requested for the antenna description information in the HA GNSS measurement session request and antenna description information is supported. Otherwise it is not present.
NotForbidden	This field shall be present unless otherwise instructed in LPP proper.
HApressure	This field shall be included in case the server requested for pressure measurements in the HA GNSS measurement session request and pressure information is supported. Otherwise it is not present.
HAantOrientation	This field shall be present, if the server requests for the antenna orientation information and such can be provided. Otherwise the field shall not be present.
IfAvailable	This field shall be present, if the target has position fix and can report millisecond ambiguity. Otherwise the target shall not be present.

OMA-LPPe-AGNSS-HAgnssProvide field descriptions
controlParameters This field specifies the control parameters of the HA GNSS session
duration This field specifies the length of the HA GNSS measurement session.
rate This field specifies the rate of delivery of the HA GNSS measurements. Scale factor 1 second.
antennaDescription This field species the GNSS antenna in the target device.
measurements This field species the HA GNSS measurements.
position This field species the position of the target device.
referenceTime This field specifies the time, when the measurements included are applicable.
localPressure This field specifies the local atmospheric pressure measurement at the target's altitude for improved altitude or delta-altitude performance.
pressure Local atmospheric pressure measurement (hPa) at the target's altitude. The scale factor is 0.1 hPa. The value is added to the average pressure 1013hPa.
pressureUncertainty The 1-sigma standard deviation of the pressure measurement. The scale factor is 0.1 hPa.
antennaOrientation This field specifies the orientation of the antenna with respect to the earth-fixed coordinate system.
signalMeasurements This field carries the HA GNSS signal measurements.
gnss-ID This field defines the ID of the GNSS for which measurements are being provided.
haGNSSperSignalList This field carries the HA GNSS measurements for the given signals.
signal-ID This field defines the ID of the GNSS signal for which measurements are being provided.
haGNSSperSVlist This field carries the HA GNSS measurements for specific satellites.
svID This field identifies the SV for which HA GNSS measurements are provided.

integerCodePhase This field indicates the integer milli-second part of the code phase.
codePhase This field contains the sub-millisecond part of the code phase observation for the particular satellite signal at the reference time. The target shall reconstruct the full pseudorange by Pseudorange = (Integer Code Phase) + (Code Phase). Scale factor 0.02 meters. Range [0, 299792.44] meters,
codePhaseRMSError This field contains the pseudorange RMS error value. This parameter is specified according to a floating-point representation defined in the corresponding table in 3GPP in section "*GNSS-MeasurementList*".
multipathDetection This field contains an estimate of the multipath environment.
cnr This field contains an estimate of the carrier-to-noise ratio. Scale factor 0.25 dB-Hz. Range [0, 63.75] dB-Hz.
adr This field contains the continuous carrier phase with direct data polarity. Scale factor 2^{-10} meters, in the range [0, 524287.999023438) meters.
adrRMSerror This field contains the RMS error of the continuous carrier phase. Scale factor 2^{-10} meters, in the range [0, 0.12403) meters.
lockIndicator This field is set to true if the carrier phase tracking has been continuous between the previous and the current measurement delivery. If false, a cycle slip has occurred.

– *OMA-LPPe-AGNSS-IonosphereMeasurements*

The *OMA-LPPe-AGNSS-IonosphereMeasurements* is used by the target to deliver ionosphere measurements to the location server. The measurements may consist either of a set of TEC values towards each of the SVs seen by the target, or a single zenith TEC value at the target's location. The location server can use the values collected from several targets to model the local ionospheric conditions.

```
-- ASN1START

OMA-LPPe-AGNSS-IonosphereMeasurements ::= SEQUENCE {
    gnssTime                GNSS-SystemTime,
    position                EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,
    tecPerSV                OMA-LPPe-AGNSS-TECPerSV             OPTIONAL,       --Cond TecPerSV
    tecAtZenith             OMA-LPPe-AGNSS-TECAtZenith          OPTIONAL,       --Cond ZenithTec
    ...
}

OMA-LPPe-AGNSS-TECPerSV ::= SEQUENCE (SIZE(1..64)) OF OMA-LPPe-AGNSS-TECPerSVElement

OMA-LPPe-AGNSS-TECPerSVElement ::= SEQUENCE {
    azimuth         INTEGER(0..359),
    elevation       INTEGER(0..90),
    tecValue        INTEGER(0..511),
    tecUncertainty  INTEGER(0..63),
    ...
}

OMA-LPPe-AGNSS-TECAtZenith ::= SEQUENCE {
    tecValueAtZenith            INTEGER(0..511),
    tecUncertaintyAtZenith      INTEGER(0..63),
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
TecPerSV	The field is mandatory present if the location server requests *TecPerSV*; otherwise it is not present.
ZenithTec	The field is mandatory present if the location server requests *ZenithTEC*; otherwise it is not present.

***OMA-LPPe-AGNSS-IonosphereMeasurements* field descriptions**
gnssTime This field indicates the measurement time.
position This field indicates the measurement location.
tecPerSV This field contains the list of TEC values from the target towards each of the SVs seen by the target.
tecAtZenith This field contains the target's estimate of the zenith TEC value at the target's position.
azimuth This field indicates the azimuth angle of the ionosphere measurement, i.e. the direction from the user where the TEC values are observed. The azimuth angle is defined as the clockwise angle from the true North. The scale factor is 1 degree.
elevation This field indicates the elevation angle of the ionosphere measurement, i.e. how high or low in the sky the TEC value is observed. The scale factor is 1 degree.
tecValue This field indicates the measured TEC value towards the SV concerned. The scale factor is 1 TEC unit, 10^{16} e^-/m^2.
tecUncertainty This field indicates the 1-sigma standard deviation of the TEC measurement. The scale factor is 1 TEC unit, 10^{16} e^-/m^2.
tecValueAtZenith This field indicates the measured vertical TEC value. The scale factor is 1 TEC unit, 10^{16} e^-/m^2.
tecUncertaintyAtZenith This field indicates the 1-sigma standard deviation of the TEC measurement. The scale factor is 1 TEC unit 10^{16} e^-/m^2.

– *OMA-LPPe-AGNSS-LocalSurfaceMeasurements*

The *OMA-LPPe-AGNSS-LocalSurfaceMeasurements* information element is used to deliver the target's surface measurements to the server. Collecting the pressure-altitude –measurement combinations allows the server to model the current local atmospheric circumstances and generate altitude assistance for targets equipped with a barometer.

```
-- ASN1START

OMA-LPPe-AGNSS-LocalSurfaceMeasurements ::= SEQUENCE {
    gnssTime                GNSS-SystemTime,
    position                EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,
    pressure                INTEGER(-1024..1023),
    pressureUncertainty     INTEGER(0..127),
    temperatureMeasurement  SEQUENCE {
                                temperature             INTEGER(-64..63)    OPTIONAL,
                                temperatureUncertainty  INTEGER(0..7)       OPTIONAL,
                                ...
                                } OPTIONAL, --Cond TemperatureAvailable
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
TemperatureAvailable	The field is mandatory present if the target is able to provide temperature measurement with the pressure measurement, otherwise it is not present.

***OMA-LPPe-AGNSS-LocalSurfaceMeasurements* field descriptions**
gnssTime This field indicates the measurement time.
position This field indicates the measurement location.
pressure Local atmospheric pressure measurement (hPa) at the target's altitude. The scale factor is 0.1 hPa. The value is added to the nominal pressure of 1013hPa.
pressureUncertainty The 1-sigma standard deviation of the pressure measurement. The scale factor is 0.1 hPa.
temperature Local temperature measured by the target. The value is added to 273K. The scale factor is 1K.
temperatureUncertainty The 1-sigma standard deviation of the temperature measurement. The scale factor is 1 K.

6.5.1.7 AGNSS Location Information Request

– *OMA-LPPe-AGNSS-RequestLocationInformation*

The *OMA-LPPe-AGNSS-RequestLocationInformation* is used to request AGNSS-based position estimate (UE-based) and measurements (UE-assisted).

```
-- ASN1START

OMA-LPPe-AGNSS-RequestLocationInformation ::= SEQUENCE {
    positioningInstructions     OMA-LPPe-AGNSS-PositioningInstructions      OPTIONAL,
    ionosphereMeasurementsReq   BIT STRING  {tecPerSV(0),
                                             zenithTEC(1) }(SIZE(1..8))     OPTIONAL,
    localSurfaceMeasurementReq  OMA-LPPe-AGNSS-LocalSurfaceMeasurementReq   OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-RequestLocationInformation* field descriptions**
ionosphereMeasurementsReq This field is used by the location server to request the target's ionosphere measurements. This is represented by a bit string with a one value at bit position 0 meaning that a TEC value per each satellite is requested and a one value at bit position 1 meaning that a zenith TEC value at the target's position is requested.
localSurfaceMeasurementReq This field is used by the location server to request the targets local surface measurements such as atmospheric pressure and temperature.

6.5.1.8 AGNSS Location Information Request Elements

– *OMA-LPPe-AGNSS-PositioningInstructions*

The *OMA-LPPe-AGNSS-PositioningInstructions* is used to provide AGNSS positioning and measuring instructions to the target device.

```
-- ASN1START

OMA-LPPe-AGNSS-PositioningInstructions ::= SEQUENCE {
    highAccuracyMethodRequested     BOOLEAN,
    haGNSSreq               OMA-LPPe-AGNSS-HAgnssRequestControlParameters   OPTIONAL, --Cond HAgnssReq
    ...,
    extUncertRange              BOOLEAN OPTIONAL
}

-- ASN1STOP
```

Conditional presence	Explanation
HAgnssReq	This field shall be present, when requesting for continuous high accuracy GNSS measurements or an update to the currently ongoing periodic Location Information session. The request shall be accompanied by *RequestPeriodicLocInfoWithUpdate* in *OMA-LPPe-CommonIEsRequestLocationInformation*. Otherwise the field is not present.

***OMA-LPPe-AGNSS-PositioningInstructions* field descriptions**
highAccuracyMethodRequested This field indicates that the server requests the target to use UE-based high accuracy AGNSS method. Note that this implies using the CCP assistance and performing positioning in the UE-based mode. Thus, the *highAccuracyMethodRequested* shall be accompanied by the setting *locationEstimateRequired* in the 3GPP LPP proper in the *LocationInformationType* of *CommonIEsRequestLocationInformation*. In case the high accuracy AGNSS method is requested, the target is expected to return the location information using the High Accuracy 3D Position information element. Likewise, in case velocity is requested (in the 3GPP LPP proper in the *QoS* information element in the *CommonIEsRequestLocationInformation* information element), the velocity shall be returned using the High Accuracy 3D Velocity information element. Thus *locationCoordinateTypes* and velocityTypes in the 3GPP LPP proper in the *CommonIEsRequestLocationInformation* information element are not applicable, when requesting High Accuracy AGNSS method. Note that since high accuracy location estimate IE carry a full 3D representation, such full 3D information shall be returned even in case the vertical coordinate was not requested in the 3GPP LPP proper in the *QoS* information element in the *CommonIEsRequestLocationInformation* information element and providing additional information was forbidden in the 3GPP LPP proper in the *additionalInformation* information element in the *CommonIEsRequestLocationInformation* information element. Response time defined in the 3GPP LPP proper in the *QoS* information element shall be obeyed, when the high accuracy AGNSS method has been requested. In case the requested response time cannot be met, the target shall report the failure using the appropriate error codes in the 3GPP LPP proper. The target shall also obey the IE *gnss-Methods*, i.e. instructions to use only allowed GNSSs in positioning, in the *GNSS-PositioningInstructions* in *A-GNSS-RequestLocationInformation* in the 3GPP LPP proper. In case the target does not support high accuracy method, the target shall return AGNSS Target Device Error "HighAccuracyMethodNotSupported".
haGNSSreq This field is used by the server to request for the High Accuracy GNSS measurements for UE-assisted HA GNSS
extUncertRange This field is used by the server to indicate whether a high accuracy position with extended uncertainty range is allowed (TRUE). This field is optional and if not present or set to FALSE, only the default uncertainty range is allowed.

– *OMA-LPPe-AGNSS-LocalSurfaceMeasurementsReq*

The *OMA-LPPe-AGNSS-LocalSurfaceMeasurementsReq* is used to request local surface measurements (pressure, temperature) from the target.

```
-- ASN1START

OMA-LPPe-AGNSS-LocalSurfaceMeasurementReq ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-HAgnssRequestControlParameters*

The *OMA-LPPe-AGNSS-HAgnssRequestControlParameters* is used to request for periodic high accuracy AGNSS measurements from the target device or to request modification to the session parameters of the on-going session. Note that the requested GNSSs and signals cannot be modified intra-session.

```
-- ASN1START

OMA-LPPe-AGNSS-HAgnssRequestControlParameters ::= SEQUENCE {
    duration                    OMA-LPPe-Duration   OPTIONAL,   --Cond FirstOrModify
    rate                        INTEGER(1..63)      OPTIONAL,   --Cond FirstOrModify
    antennaInformationReq       ENUMERATED {antennaDescriptionOnly,
                                            antennaDescriptionAndOrientation,
                                            ...}    OPTIONAL,
    pressureInformationReq      BOOLEAN,                        --Cond FirstOrModify
    signalReqList               SEQUENCE (SIZE(1..16)) OF
                                       OMA-LPPe-AGNSS-HAgnssSignalReqElement   OPTIONAL, --Cond First
    ...
}

OMA-LPPe-AGNSS-HAgnssSignalReqElement ::= SEQUENCE {
    gnssID      GNSS-ID,
    signals     GNSS-SignalIDs,
    ...
}


-- ASN1STOP
```

Conditional presence	Explanation
FirstOrModify	This field shall be present in the first message or when requesting for periodic HA GNSS measurements. Otherwise it shall not be present.
First	This field shall be present in the first message in the HA GNSS session. Otherwise it shall not be present.

OMA-LPPe-AGNSS-HAgnssRequestControlParamaters field descriptions
duration This field specifies the length of the HA GNSS measurement session.
rate This field specifies the rate of delivery of the HA GNSS measurements. Scale factor 1 second.
antennaInformationReq This field is used to request for the target antenna information,
pressureInformationReq This field is used to request for the pressure information at the target site. TRUE means requested, FALSE means not requested.
signalReqList This field is used to request HA GNSS measurements for specific GNSS signals.
gnssID This field carries the ID of the GNSS for which HA GNSS measurements are requested.
signals This field specifies the GNSS signal types for which HA GNSS measurements are requested by the server. This is represented by a bit string in *GNSS-SignalIDs*, with a one-value at the bit position means HA GNSS measurements for the particular GNSS signal type is requested; a zero-value means not requested.

6.5.1.9 AGNSS Capability Information

– *OMA-LPPe-AGNSS-ProvideCapabilities*

The *OMA-LPPe-AGNSS-ProvideCapabilities* is used by the target to provide its LPPe AGNSS capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-ProvideCapabilities ::= SEQUENCE {
    assistanceDataSupportList           OMA-LPPe-AGNSS-AssistanceDataSupportList            OPTIONAL,
    environmentObservationSupportList   OMA-LPPe-AGNSS-EnvironmentObservationSupportList    OPTIONAL,
    haGNSSsupport                       OMA-LPPe-AGNSS-HAgnssSupport                        OPTIONAL,
    ...
}

OMA-LPPe-AGNSS-AssistanceDataSupportList ::= SEQUENCE {
    commonAssistanceDataSupport     OMA-LPPe-AGNSS-CommonAssistanceDataSupport,
    genericAssistanceDataSupport    OMA-LPPe-AGNSS-GenericAssistanceDataSupport,
    ...
}

-- ASN1STOP
```

6.5.1.10 AGNSS Capability Information Element

– *OMA-LPPe-AGNSS-EnvironmentObservationSupportList*

The *OMA-LPPe-AGNSS-EnvironmentObservationSupportList* is used by the target to provide its environment observation capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-EnvironmentObservationSupportList ::= SEQUENCE{
    ionosphereMeasurementSupport        BIT STRING {tecPerSVsupport(0),
                                                    zenithTecSupport(1) } (SIZE (1..8)),
    pressureMeasurementSupported        BOOLEAN,
    temperatureMeasurementSupported     BOOLEAN,
    ...
}


-- ASN1STOP
```

– *OMA-LPPe-AGNSS-CommonAssistanceDataSupport*

The *OMA-LPPe-AGNSS-CommonAssistanceDataSupport* is used by the target to provide its GNSS-independent LPPe AGNSS capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-CommonAssistanceDataSupport ::= SEQUENCE {
    ionosphericModelSupport     OMA-LPPe-AGNSS-IonosphericModelSupport  OPTIONAL, --Cond IonoSupport
    troposphereModelSupport     OMA-LPPe-AGNSS-TroposphereModelSupport  OPTIONAL, --Cond TropoSupport
    altitudeAssistanceSupport   OMA-LPPe-AGNSS-AltitudeAssistanceSupport
                                                        OPTIONAL, --Cond AltAssistSupport
    solarRadiationSupport       OMA-LPPe-AGNSS-SolarRadiationSupport
                                                        OPTIONAL, --Cond SolarRadiationSupport
    ccpSupport                  OMA-LPPe-AGNSS-CCPsupport       OPTIONAL, --CCPsupport
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
IonoSupport	The field is mandatory present if the target supports LPPe ionosphere models, otherwise it is not present.
TropoSupport	The field is mandatory present if the target device supports LPPe troposphere models, otherwise it is not present.
AltAssistSupport	The field is mandatory present if the target device supports altitude assistance, otherwise it is not present.
SolarRadiationSupport	The field is mandatory present if the target device supports Solar Radiation information. Otherwise the field is not present.
CCPsupport	This field is mandatory present, if the target supports CCP. Otherwise it is not present.

– *OMA-LPPe-AGNSS-IonosphericModelSupport*

The *OMA-LPPe-AGNSS-IonosphericModelSupport* information element is used by the target to specify to the server which ionospheric model or models the target supports.

```
-- ASN1START

OMA-LPPe-AGNSS-IonosphericModelSupport ::=  SEQUENCE {
    ionoModel       BIT STRING {    localKlobuchar          (0),
                                    ionoStormWarning        (1),
                                    wideAreaIonoSurface     (2) } (SIZE (1..8)),
    ...
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-IonosphericModelSupport* field descriptions**
ionoModel
This field specifies the ionospheric model(s) supported by the target device. This is represented by a bit string, with a one-value at the bit position means the particular ionospheric model is supported; a zero-value means not supported.
If bit 2 for wide area ionosphere correction surface is set, the target shall support the corrections for all the supported GNSSs.

– *OMA-LPPe-AGNSS-TroposphereModelSupport*

The *OMA-LPPe-AGNSS-TroposphereModelSupport* information element is used by the target to specify to the server which troposphere model or models the target supports.

```
-- ASN1START

OMA-LPPe-AGNSS-TroposphereModelSupport ::=  SEQUENCE {
    tropoModel                      BIT STRING { localTroposphereDelay (0),
                                                 surfaceParameters     (1) } (SIZE (1..8)),
    supportForMultipleGridPoints    BOOLEAN,
    ...
}
```

```
-- ASN1STOP
```

OMA-LPPe-AGNSS-TroposphereModelSupport field descriptions
tropoModel This field specifies the troposphere model(s) supported by the target device. This is represented by a bit string, with a one-value at the bit position means the particular troposphere model is supported; a zero-value means not supported.
supportForMultipleGridPoints This field specifies, if the target supports combining troposphere information from several grid points surrounding the target.

– *OMA-LPPe-AGNSS-AltitudeAssistanceSupport*

The *OMA-LPPe-AGNSS-AltitudeAssistaceSupport* is used by the target to provide its altitude assistance capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-AltitudeAssistanceSupport ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-SolarRadiationSupport*

The *OMA-LPPe-AGNSS-SolarRadiationSupport* is used by the target to provide its solar radiation assistance capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-SolarRadiationSupport ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-CCPsupport*

The *OMA-LPPe-AGNSS-CCPsupport* is used by the target to provide its CCP capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-CCPsupport ::= SEQUENCE {
    supportAreaAssistanceSupported      BOOLEAN,
    multiReferenceStationSupported      BOOLEAN,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-CCPsupport field descriptions
supportAreaAssistanceSupported This field indicates, if the target supports the CCP Support Area assistance.
multiReferenceStationSupported This field indicates, if the target supports multibaseline solution.

– *OMA-LPPe-AGNSS-GenericAssistanceDataSupport*

The *OMA-LPPe-AGNSS-GenericAssistanceDataSupport* is used by the target to provide its GNSS-dependent LPPe AGNSS assistance data capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-GenericAssistanceDataSupport ::=
                        SEQUENCE (SIZE (1..16)) OF OMA-LPPe-AGNSS-GenericAssistDataSupportElement

OMA-LPPe-AGNSS-GenericAssistDataSupportElement ::= SEQUENCE {
    gnss-ID                                 GNSS-ID,
    mechnanicsSupport                       OMA-LPPe-AGNSS-MechanicsSupport OPTIONAL,
                                                                            --Cond MechSupport
```

```
    dcbSupport                                  OMA-LPPe-AGNSS-DCBsupport       OPTIONAL,

                                                                                --Cond DCBsupport
    navModelAccuracyModelDegradationSupport     OMA-LPPe-AGNSS-NavModelAccuracyModelDegradationSupport
                                                OPTIONAL,                       --Cond NavModDegrSupport
    ccpAssistanceSuppport                           GNSS-SignalIDs  OPTIONAL,   --Cond CCPsupport
    navModelSupport             OMA-LPPe-AGNSS-NavModelSupport      OPTIONAL,   --Cond NavModSupport
    ...
}


-- ASN1STOP
```

Conditional presence	Explanation
MechSupport	The field is mandatory present if the target device supports SV mechanics assistance. Otherwise the field is not present.
DCBsupport	The field is mandatory present if the target device supports differential code bias assistance. Otherwise the field is not present.
NavModDegrSupport	The field is mandatory present if the target device supports navigation model degradation model assistance. Otherwise the field is not present.
CCPsupport	This field is mandatory present, if the target supports CCP assistance for at least one signal of the GNSS. Otherwise it is not present.
NavModSupport	This field shall be included, if the target supports one or more LPPe navigation model types. Otherwise it is not present.

***OMA-LPPe-AGNSS-GenericAssistanceDataSupport* field descriptions**
ccpAssistanceSupport This field specifies the GNSS signal types for which CCP assistance is supported by the target device. This is represented by a bit string in *GNSS-SignalIDs*, with a one-value at the bit position means CCP assistance for the particular GNSS signal type is supported; a zero-value means not supported.

– *OMA-LPPe-AGNSS-MechanicsSupport*

The *OMA-LPPe-AGNSS-MechanicsSupport* is used by the target to provide its mechanics assistance capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-MechanicsSupport ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-DCBsupport*

The *OMA-LPPe-AGNSS-MechanicsSupport* is used by the target to provide its Differential Code Bias assistance capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-DCBsupport ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-NavModelAccuracyModelDegradationSupport*

The *OMA-LPPe-AGNSS- NavModelAccuracyModelDegradationSupport* is used by the target to provide its navigation model degradation model assistance capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-NavModelAccuracyModelDegradationSupport ::= SEQUENCE {
    ...
```

```
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-NavModelSupport*

The *OMA-LPPe-AGNSS- NavModelSupport* is used by the target to provide its navigation model assistance capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-NavModelSupport ::= SEQUENCE {
    navModelSupport     SEQUENCE (SIZE(1..8)) OF INTEGER(1..8)  OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-NavModelSupport* field descriptions**
navModelSupport   This field is used to indicate the navigation model support to the server. The sequence carries within the Model-IDs of the supported navigation mode types. IDs are specified in the description of *OMA-LPPe-AGNSS-NavigationModelReq*.

– *OMA-LPPe-AGNSS-HAgnssSupport*

The *OMA-LPPe-AGNSS-HAgnssSupport* is used by the target to provide its HA GNSS capabilities to the server.

```
-- ASN1START

OMA-LPPe-AGNSS-HAgnssSupport ::= SEQUENCE {
    modeSupport                         BIT STRING {ueBased (0), ueAssisted (1) } (SIZE(2)),
    haGNSSpressureInformationSupport    BOOLEAN,
    haGNSSantennaInformationSupport     BIT STRING { antennaDescriptionSupported (0),
                                                     antennaOrientationSupported (1)
                                                     }  (SIZE(8)),

    haGNSSperGNSSsupport                SEQUENCE (SIZE(1..8)) OF OMA-LPPe-AGNSS-HAgnssPerGNSSsupport,
    ...
}

OMA-LPPe-AGNSS-HAgnssPerGNSSsupport::= SEQUENCE {
    gnss-ID                 GNSS-ID,
    haGNSSsignalSupport     GNSS-SignalIDs,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-HAgnssSupport field descriptions
modeSupport This field is used to indicate If bit 0 set, UE-based supported. If bit 1 set, UE-assisted supported.
haGNSSpressureInformationSupport This field is used to provide information, if the target is capable of providing absolute pressure information for improved delta-altitude performance.
haGNSSantennaInformationSupport This field is used to carry the antenna information support.
haGNSSperGNSSsupport This field is used to carry the HA GNSS signal measurement capabilities of the target.
gnss-ID This field specifies the ID of the GNSS for which HA GNSS capabilities are provided.
haGNSSsignalSupport This field specifies the GNSS signal types for which HA GNSS signal measurements are supported by the target device. This is represented by a bit string in *GNSS-SignalIDs*, with a one-value at the bit position means HA GNSS measurements for the particular GNSS signal type is supported; a zero-value means not supported.

6.5.1.11 AGNSS Capability Information Request

– *OMA-LPPe-AGNSS-RequestCapabilities*

The IE *OMA-LPPe-AGNSS-RequestCapabilities* is used to request LPPe AGNSS capabilities information from the target.

```
-- ASN1START

OMA-LPPe-AGNSS-RequestCapabilities ::= SEQUENCE {
    assistanceDataSupportListReq                NULL    OPTIONAL,
    environmentObservationSupportListReq        NULL    OPTIONAL,
    haGNSSsupportReq                            NULL    OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-AGNSS-RequestCapabilities field descriptions
assistanceDataSupportListReq This field is used to request the common and generic assistance data capabilities of the target.
environmentObservationSupportListReq This field is used to request environment observation capabilities.
haGNSSsupportReq This field is used to request HA GNSS capabilities of the target.

6.5.1.12 AGNSS Error Elements

– *OMA-LPPe-AGNSS-Error*

The IE *OMA-LPPe-AGNSS-Error* is used by the target or server to provide GNSS Error Reasons.

```
-- ASN1START

OMA-LPPe-AGNSS-Error ::= CHOICE {
    agnss-locationServerErrorCauses     OMA-LPPe-AGNSS-LocationServerErrorCauses,
    agnss-targetDeviceErrorCauses       OMA-LPPe-AGNSS-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-LocationServerErrorCauses*

The IE *OMA-LPPe-AGNSS-LocationServerErrorCauses* is used by the server to provide GNSS Error Reasons to the target. The IE *OMA-LPPe-AGNSS-LocationServerErrorCauses* is used, when the IE *OMA-LPPe-AGNSS-Error* is included in the LPP Provide Assistance Data message extension by the server.

```
-- ASN1START

OMA-LPPe-AGNSS-LocationServerErrorCauses ::= SEQUENCE {
     waIonoErrorCauses  ENUMERATED {    undefined,
                                        waIonoNotSupportedByServer,
                                        waIonoNotSupportedInTargetArea,
                                        waIonoNotSupportedForAnyRequestedGNSS,
                                        ...} OPTIONAL,
     ccpErrorCauses     ENUMERATED {    undefined,
                                        ccpNotSupportedByServer,
                                        ccpNotSupportedInTargetArea,
                                        ccpNotSupportedForAnyRequestedSignal,
                                        ccpQorCannotBeMet,
                                        ccpUnableToModifyControlParameters,
                                        ccpMultiReferenceStationNotSupported,
                                        ccpNeighborListNotSupported,
                                        ccpSupportAreaAssistanceNotSupported,
                                        ...} OPTIONAL,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-AGNSS-TargetDeviceErrorCauses*

The IE *OMA-LPPe-AGNSS-TargetDeviceErrorCauses* is used by the target to provide GNSS Error Reasons to the server. In addition, the target may return an additional error reason in the LPP proper. The IE *OMA-LPPe-AGNSS-TargetDeviceErrorCauses* is used, when the IE *OMA-LPPe-AGNSS-Error* is included in the LPP Provide Location Information message extension by the target.

```
-- ASN1START

OMA-LPPe-AGNSS-TargetDeviceErrorCauses ::= SEQUENCE {
    highAccuracyErrorCauses             ENUMERATED {    undefined,
                                                        highAccuracyMethodNotSupported,
                                                        ...} OPTIONAL,
    ionosphereMeasurementErrorCauses    ENUMERATED  {   undefined,
                                                        ionosphereMeasurementsNotSupported,
                                                        ionosphereMeasurementsNotAvailable,
                                                        ...}    OPTIONAL,
    environmentObservationErrorCauses   ENUMERATED  {   undefined,
                                                        surfaceMeasurementsNotSupported,
                                                        surfaceMeasurementsNotAvailable,
                                                        ...}    OPTIONAL,
    haGNSSerrorCauses                   ENUMERATED {    undefined,
                                                        haGNSSnotSupportedByTarget,
                                                        haGNSSunavailableForAllRequestedSignals,
                                                        haGNSSantennaInformationNotSupported,
                                                        haGNSSantennaInformationNotAvailable,
                                                        haGNSSpressureInformationNotSupported,
                                                        haGNSSpressureInformationNotAvailable,
                                                        haGNSSunableToModifyControlParameters,
                                                        ...} OPTIONAL,
    ...
}

-- ASN1STOP
```

6.5.1.13 Common AGNSS Information Elements

– *OMA-LPPe-AGNSS-CCPreferenceStationID*

The *OMA-LPPe-AGNSS-CCPreferenceStationID* IE defines a GNSS reference station.

```
-- ASN1START

OMA-LPPe-AGNSS-CCPreferenceStationID ::= SEQUENCE {
    stationID   INTEGER(0..65535),
    ...
}

maxReferenceStations INTEGER ::= 8

-- ASN1STOP
```

***OMA-LPPe-AGNSS-CCPreferenceStationID* field descriptions**
stationID Defines the ID of the reference station. Reference stations IDs are used to link the CCP assistance to the correct reference station. IDs are allocated by the server. One reference station shall have one ID. The ID shall not change during the CCP assistance session.
maxReferenceStations This field species the maximum number of reference stations that can be provided to the target at a time.

– *OMA-LPPe-AGNSS-AntennaDescription*

The *OMA-LPPe-AGNSS-AntennaDescription* is used to provide the target information on the antenna at the reference station.

The IE supports a straightforward mapping from RTCM 10403.1.

```
-- ASN1START

OMA-LPPe-AGNSS-AntennaDescription ::= SEQUENCE {
    antennaDescription      CHOICE {
                                igsAntennaName      OMA-LPPe-CharArray,
                                proprietaryName     OMA-LPPe-CharArray,
                                ...
                                },
    antennaSetupID          INTEGER(0..255)         OPTIONAL,
    antennaSerialNumber     OMA-LPPe-CharArray      OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-AGNSS-AntennaDescription* field descriptions**
igsAntennaName This field specifies the antenna equipment name as specified in RTCM 10403.1.
proprietaryName This field carries proprietary antenna information.
antennaSetupId Antenna setup information as specified in RTCM 10403.1.
antennaSerialNumber Antenna serial number as issued by the antenna manufacturer.

6.5.1.14 AGNSS Abort Elements

– ***OMA-LPPe-AGNSS-Abort***

The IE *OMA-LPPe-AGNSS-Abort* is used by the target or server to provide GNSS Abort Reasons.

```
-- ASN1START

OMA-LPPe-AGNSS-Abort::= SEQUENCE {
    targetDeviceAbortCauses     SEQUENCE {
        ccpAbort    ENUMERATED  {   undefined,
                                    ccpNotSupported,
                                    ccpNotSupportedForProvidedSignals,
                                    ... }      OPTIONAL,
        waIonoAbort ENUMERATED  {   undefined,
                                    waIonoNotSupported,
                                    waIonoNotSupportedForProvidedGNSSs,
                                    ... } OPTIONAL,
        ...
        } OPTIONAL,
    ...
}

-- ASN1STOP
```

6.5.2 OTDOA Positioning

6.5.2.1 OTDOA Assistance Data

– ***OMA-LPPe-OTDOA-ProvideAssistanceData***

The IE *OMA-LPPe-OTDOA-ProvideAssistanceData* is used to provide assistance for UE-based OTDOA (E-UTRAN).

```
-- ASN1START

OMA-LPPe-OTDOA-ProvideAssistanceData ::= SEQUENCE {
    otdoa-ReferenceCellInfo             OMA-LPPe-OTDOA-ReferenceCellInfo            OPTIONAL,
    otdoa-NeighbourCellInfo             OMA-LPPe-OTDOA-NeighbourCellInfoList        OPTIONAL,
    otdoa-Error                         OMA-LPPe-OTDOA-Error                        OPTIONAL,
    ...
}

-- ASN1STOP
```

6.5.2.2 OTDOA Assistance Data Elements

– ***OMA-LPPe-OTDOA-ReferenceCellInfo***

The IE *OMA-LPPe-OTDOA-ReferenceCellInfo* is used by the location server to provide reference cell information for OTDOA assistance data.

```
-- ASN1START

OMA-LPPe-OTDOA-ReferenceCellInfo ::= SEQUENCE {
    referenceCellInfo           OTDOA-ReferenceCellInfo,
    positionCalculationInfoRef  OMA-LPPe-OTDOA-PositionCalculationInfoRef,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-OTDOA-ReferenceCellInfo* field descriptions**
referenceCellInfo This field provides OTDOA reference cell information as specified in [LPP].
positionCalculationInfoRef This field provides position calculation assistance data for the reference cell.

– *OMA-LPPe-OTDOA-PositionCalculationInfoRef*

The IE *OMA-LPPe-OTDOA-PositionCalculationInfoRef* is used by the location server to provide location and other information of the reference cell useful for UE-based OTDOA.

```
-- ASN1START

OMA-LPPe-OTDOA-PositionCalculationInfoRef ::= SEQUENCE {
    systemFrameNumber       BIT STRING (SIZE(10))               OPTIONAL, --Cond driftRate
    rtdReferenceStd         OMA-LPPe-OTDOA-RTDquality           OPTIONAL,
    cellLocation            SEQUENCE {
                                reference-point     OMA-LPPe-ReferencePoint         OPTIONAL,
                                relative-location   OMA-LPPe-RelativeLocation       OPTIONAL,
                                ...
                                },
    femtoCellInfo           SEQUENCE {
                                    location-reliability    INTEGER(1..100) OPTIONAL,
                                    ...
                                    }                           OPTIONAL,   --Cond femto

    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
driftRate	The field is mandatory present if *fineRTDdriftRate* is included in *OMA-LPPe-OTDOA-NeighbourCellInfoList*.
femto	This field is mandatory present if the reference cell is a HeNB femto cell; otherwise it is not present.

***OMA-LPPe-OTDOA-PositionCalculationInfoRef* field descriptions**
systemFrameNumber This field specifies the E-UTRA system frame number of the reference cell at which the *rtdInfo* included in *OMA-LPPe-OTDOA-NeighbourCellInfoList* is valid.
rtdReferenceStd This field specifies the standard deviation of the timing of the reference cell, used to determine the RTD values provided in *OMA-LPPe-OTDOA-NeighbourCellInfoList*. This field shall be provided if available.
cellLocation This field defines the antenna location of the reference cell.
reference-point This field provides the reference point used to define the cell location. If this field is absent the reference point is the default reference point provided in LPPe common IEs.
relative-location This field provides the location of the cell relative to the reference point. If this field is absent the cell location coincides with the reference point location.
location-reliability The field provides the reliability R of the HeNB location. The probability that the HeNB location has not changed is given as a percentage. R may be based on historic change or persistence of the HeNB location over a period of time and the time interval since the HeNB location was last provided to or verified by the server. Note that location reliability is distinct from location accuracy and refers to the possibility of an HeNB having been moved to a new location. This field shall be provided if available.

– *OMA-LPPe-OTDOA-NeighbourCellInfoList*

The IE *OMA-LPPe-OTDOA-NeighbourCellInfoList* is used by the location server to provide neighbour cell information for OTDOA assistance data.

```
-- ASN1START

OMA-LPPe-OTDOA-NeighbourCellInfoList ::= SEQUENCE (SIZE (1..maxFreqLayers)) OF
                                            OMA-LPPe-OTDOA-NeighbourFreqCellInfoList
```

```
OMA-LPPe-OTDOA-NeighbourFreqCellInfoList ::= SEQUENCE {
    neighbourCellInfoList-eNB   SEQUENCE (SIZE (1..maxLTEeNBs))  OF
                                        OMA-LPPe-OTDOA-NeighbourCellInfoElement-eNB     OPTIONAL,
    neighbourCellInfoList-HeNB  SEQUENCE (SIZE (1..maxLTEHeNBs)) OF
                                        OMA-LPPe-OTDOA-NeighbourCellInfoElement-HeNB    OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-OTDOA-NeighbourCellInfoList* field descriptions**
neighbourCellInfoList-eNB This field provides OTDOA neighbour cell information for eNodeBs. Either *neighbourCellInfoList-eNB* or *neighbourCellInfoList-HeNB* or both shall be present.
neighbourCellInfoList-HeNB This field provides OTDOA neighbour cell information for Home eNodeBs. Either *neighbourCellInfoList-eNB* or *neighbourCellInfoList-HeNB* or both shall be present.

– *OMA-LPPe-OTDOA-NeighbourCellInfoElement-eNB*

The IE *OMA-LPPe-OTDOA-NeighbourCellInfoElement-eNB* is used by the location server to provide neighbour cell information for one eNodeB or several co-located eNodeBs as part of OTDOA assistance data.

```
-- ASN1START

OMA-LPPe-OTDOA-NeighbourCellInfoElement-eNB ::= SEQUENCE {
    relative-Location               OMA-LPPe-RelativeLocation,
    otdoa-eNB-CellDataList          SEQUENCE (SIZE (1..maxLTEMacroCells)) OF OMA-LPPe-OTDOA-CellData,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-OTDOA-NeighbourCellInfoElement-eNB* field descriptions**
relative-Location This field provides the location and optional uncertainty in location of the antenna of the eNodeB relative to the reference point used to define the location of the reference cell. For an eNodeB with multiple antennas or a set of co-located eNodeBs, the location may be averaged.
otdoa-eNB-CellDataList This field provides OTDOA neighbour cell information for one or more eNodeBs sharing a common eNodeB antenna, or using antennas in close proximity to one another.

– *OMA-LPPe-OTDOA-NeighbourCellInfoElement-HeNB*

The IE *OMA-LPPe-OTDOA-NeighbourCellInfoElement-HeNB* is used by the location server to provide neighbour cell information for one Home eNodeB as part of OTDOA assistance data.

```
-- ASN1START

OMA-LPPe-OTDOA-NeighbourCellInfoElement-HeNB ::= SEQUENCE {
    relative-Location               OMA-LPPe-RelativeLocation,
    location-reliability            INTEGER (1..100)                OPTIONAL,
    otdoa-HeNB-CellDataList         OMA-LPPe-OTDOA-CellData,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-OTDOA-NeighbourCellInfoElement-HeNB* field descriptions**
relative-Location This field provides the location and optional uncertainty in location of the antenna of the Home eNodeB relative to the reference point used to define the location of the reference cell.

OMA-LPPe-OTDOA-NeighbourCellInfoElement-HeNB field descriptions
location-reliability The field provides the reliability R of the HeNB location. The probability that the HeNB location has not changed is given as a percentage. R may be based on historic change or persistence of the HeNB location over a period of time and the time interval since the HeNB location was last provided to or verified by the server. Note that location reliability is distinct from location accuracy and refers to the possibility of an HeNB having been moved to a new location. This field shall be provided if available.
otdoa-HeNB-CellDataList This field provides OTDOA neighbour cell information for the Home eNodeB.

– *OMA-LPPe-OTDOA-CellData*

The IE *OMA-LPPe-OTDOA-CellData* is used by the location server to provide neighbour cell information for one eNodeB or Home eNodeB as part of OTDOA assistance data.

```
-- ASN1START

OMA-LPPe-OTDOA-CellData  ::= SEQUENCE {
    otdoa-NeighbourCellInfoElement  OTDOA-NeighbourCellInfoElement,
    rtdInfo                         SEQUENCE {
                                            subframeOffset      INTEGER(0..10229)       OPTIONAL,
                                            fineRTD             INTEGER(0..99999),
                                            fineRTDstd          OMA-LPPe-OTDOA-RTDquality,
                                            fineRTDdriftRate    INTEGER(-100..100)      OPTIONAL,
                                            ...
                                    },
    ...
}

-- ASN1STOP
```

OMA-LPPe-OTDOA-NeighbourCellData field descriptions
otdoa-NeighbourCellInfoElement This field provides OTDOA neighbour cell information as specified in [LPP].
rtdInfo This field specifies the real time difference between this neighbour cell and the reference cell.
subframeOffset This field specifies the subframe offset between this cell and the reference cell. Define T_{ref} as the time of beginning of frame with SFN_{ref}=0 of the reference cell; define T_{nc} as the time of beginning of frame with SFN_{nc}=0 of this neighbour cell occuring immediately after the time T_{ref}. Then *subframeOffset* = T_{nc} - T_{ref} in units of 1-subframe (1ms). In other words, SFN_{nc} = SFN_{ref} + (*subframeOffset*/10). This field shall be provided if available.
fineRTD This field specifies the Real Time Difference between this cell and the reference cell in units of 10 ns. Define t_{ref} as the time of beginning of a subframe of the reference cell; define t_{nc} as the time of beginning of the subframe of this neighbour cell occuring immediately after the time t_{ref}. Then *fineRTD* = t_{nc} - t_{ref} in units of 10 ns.
fineRTDstd This field specifies the standard deviation of the *fineRTD* value.
fineRTDdriftRate This field specifies the drift rate of the RTD between this cell and the reference cell in units of 1 nano-second per second. A positive value indicates that the reference cell clock is running at a greater frequency than the neighbouring cell clock. This field shall be provided if available.

– *OMA-LPPe-OTDOA-RTDquality*

The IE *OMA-LPPe-OTDOA-RTDquality* is used by the location server to provide the quality of the Real Time Difference (RTD) information.

```
-- ASN1START

OMA-LPPe-OTDOA-RTDquality ::= SEQUENCE {
    resolution          ENUMERATED { ns-5, ns-10, ns-50, ns-100, ... },
    quality             INTEGER (0..127),
    ...
}

-- ASN1STOP
```

OMA-LPPe-OTDOA-RTDquality field descriptions
resolution   This field specifies the resolution of the provided *quality* field. Enumerated values correspond to 5, 10, 50, and 100 ns, respectively.
quality   This field specifies the standard deviation of the RTD (or of the timing of the reference cell).

6.5.2.3 OTDOA Assistance Data Request

– *OMA-LPPe-OTDOA-RequestAssistanceData*

The *OMA-LPPe-OTDOA-RequestAssistanceData* is used to request assistance for UE-based OTDOA.

```
-- ASN1START

OMA-LPPe-OTDOA-RequestAssistanceData ::= SEQUENCE {
    lteCell                 SEQUENCE {
                                physCellId      INTEGER(0..503),
                                eARFCN          ARFCN-ValueEUTRA,
                                ecgi            CellGlobalIdEUTRA-AndUTRA           OPTIONAL,
                                ...,
                                eARFCN-ext      ARFCN-ValueEUTRA-v9a0   OPTIONAL -- Cond EARFCN-ext
                            },
    requestedCells          BIT STRING {
                                    eNBs    (0),
                                    heNBs   (1) }   (SIZE (1..8)),
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
EARFCN-ext	This field is mandatory present if the value of E-UTRA ARFCN is greater than 65535. Otherwise this field is not present.

OMA-LPPe-OTDOA-RequestAssistanceData field descriptions
lteCell   This field specifies the Cell-ID of the serving or non-serving but visible LTE cell of the target device.
eARFCN   This parameter represents E-UTRA ARFCN. If the value of E-UTRA ARFCN is greater than 65535, this parameter SHALL be set to 65535.   eARFCN range: (0..65535).
eARFCN-ext   This field specifies the value of E-UTRA ARFCN of the cell as defined in [36.101], if an extended value is used i.e., if the value of E-UTRA ARFCN is > 65535. In this case, this parameter SHALL be sent and set to the value of E-UTRA ARFCN.   eARFCN-ext range: (65536..262143)
requestedCells   This field specifies whether OTDOA assistance data is requested for eNodeBs, Home eNodeBs, or both. A one value at the bit position means requested.

6.5.2.4 OTDOA Location Information

– *OMA-LPPe-OTDOA-ProvideLocationInformation*

The *OMA-LPPe-OTDOA-ProvideLocationInformation* is used to provide OTDOA-based position estimate (UE-based). It may also be used to provide UE-based OTDOA positioning specific error reason. The actual location estimate is provided in the LPP proper (CommonIEsProvideLocationInformation).

```
-- ASN1START

OMA-LPPe-OTDOA-ProvideLocationInformation ::= SEQUENCE {
    otdoaLocationInformation           OMA-LPPe-OTDOA-LocationInformation          OPTIONAL,
    otdoaError                         OMA-LPPe-OTDOA-Error                       OPTIONAL,
    ...
}

-- ASN1STOP
```

6.5.2.5 OTDOA Location Information Elements

– *OMA-LPPe-OTDOA-LocationInformation*

The IE *OMA-LPPe-OTDOA-LocationInformation* is used by the target device to provide OTDOA location information to the location server. Note that in the event that the target device is unable to calculate a location estimate using UE-based OTDOA, it may still return OTDOA measurements to the server using LPP if permitted by the server in the LPP common IEs in the Request Location Information message.

```
-- ASN1START

OMA-LPPe-OTDOA-LocationInformation ::= SEQUENCE {
    systemFrameNumber       BIT STRING (SIZE (10)),
    physCellId              INTEGER (0..503),
    cellGlobalId            CellGlobalIdEUTRA-AndUTRA          OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-OTDOA-LocationInformation* field descriptions**
systemFrameNumber This field specifies the SFN for which the location Estimate (provided in the LPP common IEs) is valid.
physCellId This field specifies the physical cell identity of the cell for which the *systemFrameNumber* is provided.
cellGlobalId This field specifies the ECGI, the globally unique identity of a cell in E-UTRA, of the cell for which the *systemFrameNumber* is provided.

6.5.2.6 OTDOA Location Information Request

– *OMA-LPPe-OTDOA-RequestLocationInformation*

The *OMA-LPPe-OTDOA-RequestLocationInformation* is used to request OTDOA-based position estimate (UE-based).

```
-- ASN1START

OMA-LPPe-OTDOA-RequestLocationInformation ::= SEQUENCE {
       assistanceAvailability                BOOLEAN,
       ...
}

-- ASN1STOP
```

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

6.5.2.7 OTDOA Capability Information

– *OMA-LPPe-OTDOA-ProvideCapabilities*

The *OMA-LPPe-OTDOA-ProvideCapabilities* is used by the target to provide its OTDOA capabilities to the server.

```
-- ASN1START

OMA-LPPe-OTDOA-ProvideCapabilities ::= SEQUENCE {
    eNodeB-AD-sup               SEQUENCE { ... }               OPTIONAL,
    home-eNodeB-AD-sup          SEQUENCE { ... }               OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-OTDOA-ProvideCapabilities field descriptions
eNodeB-AD-sup
This field, if present, indicates that the target supports OTDOA assistance data for eNodeBs.
home-eNodeB-AD-sup
This field, if present, indicates that the target supports OTDOA assistance data for Home eNodeBs.

6.5.2.8 OTDOA Capability Information Request

– *OMA-LPPe-OTDOA-RequestCapabilities*

The *OMA-LPPe-OTDOA-RequestCapabilities* is used to request OTDOA capabilities information from the target.

```
-- ASN1START

OMA-LPPe-OTDOA-RequestCapabilities ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.2.9 OTDOA Error Elements

– *OMA-LPPe-OTDOA-Error*

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

```
-- ASN1START

OMA-LPPe-OTDOA-Error ::= CHOICE {
    locationServerErrorCauses       OMA-LPPe-OTDOA-LocationServerErrorCauses,
    targetDeviceErrorCauses         OMA-LPPe-OTDOA-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-OTDOA-LocationServerErrorCauses*

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

```
-- ASN1START

OMA-LPPe-OTDOA-LocationServerErrorCauses ::= SEQUENCE {
    cause       ENUMERATED  {   undefined,
                                locationCalculationAssistanceDataNotSupported,
```

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

-- ASN1STOP
```

– *OMA-LPPe-OTDOA-TargetDeviceErrorCauses*

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

```
-- ASN1START

OMA-LPPe-OTDOA-TargetDeviceErrorCauses ::= SEQUENCE {
    cause       ENUMERATED {    undefined,
                                there-were-not-enough-signals-received-for-ueBased-otdoa,
                                location-calculation-assistance-data-missing,
                                ...
                            },
    ...
}

-- ASN1STOP
```

6.5.3 EOTD Positioning

6.5.3.1 EOTD Assistance Data

– *OMA-LPPe-EOTD-ProvideAssistanceData*

The IE *OMA-LPPe-EOTD-ProvideAssistanceData* is used to provide assistance for UE-based and UE-assisted EOTD-based methods.

```
-- ASN1START

OMA-LPPe-EOTD-ProvideAssistanceData ::= SEQUENCE {
    referenceBTS                OMA-LPPe-EOTD-ReferenceBTSForAssistance     OPTIONAL,   --Cond NotError
    msrAssistDataList           OMA-LPPe-EOTD-MsrAssistDataList             OPTIONAL,
    systemInfoAssistDataList    OMA-LPPe-EOTD-SystemInfoAssistDataList      OPTIONAL,
    eotdError                   OMA-LPPe-EOTD-Error                         OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
NotError	The field is mandatory present unless the IE *OMA-LPPe-EOTD-ProvideAssistanceData* contains an error message.

***OMA-LPPe-EOTD-ProvideAssistanceData* field descriptions**
referenceBTS This field defines the reference BTS for E-OTD positioning.
msrAssistDataList This field identifies the BTSs that are used for E-OTD positioning.
systemInfoAssistDataList This field identifies the BTSs that are used for E-OTD positioning. This field is used in dedicated mode, packet idle mode, packet transfer mode, or dual transfer mode.
eotdError This field provides the E-OTD assistance data error.

6.5.3.2 EOTD Assistance Data Elements

– *OMA-LPPe-EOTD-ReferenceBTSForAssistance*

The IE *OMA-LPPe-EOTD-ReferenceBTSForAssistance* is used to define the reference BTS for E-OTD positioning. The RTD and 51 multiframe offset values in the *OMA-LPPe-EOTD-MsrAssistDataList* IE and in the *OMA-LPPe-EOTD-SystemInfoAssistDataList* are calculated relative to the BTS indicated in this element.

Inclusion of this parameter is mandatory for E-OTD since it is not possible to reliably default to the current serving BTS for the target, as there is a chance that the server does not know this. If the E-OTD *systemInfoAssistDataList* in IE *OMA-LPPe-EOTD-ProvideAssistData* is present, the current serving cell must be the same as reference BTS identified in this element.

```
-- ASN1START

OMA-LPPe-EOTD-ReferenceBTSForAssistance ::= SEQUENCE {
    bsicAndCarrier      OMA-LPPe-CellNonUniqueIDGERAN,
    timeSlotScheme      OMA-LPPe-EOTD-TimeSlotScheme,
    btsPosition         CHOICE {
            ellipsoidPoint                  Ellipsoid-Point,
            ellipsoidPointWithAltitudeAndUncertaintyEllipsoid
                                                    EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,
            ...
            }       OPTIONAL,               --Cond UE-based
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
UE-based	The field is mandatory present if the assistance is for UE-based E-OTD, otherwise it is not present.

***OMA-LPPe-EOTD-ReferenceBTSForAssistance* field descriptions**
bsicAndCarrier This field includes the BSIC and BCCH of the reference BTS.
timeSlotScheme The time slot scheme field indicates the type of transmission scheme the particular BTS is using.
btsPosition In this field, the reference BTS position is given.

– *OMA-LPPe-EOTD-MsrAssistDataList*

This element identifies BTSs that are used for E-OTD measurements. This element helps the UE to make measurements from neighbor BTS (even below decoding level). This element is optional in the E-OTD assistance data. The presence of this element means that the UE should try to measure the E-OTD values between the reference BTS and the BTSs identified in this element.

This element is used to deliver E-OTD measurement assistance data for those BTSs, that are not included in the *systemInfoAssistDataList* of the reference BTS in the IE *OMA-LPPe-EOTD-ProvideAssistanceData*, if necessary.

The RTD and 51 multiframe offset values are calculated relative to the BTS indicated in the E-OTD Reference BTS in Provide Assistance Data.

```
-- ASN1START

OMA-LPPe-EOTD-MsrAssistDataList ::= SEQUENCE (SIZE (1..15)) OF OMA-LPPe-EOTD-MsrAssistBTS

OMA-LPPe-EOTD-MsrAssistBTS ::= SEQUENCE {
    bsicAndCarrier      OMA-LPPe-CellNonUniqueIDGERAN,
    multiFrameOffset    OMA-LPPe-EOTD-MultiFrameOffset,
    timeSlotScheme      OMA-LPPe-EOTD-TimeSlotScheme,
    roughRTD            OMA-LPPe-EOTD-RoughRTD,
    expectedOTD         OMA-LPPe-EOTD-ExpectedOTD,
    calcAssistanceBTS   OMA-LPPe-EOTD-CalcAssistanceBTS     OPTIONAL,   --Cond UE-based
```

```
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
UE-based	The field is mandatory present if the assistance is required for UE-based positioning.

***OMA-LPPe-EOTD-MsrAssistDataList* field descriptions**
bsicAndCarrier This field includes the BSIC and BCCH of the reference BTS.
multiFrameOffset This field indicates the frame difference between the start of the 51 multiframes frames being transmitted from this BTS and the reference BTS.
timeSlotScheme The time slot scheme field indicates the type of transmission scheme the reference BTS is using.
roughRTD This field indicates the rough RTD value between this BTS and reference BTS.
expectedOTD This field indicates the OTD value that the target is expected to measure between this BTS and reference BTS in the estimated location of the target.
calcAssistanceBTS This field specifies the coordinates of the neighbour BTSs that are used for E-OTD measurements, and also fine RTD values. This information allows the target to calculate its own location. This IE is used for UE-based E-OTD positioning.

– *OMA-LPPe-EOTD-SystemInfoAssistDataList*

This element identifies those BTSs in the System Information Neighbor List that are used for E-OTD measurements. This list is sent in the dedicated mode, packet idle mode, packet transfer mode, or dual transfer mode. This element helps the target to make measurements from those neighbour BTSs (even below decoding level). This element is optional. The presence of this element means that the target should use the BTSs identified here to the E-OTD measurements.

The RTD and 51 multiframe offset values are calculated relative to the reference BTS.

```
-- ASN1START

OMA-LPPe-EOTD-SystemInfoAssistDataList ::= SEQUENCE (SIZE (1..32)) OF OMA-LPPe-EOTD-SystemInfoAssistBTS

OMA-LPPe-EOTD-SystemInfoAssistBTS ::= CHOICE{
    notPresent          NULL,
    present             OMA-LPPe-EOTD-AssistBTSData
}

OMA-LPPe-EOTD-AssistBTSData ::= SEQUENCE {
    bsic                INTEGER(0..63),
    multiFrameOffset    OMA-LPPe-EOTD-MultiFrameOffset,
    timeSlotScheme      OMA-LPPe-EOTD-TimeSlotScheme,
    roughRTD            OMA-LPPe-EOTD-RoughRTD,
    expectedOTD         OMA-LPPe-EOTD-ExpectedOTD           OPTIONAL,
    calcAssistanceBTS   OMA-LPPe-EOTD-CalcAssistanceBTS     OPTIONAL,   --Cond UE-based
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
UE-based	The field is mandatory present if the assistance is required for UE-based positioning.

OMA-LPPe-EOTD-SystemInfoAssistDataList **field descriptions**
notPresent This field indicates that assistance data related to the BTS corresponding to the current location in *OMA-LPPe-EOTD-SystemInfoAssistDataList* is not present.
present This field contains the assistance data related to the BTS corresponding to the current location in *OMA-LPPe-EOTD-SystemInfoAssistDataList.*
bsic This field indicates the BSIC (Base Station Identity Code) of the particular BTS.
multiFrameOffset This field indicates the frame difference between the start of the 51 multiframes frames being transmitted from this BTS and the reference BTS.
timeSlotScheme The time slot scheme field indicates the type of transmission scheme the reference BTS is using.
roughRTD This field indicates the rough RTD value between this BTS and reference BTS.
expectedOTD This field indicates the OTD value that UE is expected to measure between this BTS and reference BTS in its current estimated location.
calcAssistanceBTS This field specifies the coordinates of neighbour BTSs that are used for E-OTD measurements, and also fine RTD values. This information allows the UE to calculate its own location. This field is used in UE-based E-OTD positioning.

– *OMA-LPPe-EOTD-CalcAssistanceBTS*

The *OMA-LPPe-EOTD-CalcAssistanceBTS* tells the coordinates of neighbour BTSs that are used for E-OTD measurements, and also fine RTD values. This information allows the target to calculate its own location.

```
-- ASN1START

OMA-LPPe-EOTD-CalcAssistanceBTS ::= SEQUENCE {
    fineRTD             OMA-LPPe-EOTD-FineRTD,
    relativePos         OMA-LPPe-EOTD-relativePos,
    ...
}

OMA-LPPe-EOTD-relativePos ::= SEQUENCE {
    relativeNorth       OMA-LPPe-EOTD-RelDistance,
    relativeEast        OMA-LPPe-EOTD-RelDistance,
    relativeAlt         OMA-LPPe-EOTD-RelativeAlt       OPTIONAL,
    ...
}

OMA-LPPe-EOTD-FineRTD ::= INTEGER(0..255)

OMA-LPPe-EOTD-RelDistance ::= INTEGER(-200000..200000)

OMA-LPPe-EOTD-RelativeAlt ::= INTEGER(-4000..4000)

-- ASN1STOP
```

OMA-LPPe-EOTD-CalcAssistanceBTS field descriptions
fineRTD This field indicates the fine RTD value between this BTS and reference BTS. It provides the 1/256 bit duration resolution to the value expressed in the corresponding Rough RTD field. This RTD value is the RTD value of TS0s (i.e. the difference in starting of TS0), not only the RTD between starts of bursts. The RTD is defined as $T_{BTS} - T_{Ref}$, where T_{BTS} is the time of the start of TS0 in the BTS in question, and T_{Ref} is the time of the start of the TS0 in the reference BTS. Scale factor 1/256 GSM bits. Range [0..1-2^{-8}] GSM bits.
relativePos This field specifies the position of the cell with respect to the reference cell.
relativeNorth This field indicates the distance of the neighbour BTS from the reference BTS in North (negative values mean South) direction. The used reference ellipsoid is WGS 84 ellipsoid. Scale factor 0.03/3600 degrees, range [-6000..6000] 1/3600 degrees.
relativeEast This field indicates the distance of the neighbour BTS from the reference BTS in East (negative values mean West) direction. The used reference ellipsoid is WGS 84 ellipsoid. Scale factor 0.03/3600 degrees, range [-6000..6000] 1/3600 degrees.
relativeAlt This field indicates the altitude of the neighbor BTS relative to the reference BTS in meters. This field is optional. Scale factor 1 m, range [-4000, 4000] meters.

6.5.3.3 EOTD Assistance Data Request

– *OMA-LPPe-EOTD-RequestAssistanceData*

The *OMA-LPPe-EOTD-RequestAssistanceData* is used to request assistance for UE-based and UE-assisted EOTD-based methods.

```
-- ASN1START

OMA-LPPe-EOTD-RequestAssistanceData ::= SEQUENCE {
    eotdAssistanceReq       BIT STRING { ueAssisted (0), ueBased (1) },
    ...
}

-- ASN1STOP
```

OMA-LPPe-EOTD-RequestAssistanceData field descriptions
eotdAssistanceReq This field specifies, which kind of assistance data is requested for. If bit 0 is set, assistance for UE-assisted E-OTD positioning is requested. If bit 1 is set, assistance for UE-based E-OTD positioning is requested.

6.5.3.4 EOTD Location Information

– *OMA-LPPe-EOTD-ProvideLocationInformation*

The purpose of the *OMA-LPPe-EOTD-ProvideLocationInformation* element is to provide OTD measurements of signals sent from the reference and neighbor base stations. The length of this element depends on the number of neighbor cells for which OTD measurements have been collected. BTSs which cannot be measured or whose measurements are excessively inaccurate need not be reported. The target may include measurements for other BTSs not given in the assistance data by the server.

```
-- ASN1START

OMA-LPPe-EOTD-ProvideLocationInformation ::= SEQUENCE {
    eotdMsrElement          OMA-LPPe-EOTD-MsrElement        OPTIONAL,
    eotdError               OMA-LPPe-EOTD-Error             OPTIONAL,
    ...
}

-- ASN1STOP
```

6.5.3.5 EOTD Location Information Elements

– *OMA-LPPe-EOTD-MsrElement*

The *OMA-LPPe-EOTD-MsrElement* consists of the EOTD location information measurements provided by the target to the server.

```
-- ASN1START


OMA-LPPe-EOTD-MsrElement ::= SEQUENCE {
    refFrameNumber          INTEGER(0..42431),
    referenceTimeSlot       OMA-LPPe-EOTD-ModuloTimeSlot,
    toaMeasurementsOfRef    OMA-LPPe-EOTD-TOA-MeasurementsOfRef                    OPTIONAL,
    stdResolution           BIT STRING(SIZE(2)),
    taCorrection            INTEGER(0..960)                                        OPTIONAL,
    otd-FirstSetMsrs        SEQUENCE (SIZE(1..15)) OF OMA-LPPe-EOTD-MeasurementWithID   OPTIONAL,
    ...
}


OMA-LPPe-EOTD-TOA-MeasurementsOfRef ::= SEQUENCE {
    refQuality              BIT STRING(SIZE(5)),
    numOfMeasurements       BIT STRING(SIZE(3)),
    ...
}

-- ASN1STOP
```

***OMA-LPPe-EOTD-MsrElement* field descriptions**
refFrameNumber This field indicates the frame number of the last measured burst from the reference BTS modulo 42432. This information can be used as a time stamp for the measurements. Scale factor 1 frame.
referenceTimeSlot Reference Time Slot indicates the time slot modulo 4 relative to which the target reports the reference BTS measurements. NOTE: If target does not know timeslot scheme, the target reports the used timeslot. Target can only report results based on one time slot (N) or two time slots (N and N+4). If the target knows the timeslot scheme, it can make measurements from several timeslots and reports that the used timeslot is zero (and makes correction).
toaMeasurementsOfRef This field consists of reference quality and number of measurements.
stdResolution Std Resolution field includes the resolution used in Reference Quality field and Std of EOTD Measurements field. Encoding on 2 bits as follows: '00' 10 meters; '01' 20 meters; '10' 30 meters; '11' Reserved.
taCorrection This field indicates the estimate of the time difference between the moment that the target uses to adjust its internal timing for reception and transmission (e.g. corresponding to maximum energy) and the estimate of the reception of the first arriving component from the serving BTS. This value can be used as a correction by the server to the Timing Advance (TA) value when the distance between the target and the serving BTS is estimated based on TA. The value *TACorrection* in this field corresponds to the TA Correction in bit periods as follows: - TA Correction in bit periods = *TACorrection*/64 -8. Scale factor 1/64 bit period, range [-8..+7] bit periods. Negative TA Correction in bits indicates that the first signal component from the serving BTS is estimated to arrive before the moment used for communication.

***OMA-LPPe-EOTD-MsrElement* field descriptions**
otd-FirstSetMsrs Measured neighbors in OTD measurements.
refQuality Reference Quality field includes the standard deviation of the TOA measurements from the reference BTS with respect to T_{Ref} (where T_{Ref} is the time of arrival of signal from the reference BTS used to calculate the OTD values). This field is optional. The Reference Quality field can be used to evaluate the reliability of E-OTD measurements in the server and in weighting of the E-OTD values in the location calculation. Following linear 5 bit encoding is used: '00000' 0 - (R*1-1) meters; '00001' R*1 - (R*2-1) meters; '00010' R*2 - (R*3-1) meters; … '11111' R*31 meters or more. where R is the resolution defined by Std Resolution field. For example, if R=20 meters, corresponding values are 0 - 19 meters, 20 - 39 meters, 40 - 59 meters, …, 620+ meters.
numOfMeasurements Number of Measurements for the Reference Quality field is used together with Reference Quality to define quality of the reference base site TOA. The field indicates how many measurements have been used in the target to define the standard deviation of the measurements. The following 3 bit encoding is used: '000': 2-4; '001': 5-9; '010': 10-14 '011': 15-24; '100': 25-34; '101': 35-44; '110': 45-54; '111': 55 or more.

– *OMA-LPPe-EOTD-MeasurementWithID*

The *OMA-LPPe-EOTD-MeasurementWithID* defines the EOTD measurement for BTS with known ID.

```
-- ASN1START


OMA-LPPe-EOTD-MeasurementWithID ::= SEQUENCE {
    neighborIdentity        OMA-LPPe-EOTD-NeighborIdentity,
    nborTimeSlot            OMA-LPPe-EOTD-ModuloTimeSlot,
    eotdQuality             OMA-LPPe-EOTD-EOTDQuality,
    otdValue                OMA-LPPe-EOTD-OTDValue,
    ...
}


OMA-LPPe-EOTD-NeighborIdentity ::= CHOICE {
    bsicAndCarrier      OMA-LPPe-CellNonUniqueIDGERAN,
    ci                  OMA-LPPe-EOTD-CellID,
    multiFrameCarrier   OMA-LPPe-EOTD-MultiFrameCarrier,
    requestIndex        OMA-LPPe-EOTD-RequestIndex,
    systemInfoIndex     OMA-LPPe-EOTD-SystemInfoIndex,
    ciAndLac            OMA-LPPe-CellLocalIdGERAN,
    ...
}

OMA-LPPe-EOTD-EOTDQuality ::= SEQUENCE {
    nbrOfMeasurements           BIT STRING(SIZE(3)),
    stdOfEOTD                   BIT STRING(SIZE(5)),
    ...
}

OMA-LPPe-EOTD-OTDValue ::= INTEGER (0..39999)
```

```
OMA-LPPe-EOTD-CellID ::= INTEGER (0..65535)

OMA-LPPe-EOTD-RequestIndex ::= INTEGER (1..16)
OMA-LPPe-EOTD-SystemInfoIndex ::= INTEGER (1..32)

OMA-LPPe-EOTD-MultiFrameCarrier ::= SEQUENCE {
    bcchCarrier         OMA-LPPe-EOTD-BCCHCarrier,
    multiFrameOffset    OMA-LPPe-EOTD-MultiFrameOffset,
    ...
}

OMA-LPPe-EOTD-BCCHCarrier ::= INTEGER (0..1023)

-- ASN1STOP
```

***OMA-LPPe-EOTD-MeasurementWithID* field descriptions**
neighborIdentity This field identifies the neighbour cell.
nborTimeSlot Neighbor Time Slot indicates the time slot modulo 4 relative to which the UE reports the neighbor BTS measurements. NOTE: If the UE does not know the timeslot scheme, the target reports the used timeslot. Target can only report a result based on one time slot (N) or two time slots (N and N+4). If the target knows the timeslot scheme, the target can make measurements from several timeslots and reports that the used timeslot is zero (and makes the correction).
eotdQuality This field includes the number of measurements and the standard deviation of EOTD measurements.
otdValue This field indicates the measured OTD value between the receptions of signals from the reference and the neighbour BTS. The OTD is defined as T_{Nbor} - T_{Ref} (modulo burst length) where T_{Nbor} is the time of arrival of signal from the neighbour BTS, and T_{Ref} is the time of arrival of signal from the reference BTS. The scale factor is 1/256 GSM bits. Range [0..156.2461] GSM bits.
bsicAndCarrier Cell identity is specified using BSIC and BCCH carrier.
ci Cell identity is told using CI, and the LAC is the same as the current serving BTS.
multiFrameCarrier Cell identity is specified using 51 Multiframe offset and BCCH carrier.
requestIndex Cell identity is specified using an index referring to the BTS listed in the assistance data component *OMA-LPPe-EOTD-MsrAssistdDataList*.
systemInfoIndex Cell identity is specified using an index referring to the BTS listed in the BCCH allocation list of the serving BTS, *OMA-LPPe-EOTD-SystemInfoAssistDataList* component of assistance data. This type of neighbor identity shall not be used by the target unless it has received the "E-OTD Measurement Assistance Data for System Information List Element" from the server for this cell.
ciAndLac Cell identity is specified using CI and the LAC.

OMA-LPPe-EOTD-MeasurementWithID field descriptions
nbrOfMeasurements
Number of Measurements field is used together with Std of EOTD Measurements field to define quality of a reported EOTD measurement. The field indicates how many EOTD measurements have been used in the target to define the standard deviation of these measurements. The following 3 bit encoding is used. '000': 2-4; '001': 5-9; '010': 10-14; '011': 15-24; '100': 25-34; '101': 35-44; '110': 45-54; '111': 55 or more.
stdOfEOTD
Std of EOTD Measurements field includes standard deviation of EOTD measurements. It can be used to evaluate the reliability of EOTD measurements in the server and in weighting of the OTD values in location calculation. Following linear 5 bit encoding is used: '00000' 0 - (R*1-1) meters; '00001' R*1 - (R*2-1) meters; '00010' R*2 - (R*3-1) meters; … '11111' R*31 meters or more. where R is the resolution defined by Std Resolution field. For example, if R=20 meters, corresponding values are 0 - 19 meters, 20 - 39 meters, 40 - 59 meters, …, 620+ meters.
multiFrameOffset
This field indicates the frame difference between the start of the 51 multiframes frames arriving from this BTS and the reference BTS. The multiframe offset is defined as $T_{BTS} - T_{Ref}$, where T_{BTS} is the time of the start of the 51 multiframe in the BTS in question, and T_{Ref} is the time of the start of the 51 multiframe in the reference BTS. The scale factor is 1 frame.

6.5.3.6 EOTD Location Information Request

– *OMA-LPPe-EOTD-RequestLocationInformation*

The *OMA-LPPe-EOTD-RequestLocationInformation* is used to request EOTD-based position estimate (UE-based) and measurements (UE-assisted).

```
-- ASN1START

OMA-LPPe-EOTD-RequestLocationInformation ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.3.7 EOTD Capability Information

– *OMA-LPPe-EOTD-ProvideCapabilities*

The *OMA-LPPe-EOTD-ProvideCapabilities* is used by the target to provide its EOTD capabilities to the server.

```
-- ASN1START

OMA-LPPe-EOTD-ProvideCapabilities ::= SEQUENCE {
    eotdSupport BIT STRING{ ueBased(0), ueAssisted(1) },
    ...
}

-- ASN1STOP
```

6.5.3.8 EOTD Capability Information Request

– *OMA-LPPe-EOTD-RequestCapabilities*

The *OMA-LPPe-EOTD-RequestCapabilities* is used to request EOTD capabilities information from the target.

```
-- ASN1START

OMA-LPPe-EOTD-RequestCapabilities ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.3.9 EOTD Error Elements

– *OMA-LPPe-EOTD-Error*

The *OMA-LPPe-EOTD-Errors* is used by the location server or target device to provide E-OTD error reasons to the target device or location server, respectively.

```
-- ASN1START

OMA-LPPe-EOTD-Error ::= CHOICE {
    locationServerErrorCauses       OMA-LPPe-EOTD-LocationServerErrorCauses,
    targetDeviceErrorCauses         OMA-LPPe-EOTD-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-EOTD-LocationServerErrorCauses*

The *OMA-LPPe-EOTD-LocationServerErrorCauses* is used by the location server to provide E-OTD error reasons to the target device.

```
-- ASN1START

OMA-LPPe-EOTD-LocationServerErrorCauses ::= SEQUENCE {
    cause           ENUMERATED{ undefined,
                                assistanceDataForUEbasedEOTDnotAvailable,
                                assistanceDataForUEassistedEOTDnotAvailable,
                                ...},
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-EOTD-TargetDeviceErrorCauses*

The *OMA-LPPe-EOTD-TargetDeviceErrorCauses* is used by the target device to provide E-OTD error reasons to the location server.

```
-- ASN1START

OMA-LPPe-EOTD-TargetDeviceErrorCauses ::= SEQUENCE {
    cause           ENUMERATED{ undefinedError,
                                notEnoughBTsforEOTD,
                                assistanceDataMissing,
                                referenceCellNotServingCell,
                                eotdMeasurementsNotSupported,
                                eotdMeasurementsNotAvailable,
                                uebasedEOTDnotSupported,
                                ...},
    ...
}

-- ASN1STOP
```

6.5.3.10 EOTD Common Information

– *OMA-LPPe-EOTD-TimeSlotScheme*

```
-- ASN1START

OMA-LPPe-EOTD-TimeSlotScheme ::= ENUMERATED {
    equalLength (0),
    variousLength (1)
}

-- ASN1STOP
```

***OMA-LPPe-EOTD-TimeSlotScheme* field descriptions**
OMA-LPPe-EOTD-TimeSlotScheme The time slot scheme field indicates the type of transmission scheme the reference BTS is using. If the target measures BTSs signals from time slots other than 0 or 4 and the target is informed about the burst length schemes used by BTSs, the target can compensate for the possible error. (This is necessary if the target averages bursts from different time slots, and the BTS uses varying lengths of bursts.) '0' = all time slots are 156,25 bits long. '1' = time slots 0 and 4 are 157 bits long and other time slots are 156 bits long.

– *OMA-LPPe-EOTD-MultiFrameOffset*

```
-- ASN1START

OMA-LPPe-EOTD-MultiFrameOffset ::= INTEGER (0..51)

-- ASN1STOP
```

OMA-LPPe-EOTD-MultiFrameOffset field descriptions
OMA-LPPe-EOTD-MultiFrameOffset
This field indicates the frame difference between the start of the 51 multiframes frames being transmitted from this BTS and the reference BTS. The multiframe offset is defined as T_{BTS} - T_{Ref}, where T_{BTS} is the time of the start of the 51 multiframe in the BTS in question, and T_{Ref} is the time of the start of the 51 multiframe in the reference BTS. This field is mandatory. Multiframe Offset may be used to calculate the Expected Multiframe Offset (the Multiframe Offset value that the target is expected to measure between this BTS and reference BTS in its current estimated location). Expected Multiframe Offset = (Multiframe Offset + Adjustment) modulo 51 Adjustment = 1 if Rough RTD - Expected OTD >= 850 Adjustment = -1 if Rough RTD - Expected OTD =< -850 Adjustment = 0 if -400 =< Rough RTD - Expected OTD =< 400 If the Rough RTD - Expected OTD is not within any of the ranges above, an error has occurred and the Expected OTD should be ignored and no Expected Multiframe Offset can be calculated. Usable range of Multiframe Offset value is 0 - 50. The Multiframe Offset value 51 shall not be encoded by the transmitting entity and shall be treated by the receiving entity as 0.

– *OMA-LPPe-EOTD-RoughRTD*

```
-- ASN1START

OMA-LPPe-EOTD-RoughRTD ::= INTEGER (0..1250)

-- ASN1STOP
```

OMA-LPPe-EOTD-RoughRTD field descriptions
OMA-LPPe-EOTD-RoughRTD
This field indicates the rough RTD value between this BTS and reference BTS. The used resolution is 1 bit. This RTD value is the RTD value of TS0s (i.e. the difference in starting of TS0), not only the RTD between starts of bursts. The RTD is defined as T_{BTS} - T_{Ref}, where T_{BTS} is the time of the start of TS0 in the BTS in question, and T_{Ref} is the time of the start of the TS0 in the reference BTS. This field is mandatory. Usable range of Rough RTD value is 0 - 1249. The Rough RTD value 1250 shall not be encoded by the transmitting entity and shall be treated by the receiving entity as 0. Accurate RTD values are needed for UE-based E-OTD, i.e. when the target calculates its own position. The scale factor is 1 GSM bit.

– *OMA-LPPe-EOTD-ExpectedOTD*

```
-- ASN1START

OMA-LPPe-EOTD-ExpectedOTD ::= SEQUENCE {
    expectedOTD         INTEGER(0..1250),
    expOTDUncertainty   INTEGER(0..7),
    ...
}

-- ASN1STOP
```

OMA-LPPe-EOTD-ExpectedOTD field descriptions
expectedOTD This field indicates the OTD value that the target is expected to measure between this BTS and reference BTS in its current estimated location. The server can estimate target's location roughly e.g. based on serving BTS coordinates, TA, and possibly some other information. This OTD value is the OTD value of TS0s (i.e. the difference in starting of TS0), not only the OTD between starts of bursts. The OTD is defined as $T_{BTS} - T_{Ref}$, where T_{BTS} is the time of the start of TS0 in the BTS in question, and T_{Ref} is the time of the start of the TS0 in the reference BTS. The server shall send this element to the target supporting UE-Assisted or UE-Based E-OTD. Usable range of Expected OTD value is 0 - 1249. The Expected OTD value 1250 shall not be encoded by the transmitting entity and shall be treated by the receiving entity as 0. The scale factor is 1 GSM bit.
expOTDUncertainty This field indicates the uncertainty in Expected OTD value. The uncertainty is related to server's estimation of target's location. The uncertainty defines following search window for the target, which window the target can use to speed up the OTD measurements: Expected OTD - Uncertainty < measured OTD < Expected OTD + Uncertainty. Range is 0 - 7 with following encoding: '0' 0 < uncertainty <= 2 bits; '1' 2 < uncertainty <= 4 bits; '2' 4 < uncertainty <= 8 bits; '3' 8 < uncertainty <= 12 bits; '4' 12 < uncertainty <= 16 bits; '5' 16 < uncertainty <= 22 bits; '6' 22 < uncertainty <= 30 bits; '7' uncertainty > 30 bits. NOTE: If uncertainty in UE's location is x bits, uncertainty in Expected OTD is 2*x (in the worst case). When the uncertainty is given with value '7' no upper bound exists for the uncertainty.

– *OMA-LPPe-EOTD-ModuloTimeSlot*

```
-- ASN1START

OMA-LPPe-EOTD-ModuloTimeSlot ::= INTEGER(0..3)

-- ASN1STOP
```

OMA-LPPe-EOTD-ModuloTimeSlot field descriptions
OMA-LPPe-EOTD-ModuloTimeSlot This field indicates the time slot modulo 4.

6.5.4 OTDOA-UTRA Positioning

6.5.4.1 OTDOA-UTRA Assistance Data

– *OMA-LPPe-OTDOA-UTRA-ProvideAssistanceData*

The *OMA-LPPe-OTDOA-UTRA-ProvideAssistanceData* is used to provide assistance for UE-based and UE-assisted OTDOA-UTRA -based methods.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-ProvideAssistanceData ::= SEQUENCE {
    referenceCellInfo       OMA-LPPe-OTDOA-UTRA-ReferenceCellInfo   OPTIONAL,
    neigborCellList         OMA-LPPe-OTDOA-UTRA-NeighborCellList    OPTIONAL,
    otdoaUtraError          OMA-LPPe-OTDOA-UTRA-Error               OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-OTDOA-UTRA-ProvideAssistanceData* field descriptions**
referenceCellInfo This field defines the reference cell information.
neighborCellList This field lists the neighbor cells.
otdoaUtraError This field provides the OTDOA-UTRA assistance data error.

6.5.4.2 OTDOA-UTRA Assistance Data Elements

– *OMA-LPPe-OTDOA-UTRA-ReferenceCellInfo*

The *OMA-LPPe-OTDOA-UTRA-ReferenceCellInfo* information element contains the data related to the reference cell.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-ReferenceCellInfo ::= SEQUENCE {
    sfn                     INTEGER(0..4095)            OPTIONAL,
    modeSpecificInfo    CHOICE {
        fdd                 SEQUENCE {
            primaryCPICH-info           OMA-LPPe-OTDOA-UTRA-PrimaryCPICH-Info
            },
        tdd                 SEQUENCE {
            cellAndChannelIdentity      OMA-LPPe-OTDOA-UTRA-CellAndChannelIdentity
            }
        },
    frequencyInfo           OMA-LPPe-UTRA-FrequencyInfo             OPTIONAL,
    refPosAssist            OMA-LPPe-OTDOA-UTRA-RefPosAssist        OPTIONAL,   --Cond UE-based
    ipdl-parameters         OMA-LPPe-OTDOA-UTRA-IPDL-Parameters     OPTIONAL,
    ...
}



OMA-LPPe-OTDOA-UTRA-RefPosAssist ::= SEQUENCE {
    cellPosition                CHOICE {
            ellipsoidPoint              Ellipsoid-Point,
            ellipsoidPointWithAltitude  EllipsoidPointWithAltitude,
            ...
            },
    roundTripTime               INTEGER (0..32766)          OPTIONAL,
    roundTripTimeExtension      INTEGER (0..70274)          OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
UE-based	The field is mandatory present if UE-based OTDOA positioning is used.

***OMA-LPPe-OTDOA-UTRA-ReferenceCellInfo* field descriptions**
sfn Time stamp (SFN of Reference Cell) of the SFN-SFN relative time differences and SFN-SFN drift rates. Included if any SFN-SFN drift value is included in IE *OMA-LPPe-OTDOA-UTRA-NeighborCellInfo.*
primaryCPICH-info Primary scrambling code for FDD.
cellAndChannelIdentity Identifies the channel to be measured on (TDD).
frequencyInfo Default value is the existing value of frequency information.
refPosAssist This field contains the information related to the reference cell, needed for the UE-based OTDOA positioning.
ipdl-parameters If this element is not included there are no idle periods present.
cellPosition Defines the reference cell antenna position.
roundTripTime Round trip time in chips. Scale factor 0.0625 chips. The actual value of the round-trip-time is given by: RTT = IE value * 0.0625 + 876 chips.
roundTripTimeExtension Round trip time extension in chips. Default =0. Round trip time = IE "roundTripTime" + IE "roundTripTimeExtension" Scale factor 0.0625 chips. Range [0..4392.125] chips.

– *OMA-LPPe-OTDOA-UTRA-NeighborCellList*

The *OMA-LPPe-OTDOA-UTRA-NeighborCellList* IE lists the neighbor cell information.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-NeighborCellList ::= SEQUENCE (SIZE (1..utra-maxCellMeas)) OF
                                                        OMA-LPPe-OTDOA-UTRA-NeighborCellInfo

OMA-LPPe-OTDOA-UTRA-NeighborCellInfo ::= SEQUENCE {
    modeSpecificInfo    CHOICE {
        fdd                 SEQUENCE {
            primaryCPICH-info           OMA-LPPe-OTDOA-UTRA-PrimaryCPICH-Info
            },
        tdd                 SEQUENCE {
            cellAndChannelIdentity      OMA-LPPe-OTDOA-UTRA-CellAndChannelIdentity
            }
        },
    frequencyInfo                   OMA-LPPe-UTRA-FrequencyInfo                     OPTIONAL,
    ipdl-parameters                 OMA-LPPe-OTDOA-UTRA-IPDL-Parameters             OPTIONAL,
    sfn-SFN-relTimeDifference       OMA-LPPe-OTDOA-UTRA-SFN-SFN-RelTimeDifference1,
    sfn-offsetValidity              OMA-LPPe-OTDOA-UTRA-SFN-OffsetValidity          OPTIONAL,
    sfn-SFN-drift                   OMA-LPPe-OTDOA-UTRA-SFN-SFN-Drift               OPTIONAL,
    searchWindowSize                OMA-LPPe-OTDOA-UTRA-SearchWindowSize,
    positioningAssistance           OMA-LPPe-OTDOA-UTRA-PositioningAssistance   OPTIONAL, --Cond UEbased
    ...
}

OMA-LPPe-OTDOA-UTRA-SFN-SFN-RelTimeDifference1 ::= SEQUENCE {
    sfn-offset                  INTEGER (0..4095),
    sfn-sfn-relTimeDifference   INTEGER (0..38399)
}
```

```
OMA-LPPe-OTDOA-UTRA-PositioningAssistance ::= SEQUENCE {
    relativeNorth               INTEGER (-20000..20000),
    relativeEast                INTEGER (-20000..20000),
    relativeAltitude            INTEGER (-4000..4000)               OPTIONAL,
    fineSFN-SFN                 OMA-LPPe-OTDOA-UTRA-fineSFN-SFN,
    roundTripTime               INTEGER (0..32766)                  OPTIONAL,
    roundTripTimeExtension      INTEGER (0..70274)                  OPTIONAL,
    ...
}

utra-maxCellMeas    INTEGER ::= 32

OMA-LPPe-OTDOA-UTRA-SFN-OffsetValidity ::= ENUMERATED { false }

OMA-LPPe-OTDOA-UTRA-SFN-SFN-Drift ::= ENUMERATED {
            sfnsfndrift0, sfnsfndrift1, sfnsfndrift2,
            sfnsfndrift3, sfnsfndrift4, sfnsfndrift5,
            sfnsfndrift8, sfnsfndrift10, sfnsfndrift15,
            sfnsfndrift25, sfnsfndrift35, sfnsfndrift50,
            sfnsfndrift65, sfnsfndrift80, sfnsfndrift100,
            sfnsfndrift-1, sfnsfndrift-2, sfnsfndrift-3,
            sfnsfndrift-4, sfnsfndrift-5, sfnsfndrift-8,
            sfnsfndrift-10, sfnsfndrift-15, sfnsfndrift-25,
            sfnsfndrift-35, sfnsfndrift-50, sfnsfndrift-65,
            sfnsfndrift-80, sfnsfndrift-100,
            ... }

OMA-LPPe-OTDOA-UTRA-SearchWindowSize ::= ENUMERATED { c20, c40, c80, c160, c320,
                                                      c640, c1280, moreThan1280, ... }

OMA-LPPe-OTDOA-UTRA-fineSFN-SFN ::= INTEGER (0..15)

-- ASN1STOP
```

Conditional presence	Explanation
UEbased	The field is mandatory present if the UE-based OTDOA positioning is used. Otherwise it is not present.

***OMA-LPPe-OTDOA-UTRA-NeighborCellList* field descriptions**
primaryCPICH-info Primary scrambling code for FDD.
cellAndChannelIdentity Identifies the channel to be measured on for TDD.
frequencyInfo Default value is the existing value of frequency information.
ipdl-parameters If this element is not included there are no idle periods present.
sfn-SFN-relTimeDifference Consists of SFN offset and SFN-SFN relative time difference.
sfn-offsetValidity Absence of this element means SFN offset is valid. FALSE means SFN offset is not valid.
sfn-sfn-drift Drift value in 1/256 chips per second.
searchWindowSize Search window size in chips. If the value is X then the expected SFN-SFN observed time difference is in the range [RTD-X, RTD+X] where RTD is the value of the field SFN-SFN relative time difference.
positioningAssistance This field contains the information related to the neighbor cell, needed for the UE-based OTDOA positioning.
sfnOffset Define SFNref as the system frame number of the reference cell. Let the system frame number of the neighbour cell be SFNnc. Then SFNnc=SFNref-SFNoffset modulo 4096.

OMA-LPPe-OTDOA-UTRA-NeighborCellList **field descriptions**
sfn-sfnRelTimeDifference Gives the relative timing compared to the reference cell. Equal to floor ((Tnc – Tref)*(3.84*10^6)). In chips, Tnc = the time of beginning of a system frame from the neighbour cell, Tref = the time of beginning of a system frame from the reference cell.
relativeNorth Relative position compared to reference cell. Scale factor 0.03/3600 degrees, range [-600..600] 1/3600 degrees.
relativeEast Relative position compared to reference cell. Scale factor 0.03/3600 degrees, range [-600..600] 1/3600 degrees.
relativeAltitude Relative altitude compared to reference cell. Scale factor 1m, range [-4000..4000] meters
fineSFN-SFN Gives finer resolution. Scale factor 0.0625 chips, range [0..0.9375] chips.
roundTripTime Round trip time in chips. Included if cell is in active set. The round-trip-time may be recovered from the IE value by: RTT = IE value * 0.0625 + 876 chips. Scale factor 0.0625 chips, range [876.00..2923.875] chips.
roundTripTimeExtension Round trip time extension in chips. Included if cell is in active set. Default =0. Round trip time = IE "roundTripTime" + IE "roundTripTimeExtension" Scale factor 0.0625 chips, range [0..4392.125] chips.

– *OMA-LPPe-OTDOA-UTRA-IPDL-parameters*

The *OMA-LPPe-OTDOA-UTRA-IPDL-parameters* introduces the IPDL parameters. For reference on all the fields, see [25.214] and [25.224].

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-IPDL-Parameters ::= SEQUENCE {
    modeSpecificInfo        CHOICE {
        fdd                     SEQUENCE {
            ip-spacing              OMA-LPPe-OTDOA-UTRA-IP-Spacing,
            ip-length               OMA-LPPe-OTDOA-UTRA-IP-Length,
            ip-Offset               INTEGER (0..9),
            seed                    INTEGER (0..63),
            burstModeParameters     OMA-LPPe-OTDOA-UTRA-BurstModeParameters     OPTIONAL
        },
        tdd                     SEQUENCE {
            ip-spacing-tdd          OMA-LPPe-OTDOA-UTRA-IP-Spacing-TDD,
            ip-slot                 INTEGER (0..14),
            ip-start                INTEGER (0..4095),
            ip-PCCPCH               OMA-LPPe-OTDOA-UTRA-IP-PCCPCH               OPTIONAL,
            burstModeParameters     OMA-LPPe-OTDOA-UTRA-BurstModeParameters
        }
    }
}

OMA-LPPe-OTDOA-UTRA-IP-Spacing ::= ENUMERATED { e5, e7, e10, e15, e20, e30, e40, e50}

OMA-LPPe-OTDOA-UTRA-IP-Length ::= ENUMERATED {ipl5, ipl10}

OMA-LPPe-OTDOA-UTRA-IP-Spacing-TDD ::= ENUMERATED { e30, e40, e50, e70, e100 }

OMA-LPPe-OTDOA-UTRA-IP-PCCPCH ::= BOOLEAN

OMA-LPPe-OTDOA-UTRA-BurstModeParameters ::= SEQUENCE {
    burstStart          INTEGER (0..15),
    burstLength         INTEGER (10..25),
    burstFreq           INTEGER (1..16)
}
```

```
-- ASN1STOP
```

6.5.4.3 OTDOA-UTRA Assistance Data Request

– *OMA-LPPe-OTDOA-UTRA-RequestAssistanceData*

The *OMA-LPPe-OTDOA-UTRA-RequestAssistanceData* is used to request assistance for UE-based and UE-assisted OTDOA-UTRA-based methods.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-RequestAssistanceData ::= SEQUENCE {
    otdoaUtraAssistanceReq      BIT STRING { ueAssisted (0), ueBased (1) } (SIZE(1..8)),
    ...
}

-- ASN1STOP
```

***OMA-LPPe-OTDOA-UTRA-RequestAssistanceData* field descriptions**
otdoaUtraAssistanceReq If bit 0 is set, assistance for UE-assisted OTDOA-UTRA positioning is requested. If bit 1 is set, assistance for UE-based OTDOA-UTRA positioning is requested.

6.5.4.4 OTDOA-UTRA Location Information

– *OMA-LPPe-OTDOA-UTRA-ProvideLocationInformation*

The purpose of the *OMA-LPPe-OTDOA-UTRA-ProvideLocationInformation* element is to provide measurements of signals sent from the reference and neighbor base stations.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-ProvideLocationInformation ::= SEQUENCE {
    otdoaUtraMeasurement            OMA-LPPe-OTDOA-UTRA-Measurement         OPTIONAL,
    otdoaUtraError                  OMA-LPPe-OTDOA-UTRA-Error               OPTIONAL,
    timeStampData                   OMA-LPPe-OTDOA-UTRA-TimeStampData       OPTIONAL, --Cond UE-based
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
UEbased	The field is mandatory present if the UE-based OTDOA positioning is used. Otherwise it is not present.

***OTDOA-UTRA-ProvideLocatioInformation* field descriptions**
otdoaUtraMeasuruement This field specifies the UTRA OTDOA measurements.
otdoaUtraError This field specifies the UTRA OTDOA errors.
timeStampData This field specifies the time of the location estimate.

6.5.4.5 OTDOA-UTRA Location Information Elements

– *OMA-LPPe-OTDOA-UTRA-Measurement*

The *OMA-LPPe-OTDOA-UTRA-Measurement* consists of the OTDOA-UTRA location information measurements provided by the target to the server.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-Measurement ::= SEQUENCE {
    sfn                     INTEGER (0..4095),
    modeSpecificInfoMeas    CHOICE {
        fdd                     SEQUENCE {
            referenceCellIdentity               OMA-LPPe-OTDOA-UTRA-PrimaryCPICH-Info,
            ue-RX-TX-TimeDifferenceType2Info    OMA-LPPe-OTDOA-UTRA-UE-RX-TX-TimeDifferenceType2Info,
            ...
            },
        tdd                     SEQUENCE {
            cellAndChannelIdentity              OMA-LPPe-OTDOA-UTRA-CellAndChannelIdentity,
            ...
            }
    },
    neighborList            OMA-LPPe-OTDOA-UTRA-NeighborList        OPTIONAL,
    ...
}

OMA-LPPe-OTDOA-UTRA-UE-RX-TX-TimeDifferenceType2Info ::= SEQUENCE {
    ue-RX-TX-timeDifferenceType2        OMA-LPPe-OTDOA-UTRA-TimeDifferenceType2,
    neighborQuality                     OMA-LPPe-OTDOA-UTRA-NeighborQuality
}

OMA-LPPe-OTDOA-UTRA-TimeDifferenceType2 ::= INTEGER(0..8191)

OMA-LPPe-OTDOA-UTRA-NeighborList ::= SEQUENCE (SIZE (1..utra-maxCellMeas)) OF
                                        OMA-LPPe-OTDOA-UTRA-Neighbor

OMA-LPPe-OTDOA-UTRA-Neighbor ::= SEQUENCE {
    modeSpecificInfo    CHOICE {
        fdd                 SEQUENCE {
            neighborIdentity                    OMA-LPPe-OTDOA-UTRA-PrimaryCPICH-Info   OPTIONAL,
            ue-RX-TX-timeDifferenceType2Info
                                OMA-LPPe-OTDOA-UTRA-UE-RX-TX-TimeDifferenceType2Info    OPTIONAL,
            ... },
        tdd                 SEQUENCE {
            cellAndChannelIdentity      OMA-LPPe-OTDOA-UTRA-CellAndChannelIdentity  OPTIONAL,
            uarfcn                      ARFCN-ValueUTRA                             OPTIONAL,
            ... }
    },
    neighborQuality                 OMA-LPPe-OTDOA-UTRA-NeighborQuality,
    sfn-sfn-ObsTimeDifference2      OMA-LPPe-OTDOA-UTRA-SFN-SFN-ObsTimeDifference2,
    ...
}

OMA-LPPe-OTDOA-UTRA-NeighborQuality ::= SEQUENCE {
    quality             OMA-LPPe-OTDOA-UTRA-Quality,
    ...
}

OMA-LPPe-OTDOA-UTRA-SFN-SFN-ObsTimeDifference2 ::= INTEGER (0..65535)

OMA-LPPe-OTDOA-UTRA-Quality ::= SEQUENCE {
    stdResolution                   BIT STRING (SIZE (2)),
    numberOfOTDOA-Measurements      BIT STRING (SIZE (3)),
    stdOfOTDOA-Measurements         BIT STRING (SIZE (5)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-OTDOA-UTRA-Measurement **field descriptions**
sfn SFN during which the last measurement was performed.
modeSpecificInfoMeas This field contains TDD- and FDD- specific information.
referenceCellIdentity Identifies reference cell.
ue-RX-TX-TimeDifferenceType2Info The difference in time between the uplink and downlink and the quality of measurements.
cellAndChannelIdentity Identifies the channel to be measured.
neighborList Lists the neighbor cell measurements.
ue-RX-TX-TimeDifferenceType2 The difference in time between the UE uplink DPCCH/DPDCH frame transmission and the first detected path (in time), of the downlink DPCH or F-DPCH frame from the measured radio link.
neighborQuality Quality of the SFN-SFN observed time difference type 2 measurement from the reference cell.
modeSpecificInfo This field contains TDD- and FDD- specific information.
neighborIdentity Identifies neighbour cell.
sfn-sfn-ObsTimeDifference2 This field specifies the timing relative to the reference cell.For further information see [25.214] and [25.224]
quality Specifies standard deviation and resolution of standard deviation of the measurements and number of measurements.
stdResolution Std Resolution field includes the resolution used in Std of OTDOA Measurements field. Encoding on two bits as follows: ‘00’ 10 meters ‘01’ 20 meters ‘10’ 30 meters ‘11’ Reserved
numberOfOTDOA-Measurements This field indicates how many OTDOA measurements have been used in the UE to determine the sample standard deviation of the measurements. Following 3 bit encoding is used: ‘001’ 5-9 ‘002’ 10-14 ‘011’ 15-24 ‘100’ 25-34 ‘101’ 35-44 ‘110’ 45-54 ‘111’ 55 or more Special case: '000': In this case the field 'Std of OTDOA measurements' contains the std of the reported SFN-SFN otd value = sqrt(E[(x-μ)2]), where x is the reported value and μ = E[x] is the expectation value (i.e. the true value) of x. This std can be used irrespective of the number of measurements and reporting of the number of measurements is not needed. Also other measurements such as Ec/No or Rx levels can be utilised in this case to evaluate the 'Std of OTDOA measurements'

OMA-LPPe-OTDOA-UTRA-Measurement field descriptions
stdOfOTDOA-Measurements Std of OTDOA Measurements field includes sample standard deviation of OTDOA measurements (when number of measurements is reported in 'Number of OTDOA measurements field') or standard deviation of the reported SFN-SFN otd value = sqrt(E[(x-μ)2]), where x is the reported value and μ = E[x] is the expectation value (i.e. the true value) of x (when '000' is given in 'Number of OTDOA measurements' field). Following linear 5 bit encoding is used: '00000' 0 - (R*1-1) meters '00001' R*1 – (R*2-1) meters '00010' R*2 – (R*3-1) meters … '11111' R*31 meters or more where R is the resolution defined by Std Resolution field. E.g. R=20 m corresponds to 0-19 m, 20-39 m,…,620+ m.

– *OMA-LPPe-OTDOA-UTRA-TimeStampData*

The *OMA-LPPe-OTDOA-UTRA-TimeStampData* consists of the OTDOA-UTRA frame information that can be used to time stamp the position estimate in UE-based case.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-TimeStampData ::= SEQUENCE {
    sfn                     INTEGER(0..4095),
    utraCellGlobalID        CellGlobalIdEUTRA-AndUTRA,
    frequencyInfo           OMA-LPPe-UTRA-FrequencyInfo                OPTIONAL,
    nonUniqueCellID         CHOICE {
        primaryScramblingCode   OMA-LPPe-OTDOA-UTRA-PrimaryScramblingCode,  --FDD
        cellParametersId        OMA-LPPe-OTDOA-UTRA-CellParametersID,   --TDD
        ...},
    ...
}

-- ASN1STOP
```

OMA-LPPe-OTDOA-UTRA-TimeStampData field descriptions
sfn SFN during which the measurement was performed.
utraCellGlobalID This field identifies the UTRAN cell ID to which the SFN refers to.
frequencyInfo This field gives information on the frequency.
nonUniqueCellID This field identifies the primary scrambling code for FDD or cell parameters ID for TDD.

6.5.4.6 OTDOA-UTRA Location Information Request

– *OMA-LPPe-OTDOA-UTRA-RequestLocationInformation*

The *OMA-LPPe-OTDOA-UTRA-RequestLocationInformation* is used to request OTDOA-UTRA-based position estimate (UE-based) and measurements (UE-assisted).

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-RequestLocationInformation ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.4.7 OTDOA-UTRA Capability Information

– *OMA-LPPe-OTDOA-UTRA-ProvideCapabilities*

The *OMA-LPPe-OTDOA-UTRA-ProvideCapabilities* is used by the target to provide its OTDOA-UTRA capabilities to the server.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-ProvideCapabilities ::= SEQUENCE {
    ueBasedSupported    BOOLEAN,
    ueAssistedSupported BOOLEAN,
    ipdlSupported       BOOLEAN,
    ...
}

-- ASN1STOP
```

OMA-LPPe-OTDOA-UTRA-ProvideCapabilities field descriptions
ueBasedSupported This field indicates whether the UE supports UE based OTDOA (TRUE) or not (FALSE)
ueAssistedSupported This field indicates whether the UE supports UE assisted OTDOA (TRUE) or not (FALSE)
ipdlSupported This field indicates whether the UE supports IPDL (TRUE) or not (FALSE)

6.5.4.8 OTDOA-UTRA Capability Information Request

– *OMA-LPPe-OTDOA-UTRA-RequestCapabilities*

The *OMA-LPPe-OTDOA-UTRA-RequestCapabilities* is used to request OTDOA-UTRA capabilities information from the target.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-RequestCapabilities ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.4.9 OTDOA-UTRA Error Elements

– *OMA-LPPe-OTDOA-UTRA-Error*

The *OMA-LPPe-OTDOA-UTRA-Errors* is used by the location server or target device to provide OTDOA-UTRA error reasons to the target device or location server, respectively.

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-Error ::= CHOICE {
    locationServerErrorCauses       OMA-LPPe-OTDOA-UTRA-LocationServerErrorCauses,
    targetDeviceErrorCauses         OMA-LPPe-OTDOA-UTRA-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-OTDOA-UTRA-LocationServerErrorCauses*

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

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-LocationServerErrorCauses ::= SEQUENCE {
    cause           ENUMERATED{ undefinedError,
                                assistanceDataForUEbasedOTDOAnotAvailable,
                                assistanceDataForUEassistedOTDOAnotAvailable,
                                ...},
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-OTDOA-UTRA-TargetDeviceErrorCauses*

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

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-TargetDeviceErrorCauses ::= SEQUENCE {
    cause           ENUMERATED{ undefinedError,
                                notEnoughOTDOA-cells,
                                assistanceDataMissing,
                                referenceCellNotServingCell,
                                otdoaMeasurementsNotSupported,
                                otdoaMeasurementsNotAvailable,
                                uebasedOTDOAnotSupported,
                                ...},
    ...
}

-- ASN1STOP
```

6.5.4.10 OTDOA-UTRA Common Elements

– *OMA-LPPe-OTDOA-UTRA-PrimaryCPICH-Info*

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-PrimaryCPICH-Info ::= SEQUENCE {
    primaryScramblingCode       OMA-LPPe-OTDOA-UTRA-PrimaryScramblingCode
}

-- ASN1STOP
```

– *OMA-LPPe-OTDOA-UTRA-PrimaryScramblingCode*

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-PrimaryScramblingCode ::= INTEGER (0..511)

-- ASN1STOP
```

– *OMA-LPPe-OTDOA-UTRA-CellAndChannelIdentity*

```
-- ASN1START

OMA-LPPe-OTDOA-UTRA-CellAndChannelIdentity ::= SEQUENCE {
    burstType           OMA-LPPe-OTDOA-UTRA-BurstType,
    midambleShift       OMA-LPPe-OTDOA-UTRA-MidambleShiftLong,
    timeslot            OMA-LPPe-OTDOA-UTRA-TimeSlotNumber,
    cellParametersID    OMA-LPPe-OTDOA-UTRA-CellParametersID,
    ...
}

OMA-LPPe-OTDOA-UTRA-BurstType ::= ENUMERATED { type1, type2 }

OMA-LPPe-OTDOA-UTRA-MidambleShiftLong ::= INTEGER (0..15)

OMA-LPPe-OTDOA-UTRA-TimeSlotNumber ::= INTEGER (0..14)

OMA-LPPe-OTDOA-UTRA-CellParametersID ::= INTEGER (0..127)

-- ASN1STOP
```

***OMA-LPPe-OTDOA-UTRA-CellAndChannelIdentity* field descriptions**
burstType Identifies the channel in combination with the midamble shift and slot number. It is not used in 1.28 Mcps TDD and may be set to either value. This IE should be ignored by the receiver for 1.28Mcps TDD.
midambleShift This shift, when present, applies to all the HS-PDSCH resources assigned to the target.

OMA-LPPe-OTDOA-UTRA-CellAndChannelIdentity field descriptions
timeSlot This IE is present only if no IPDL scheme is configured in the reference cell. Otherwise the slot is defined by the IPDL configuration.
cellParametersID Identifies the cell.

6.5.5 LTE Enhanced Cell ID Positioning

6.5.5.1 LTE ECID Assistance Data

– *OMA-LPPe-ECID-LTE-ProvideAssistanceData*

The *OMA-LPPe-ECID-LTE-ProvideAssistanceData* is used to provide assistance for UE-based and UE-assisted LTE ECID based methods.

```
-- ASN1START

OMA-LPPe-ECID-LTE-ProvideAssistanceData ::= SEQUENCE {
    ecid-LTE-NetworkData    SEQUENCE (SIZE (1..maxLTENetworks)) OF
                                    OMA-LPPe-ECID-LTE-NetworkData       OPTIONAL,
    ecid-LTE-Error          OMA-LPPe-ECID-LTE-Error                     OPTIONAL,
    ...
}

maxLTENetworks  INTEGER ::= 8

-- ASN1STOP
```

6.5.5.2 LTE ECID Assistance Data Elements

– *OMA-LPPe-ECID-LTE-NetworkData*

The IE *OMA-LPPe-ECID-LTE-NetworkData* is used by the location server to provide eNodeB and HeNB information for one LTE network as part of LTE ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-LTE-NetworkData ::= SEQUENCE {
    plmn-Identity           SEQUENCE {
                                mcc     SEQUENCE (SIZE (3))     OF INTEGER (0..9),
                                mnc     SEQUENCE (SIZE (2..3))  OF INTEGER (0..9),
                                ...
                            },
    multiple-PLMNs          BOOLEAN,
    reference-location      OMA-LPPe-ReferencePoint     OPTIONAL,   --Cond eNBlocations
    ecid-lte-eNodeB-list    SEQUENCE (SIZE (1..maxLTEeNBs)) OF OMA-LPPe-ECID-LTE-eNodeBData,
    ecid-lte-HeNB-list      SEQUENCE (SIZE (1..maxLTEHeNBs)) OF OMA-LPPe-ECID-LTE-HeNBData  OPTIONAL,
    ...
}

maxLTEeNBs  INTEGER ::= 32

maxLTEHeNBs INTEGER ::= 128

-- ASN1STOP
```

Conditional presence	Explanation
eNBlocations	The field is mandatory when one or more eNodeB or HeNB locations are provided for the network and a default reference point is not provided in LPPe common IEs.

OMA-LPPe-ECID-LTE-NetworkData field descriptions
plmn-Identity
This field identifies the PLMN as defined in [23.003]. For a network supporting multiple PLMNs, this field identifies the first listed (i.e. primary) PLMN.
multiple-PLMNs
This field indicates whether the network supports multiple PLMNs (true) or not (false).
reference-location
This field specifies an arbitrary reference location for the LTE network. If this field is absent, the reference location is provided by the default reference point in LPPe common IEs.
ecid-lte-eNodeB-list
This parameter provides information for one or more eNodeBs belonging to the indicated LTE network. Either ecid-lte-eNodeB-list or ecid-lte-HeNB-list or both shall be included.
ecid-lte-HeNB-list
This parameter provides information for one or more HeNBs belonging to the indicated LTE network. Either ecid-lte-eNodeB-list or ecid-lte-HeNB-list or both shall be included.

– *OMA-LPPe-ECID-LTE-eNodeBData*

The IE *OMA-LPPe-ECID-LTE-eNodeBData* is used by the location server to provide information for one LTE eNodeB or several collocated eNodeBs as part of LTE ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-LTE-eNodeBData ::= SEQUENCE {
    relative-location               OMA-LPPe-RelativeLocation       OPTIONAL,
    ecid-lte-eNodeB-CellData        SEQUENCE (SIZE (1..maxLTEMacroCells)) OF OMA-LPPe-ECID-LTE-CellData,
    ...
}

maxLTEMacroCells    INTEGER ::= 8

-- ASN1STOP
```

OMA-LPPe-ECID-LTE-eNodeBData field descriptions
relative-location
This field provides the location and optional uncertainty in location of the antenna of the eNodeB relative to the reference location for the network. For an eNodeB with multiple antennas or a set of collocated eNodeBs, the location can be averaged. This field shall be provided if requested and available.
ecid-lte-eNodeB-CellData
This field provides information for one or more LTE macro or pico cells sharing a common eNodeB antenna or using antennas in close proximity to one another.

– *OMA-LPPe-ECID-LTE-HeNBData*

The IE *OMA-LPPe-ECID-LTE-HeNBData* is used by the location server to provide information for one LTE HeNB as part of LTE ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-LTE-HeNBData ::= SEQUENCE {
    relative-location               OMA-LPPe-RelativeLocation       OPTIONAL,
    location-reliability            INTEGER (1..100)                OPTIONAL,
    coverageArea                    OMA-LPPe-WLANFemtoCoverageArea  OPTIONAL,
    ecid-lte-HeNB-CellData          OMA-LPPe-ECID-LTE-CellData,
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-LTE-HeNBData field descriptions
relative-location This field provides the location and optional uncertainty in location of the antenna of the HeNB relative to the reference location for the network.
location-reliability The field provides the reliability R of the HeNB location. The probability that the HeNB location has not changed is given as a percentage. R may be based on historic change or persistence of the HeNB location over a period of time and the time interval since the HeNB location was last provided to or verified by the server. Note that location reliability is distinct from location accuracy and refers to the possibility of an HeNB having been moved to a new location. This field shall be provided if requested and available.
coverageArea This parameter provides the coverage area of the HeNB. This parameter shall be provided if requsted and available.
ecid-lte-HeNB-CellData This field provides information for the HeNB femtocell.

– *OMA-LPPe-ECID-LTE-CellData*

The IE *OMA-LPPe-ECID-LTE-CellData* is used by the location server to provide information for one LTE macro, pico or femto cell as part of LTE ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-LTE-CellData ::= SEQUENCE {
    physCellId                      INTEGER (0..503)                OPTIONAL, --Cond AtLeastOne
    cellIdentity                    BIT STRING (SIZE (28))          OPTIONAL, --Cond AtLeastOne
    dl-CarrierFreq                  ARFCN-ValueEUTRA,
    rs-transmit-power               INTEGER (-127..128)                         OPTIONAL,
    antennaPortConfig               ENUMERATED {port1, ports2, ports4, ... }    OPTIONAL,
    antenna-gain                    INTEGER (-127..128)                         OPTIONAL,
    beam-width                      INTEGER (1..360)                            OPTIONAL,
    transmit-direction              INTEGER (0..360)                            OPTIONAL,
    frequency-accuracy              INTEGER (0..100),
    ...,
    dl-CarrierFreq-ext              ARFCN-ValueEUTRA-v9a0   OPTIONAL -- Cond EARFCN-ext
}

-- ASN1STOP
```

Conditional presence	Explanation
EARFCN-ext	This field is mandatory present if the value of E-UTRA ARFCN is greater than 65535. Otherwise this field is not present.
AtLeastOne	At least one of the fields with the condition "AtLeastOne" must be present.

OMA-LPPe-ECID-LTE-CellData field descriptions
physCellId This field specifies the physical cell identity, as defined in [36.331].
cellIdentity This field defines the identity of the cell within the context of the PLMN as defined in [36.331].
dl-CarrierFreq This field specifies the value of E-UTRA ARFCN of the cell as defined in [36.101]. If the value of E-UTRA ARFCN is greater than 65535, this field SHALL be set to 65535. ***dl-CarrierFreq*** range: (0..65535).
rs-transmit-power This field specifies the downlink reference signal transmit power for the cell in dBm as defined in [36.314]. The RS EPRE can be derived from this as defined in [36.213]. This field shall be provided if requested and available.
antennaPortConfig This field specifies whether 1, 2 or 4 antenna ports are used for downlink cell reference signals. This field shall be provided if requested and available.

OMA-LPPe-ECID-LTE-CellData **field descriptions**
antenna-gain   This field specifies the antenna gain in dBi. This field is applicable to a macro or pico cell only and shall be provided if requested and available.
beam-width   This field specifies the engineered horizontal width of the antenna beam in degrees. This field is applicable to a macro or pico cell only and shall be provided if requested and available.
transmit-direction   This field specifies the direction of the center of the main downlink transmission lobe in degrees clockwise from true north (0-359). A value of 360 indicates omnidirectional transmission. This field is applicable to a macro or pico cell only and shall be provided if requested and available.
frequency-accuracy   This field specifies the minimum frequency accuracy of the cell in units of 0.005 ppm. A value of zero indicates frequency accuracy is outside the provided range.
dl-CarrierFreq-Ext   This field specifies the value of E-UTRA ARFCN of the cell as defined in [36.101], if an extended value is used i.e., if the value of E-UTRA ARFCN is > 65535. In this case, this parameter SHALL be sent and set to the value of E-UTRA ARFCN.   ***dl-CarrierFreq-Ext*** t range: (65536..262143).

6.5.5.3 LTE ECID Assistance Data Request

– *OMA-LPPe- ECID-LTE-RequestAssistanceData*

The *OMA-LPPe- ECID-LTE-RequestAssistanceData* is used to request assistance for UE-based and UE-assisted LTE ECID based methods.

```
-- ASN1START

OMA-LPPe-ECID-LTE-RequestAssistanceData ::= SEQUENCE {
    eNBrequestedAD      BIT STRING  {   bslist              (0),
                                        bslocation          (1),
                                        transmit-power      (2),
                                        antennaPortConfig   (3),
                                        antenna-gain        (4),
                                        beam-width          (5),
                                        transmit-direction  (6),
                                        frequency-accuracy  (7),
                                        non-serving         (8) } (SIZE(1..16)) OPTIONAL,
    heNBrequestedAD     BIT STRING  {   bslist              (0),
                                        bslocation          (1),
                                        locationreliability (2),
                                        transmit-power      (3),
                                        antennaPortConfig   (4),
                                        frequency-accuracy  (5),
                                        coveragearea        (6),
                                        non-serving         (7) } (SIZE(1..16)) OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-LTE-RequestAssistanceData field descriptions
eNBrequestedAD
This parameter specifies the LTE E-CID assistance data requested for eNodeBs associated with macro and pico cells. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is requested; a zero-value means not requested. If this parameter is absent, no assistance data is requested for macro or pico cells. The following assistance data types are included: bslist: include mandatory eNodeB and cell information bslocation: include the location of each eNodeB if available transmit-power: include the downlink transmit power for each cell if available antennaPortConfig: include the antenna port configuration for the downlink RS antenna-gain: include the antenna gain for each cell if available beam-width: include the beam width for each cell if available transmit-direction: include the transmit direction for each cell if available frequency-accuracy: include the frequency accuracy for each cell if available non-serving: include information for non-serving LTE networks in addition to the serving LTE network (or include information for multiple LTE networks if the serving network is either unknown or not LTE)
heNBrequestedAD
This parameter specifies the LTE E-CID assistance data requested for HeNBs associated with femto cells. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is requested; a zero-value means not requested. If this parameter is absent, no assistance data is requested for femto cells. The following assistance data types are included: bslist: include mandatory HeNB and cell information bslocation: include the location of each HeNB if available locationreliability: include the reliability of HeNB location if available transmit-power: include the transmit power for each cell if available antennaPortConfig: include the antenna port configuration for the downlink RS frequency-accuracy: include the frequency accuracy for each cell if available coveragearea: include the coverage area for each HeNB if available non-serving: include information for non-serving LTE networks in addition to the serving LTE network (or include information for multiple LTE networks if the serving network is either unknown or not LTE)

6.5.5.4 LTE ECID Location Information

– *OMA-LPPe-ECID-LTE-ProvideLocationInformation*

The *OMA-LPPe-ECID-LTE -ProvideLocationInformation* is used to provide ECID measurements (UE-assisted) for LTE access networks at both current and historic times. Assuming the target device supports LPP E-CID measurement reporting, the target device shall use LPP and not LPPe to report LTE E-CID measurements to the server if either of the following conditions apply:

(a) The server sends an LPP Request Location Information message to the target containing an LPP request for E-CID measurements and the target is served by an LTE network.

(b) The target sends an unsolicited LPP Provide Location Information message to the server carrying current but not historic E-CID measurements for a serving LTE network and the target is either aware that the server supports LPP E-CID location information or is both not aware of the level of server LPP E-CID support and not aware that the server supports LPPe E-CID location information.

For all other cases of E-CID reporting for LTE, the target shall use LPPe and not LPP.

```
-- ASN1START

OMA-LPPe-ECID-LTE-ProvideLocationInformation ::= SEQUENCE {
    ecid-LTE-CombinedLocationInformation    SEQUENCE (SIZE (1..maxLTEECIDSize))
                                            OF OMA-LPPe-ECID-LTE-LocationInformationList    OPTIONAL,
    ecid-LTE-Error                          OMA-LPPe-ECID-LTE-Error OPTIONAL,
    ...
}

OMA-LPPe-ECID-LTE-LocationInformationList ::= SEQUENCE {
    ecid-LTE-LocationInformation    OMA-LPPe-ECID-LTE-LocationInformation,
    relativeTimeStamp               INTEGER (0..65535)                      OPTIONAL,
```

```
    servingFlag                     BOOLEAN,
    ...
}

maxLTEECIDSize  INTEGER ::= 64

-- ASN1STOP
```

OMA-LPPe-ECID-LTE-ProvideLocationInformation field descriptions
ecid-LTE-CombinedLocationInformation
This parameter provides E-CID measurements for one or more LTE access networks at the current time and/or for historic times. This parameter supports part of the Location ID and Multiple Location IDs parameters in SUPL 2.0.
ecid-LTE-Error
This parameter provides error information when not all requested LTE E-CID measurements can be reported. This parameter should be included when some but not all requested measurements are reported and shall be included when no requested measurements are reported.
relativeTimeStamp
This parameter shall be included for historic LTE E-CID measurements and provides the time of the historic measurements relative to current time in units of 0.01 seconds. If absent, current time is implied which is equivalent to a relativeTimeStamp of zero. Current time refers to the time when the target sends LTE E-CID measurements to the server.
servingFlag
This parameter indicates whether a set of E-CID measurements were obtained for a serving LTE access network (TRUE) or non-serving LTE access network (FALSE). A target device with multiple radio support may indicate more than one type of serving access network for the same time instant.

6.5.5.5 LTE ECID Location Information Elements

– *OMA-LPPe-ECID-LTE-LocationInformation*

The IE *OMA-LPPe-ECID-LTE-LocationInformation* is used by the target device to provide E-CID measurements for a serving or non-serving LTE network to the server.

```
-- ASN1START

OMA-LPPe-ECID-LTE-LocationInformation ::= SEQUENCE {
    lpp-ECID-SignalMeasurementInformation       ECID-SignalMeasurementInformation,
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-LTE-LocationInformation field descriptions
lpp-ECID-SignalMeasurementInformation
This parameter provides E-CID measurements for a serving or non-serving LTE access network.

6.5.5.6 LTE ECID Location Information Request

– *OMA-LPPe-ECID-LTE-RequestLocationInformation*

The *OMA-LPPe-ECID-LTE-RequestLocationInformation* is used to request ECID measurements (UE-assisted).

```
-- ASN1START

OMA-LPPe-ECID-LTE-RequestLocationInformation ::= SEQUENCE {
    requestedMeasurements   BIT STRING {    rsrp        (0),
                                            rsrq        (1),
                                            ueRxTx      (2),
                                            non-serving (3),
                                            historic    (4) } (SIZE(1..8)),
    ...
```

```
}

-- ASN1STOP
```

OMA-LPPe-ECID-LTE-RequestLocationInformation field descriptions
requestedMeasurements
This field specifies the LTE E-CID measurements requested. This is represented by a bit string, with a one-value at the bit position means the particular measurement is requested; a zero-value means not requested. The following measurement requests can be included. rsrp: RSRP rsrq: RSRQ ueRxTx: UE Rx-Tx time difference measurement non-serving: E-CID measurements for non-serving LTE networks (in addition to a serving LTE network) historic: historic LTE E-CID measurements (in addition to current measurements)

6.5.5.7 LTE ECID Capability Information

– *OMA-LPPe-ECID-LTE-ProvideCapabilities*

The *OMA-LPPe-ECID-LTE-ProvideCapabilities* is used by the target to provide its ECID capabilities to the server.

```
-- ASN1START

OMA-LPPe-ECID-LTE-ProvideCapabilities ::= SEQUENCE {
    ecid-lte-MeasSupported  BIT STRING  {rsrp       (0),
                                         rsrq       (1),
                                         ueRxTx     (2),
                                         non-serving (3),
                                         historic   (4) } (SIZE(1..8)),
    ecid-lte-eNodeB-ADSupported BIT STRING  {bslist             (0),
                                             bslocation         (1),
                                             transmit-power     (2),
                                             antennaPortConfig  (3),
                                             antenna-gain       (4),
                                             beam-width         (5),
                                             transmit-direction (6),
                                             frequency-accuracy (7),
                                             non-serving        (8) } (SIZE(1..16)),
    ecid-utra-HeNB-ADSupported  BIT STRING  {bslist                 (0),
                                             bslocation             (1),
                                             locationreliability    (2),
                                             transmit-power         (3),
                                             antennaPortConfig      (4),
                                             frequency-accuracy     (5),
                                             coverageareа           (6),
                                             non-serving            (7) } (SIZE(1..16)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-LTE-ProvideCapabilities field descriptions
ecid-lte-MeasSupported This field specifies the E-CID measurements supported by the target device for LTE using LPPe. This is represented by a bit string, with a one-value at the bit position means the particular measurement is supported; a zero-value means not supported. A zero-value in all bit positions in the bit string means only the basic Cell ID positioning method is supported by the target device for LTE using LPPe. The following bits are assigned for the indicated measurements. rsrp: RSRP rsrq: RSRQ ueRxTx: UE Rx-Tx time difference measurement non-serving: E-CID measurements for non-serving LTE networks (in addition to a serving LTE network) historic: historic LTE E-CID measurements
ecid-lte-eNodeB-ADSupported This field specifies the E-CID assistance data supported by the target device for LTE eNodeBs. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is supported; a zero-value means not supported. A zero-value in all bit positions or absence of this field means no assistance data is supported. The following bits are assigned for the indicated assistance data. bslist: mandatory eNodeB and cell information bslocation: location of each eNodeB transmit-power: transmit power for each cell antennaPortConfig: antenna port configuration for downlink RS antenna-gain: antenna gain for each cell beam-width: beam width for each cell transmit-direction: transmit direction for each cell frequency-accuracy: frequency accuracy for each cell non-serving: information for non-serving LTE networks in addition to the serving LTE network (or information for multiple LTE networks if the serving network is not LTE)
ecid-lte-HeNB-ADSupported This field specifies the E-CID assistance data supported by the target device for LTE HeNBs. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is supported; a zero-value means not supported. A zero-value in all bit positions or absence of this field means no assistance data is supported. The following bits are assigned for the indicated assistance data. bslist: mandatory HeNB and cell information bslocation: location of each HeNB locationreliability: location reliability of each HeNB transmit-power: transmit power for each cell antennaPortConfig: antenna port configuration for downlink RS frequency-accuracy: frequency accuracy for each cell coveragearea: coverage area for each HeNB non-serving: information for non-serving LTE networks in addition to the serving LTE network (or information for multiple LTE networks if the serving network is not LTE)

6.5.5.8 LTE ECID Capability Information Request

– *OMA-LPPe-ECID-LTE-RequestCapabilities*

The *OMA-LPPe-ECID-LTE-RequestCapabilities* is used to request ECID capabilities information from the target.

```
-- ASN1START

OMA-LPPe-ECID-LTE-RequestCapabilities ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.5.9 LTE ECID Error Element

– *OMA-LPPe-ECID-LTE-Error*

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

```
-- ASN1START

OMA-LPPe-ECID-LTE-Error ::= CHOICE {
    locationServerErrorCauses       OMA-LPPe-ECID-LTE-LocationServerErrorCauses,
    targetDeviceErrorCauses         OMA-LPPe-ECID-LTE-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-ECID-LTE-LocationServerErrorCauses*

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

```
-- ASN1START

OMA-LPPe-ECID-LTE-LocationServerErrorCauses ::= SEQUENCE {
    cause       ENUMERATED  {   undefined,
                                requestedADNotAvailable,
                                notAllrequestedADAvailable,
                                ...
                            },
    eNodeBMandatoryDataUnavailable          NULL        OPTIONAL,
    eNodeBLocationsUnavailable              NULL        OPTIONAL,
    eNodeBcellTransmitPowerUnavailable      NULL        OPTIONAL,
    eNodeBcellAntennaPortConfigUnavailable  NULL        OPTIONAL,
    eNodeBcallAntennaGainUnavailable        NULL        OPTIONAL,
    eNodeBcellBeamWidthUnavailable          NULL        OPTIONAL,
    eNodeBcellTransmitDirectionUnavailable  NULL        OPTIONAL,
    eNodeBcellFrequencyAccuracyUnavailable  NULL        OPTIONAL,
    eNodeBnonservingADUnavailable           NULL        OPTIONAL,
    heNBMandatoryDataUnavailable            NULL        OPTIONAL,
    heNBLocationUnavailable                 NULL        OPTIONAL,
    heNBLocationReliabilityUnavailable      NULL        OPTIONAL,
    heNBcellTransmitPowerUnavailable        NULL        OPTIONAL,
    heNBcellAntennaPortConfigUnavailable    NULL        OPTIONAL,
    heNBcellFrequencyAccuracyUnavailable    NULL        OPTIONAL,
    heNBCoverageAreaUnavailable             NULL        OPTIONAL,
    heNBnonservingADUnavailable             NULL        OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ECID-LTE-LocationServerErrorCauses* field descriptions**
cause
This field provides a LTE ECID specific error cause for the server applicable to provision of assistance data. If the cause value is '*requestedADNotAvailable*', none of the requested assistance data could be provided and no further information needs to be included. If the cause value is '*notAllRequestedADAvailable*', the server was able to provide some but not all requested LTE ECID assistance data. In this case, the server should include any of the specific error indications as applicable. Note that inclusion of these fields is applicable when some of the associated information can be provided for some base stations or cells but not for all base stations and cells.

– *OMA-LPPe-ECID-LTE-TargetDeviceErrorCauses*

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

```
-- ASN1START

OMA-LPPe-ECID-LTE-TargetDeviceErrorCauses ::= SEQUENCE {
    cause       ENUMERATED {undefined,
                            requestedMeasurementsNotAvailable,
                            notAllrequestedMeasurementsPossible,
                            ...
                            },
    rsrpMeasurementNotPossible          NULL        OPTIONAL,
    rsrqMeasurementNotPossible          NULL        OPTIONAL,
```

```
    ueRxTxMeasurementNotPossible        NULL        OPTIONAL,
    non-servingMeasurementsNotAvailable NULL        OPTIONAL,
    historicMeasurementsNotAvailable    NULL        OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ECID-LTE-TargetDeviceErrorCauses* field descriptions**
cause
This field provides an LTE ECID specific error cause. If the cause value is '*requestedMeasurementsNotAvailable*', none of the requested measurements could be provided and no further information needs to be included. If the cause value is '*notAllRequestedMeasurementsPossible*', the target device was able to provide some but not all requested LTE ECID measurements. In this case, the target device should include any of the other fields, as applicable.

6.5.6 GSM Enhanced Cell ID Positioning

This section defines support for GSM ECID.

6.5.6.1 GSM ECID Assistance Data

– *OMA-LPPe-ECID-GSM-ProvideAssistanceData*

The *OMA-LPPe-ECID-GSM-ProvideAssistanceData* is used to provide assistance for UE-based and UE-assisted GSM ECID based methods.

```
-- ASN1START

OMA-LPPe-ECID-GSM-ProvideAssistanceData ::= SEQUENCE {
    ecid-gsm-NetworkData    SEQUENCE (SIZE (1..maxGSMNetworks))
                                                OF OMA-LPPe-ECID-GSM-NetworkData        OPTIONAL,
    ecid-gsm-Error          OMA-LPPe-ECID-GSM-Error OPTIONAL,
    ...
}

maxGSMNetworks  INTEGER ::= 8

-- ASN1STOP
```

6.5.6.2 GSM ECID Assistance Data Elements

– *OMA-LPPe-ECID-GSM-NetworkData*

The IE *OMA-LPPe-ECID-GSM-NetworkData* is used by the location server to provide base station information for one GSM network as part of GSM ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-GSM-NetworkData ::= SEQUENCE {
    plmn-Identity       SEQUENCE {
                            mcc     SEQUENCE (SIZE (3))     OF INTEGER (0..9),
                            mnc     SEQUENCE (SIZE (2..3))  OF INTEGER (0..9)
                            },
    reference-location  OMA-LPPe-ReferencePoint     OPTIONAL,   --Cond BSlocations
    base-station-list   SEQUENCE (SIZE (1..maxGSMBaseStations)) OF OMA-LPPe-ECID-GSM-BaseStationData,
    ...
}

maxGSMBaseStations  INTEGER ::= 32

-- ASN1STOP
```

Conditional presence	Explanation
BSlocations	The field is mandatory when one or more base station locations are provided for the network and a default reference point is not provided in LPPe common IEs.

***OMA-LPPe-ECID-GSM-NetworkData* field descriptions**
plmn-Identity This field identifies the PLMN as defined in [23.003].
reference-Location This field defines an arbitrary reference location for the GSM network. If this field is absent, the reference location is provided by the default reference point in LPPe common IEs.
base-station-list This parameter provides information for one or more base stations belonging to the indicated GSM network.

– *OMA-LPPe-ECID-GSM-BaseStationData*

The IE *OMA-LPPe-ECID-GSM-BaseStationData* is used by the location server to provide information for one GSM base station as part of GSM ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-GSM-BaseStationData ::= SEQUENCE {
    relative-location               OMA-LPPe-RelativeLocation       OPTIONAL,
    ecid-gsm-CellData               SEQUENCE (SIZE (1..maxGSMCells)) OF OMA-LPPe-ECID-GSM-CellData,
    ...
}

maxGSMCells INTEGER ::= 8

-- ASN1STOP
```

***OMA-LPPe-ECID-GSM-BaseStationData* field descriptions**
relative-location This field provides the location and optional uncertainty in location of the antenna of the GSM base station relative to the reference location for the network. For a base station with multiple antennas or a set of collocated base stations, the location can be averaged. This field shall be provided if requested and available.
ecid-gsm-CellData This field provides information for one or more GSM cells sharing a common base station antenna or using antennas in close proximity to one another.

– *OMA-LPPe-ECID-GSM-CellData*

The IE *OMA-LPPe-ECID-GSM-CellData* is used by the location server to provide information for one GSM Cell as part of GSM ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-GSM-CellData ::= SEQUENCE {
    cellNonUniqueIDGERAN            OMA-LPPe-CellNonUniqueIDGERAN   OPTIONAL, --Cond AtLeastOne
    cellLocalIDGERAN                OMA-LPPe-CellLocalIdGERAN       OPTIONAL, --Cond AtLeastOne
    transmit-power                  INTEGER (-127..128)             OPTIONAL,
    antenna-gain                    INTEGER (-127..128)             OPTIONAL,
    beam-width                      INTEGER (1..360)                OPTIONAL,
    transmit-direction              INTEGER (0..360)                OPTIONAL,
    frequency-accuracy              INTEGER (0..100)                OPTIONAL,
    ...
}


-- ASN1STOP
```

Conditional presence	Explanation
AtLeastOne	At least one of the fields with the condition "AtLeastOne" must be present.

***OMA-LPPe-ECID-GSM-CellData* field descriptions**
cellNonUniqueIDGERAN This field provides the BCCH and BSIC for the GSM cell, as defined in [23.003] and [45.001].
cellLocalIDGERAN This field provides the location area and cell ID of the GSM cell. This field shall be provided if available.
transmit-power This field specifies the transmit power used for the BCCH in dBm. This field shall be provided if requested and available.
antenna-gain This field specifies the antenna gain in dBi. This field shall be provided if requested and available.
beam-width This field specifies the engineered horizontal width of the antenna beam in degrees. This field shall be provided if requested and available.
transmit-direction This field specifies the direction of the center of the main transmission lobe in degrees clockwise from true north (0-359). A value of 360 indicates omnidirectional transmission. This field shall be provided if requested and available.
frequency-accuracy This field specifies the minimum frequency accuracy of the cell in units of 0.005 ppm. A value of zero indicates frequency accuracy is outside the provided range.

6.5.6.3 GSM ECID Assistance Data Request

– *OMA-LPPe-ECID-GSM-RequestAssistanceData*

The *OMA-LPPe-ECID-GSM-RequestAssistanceData* is used to request assistance for UE-based and UE-assisted GSM ECID based methods.

```
-- ASN1START


OMA-LPPe-ECID-GSM-RequestAssistanceData ::= SEQUENCE {
    requestedAD     BIT STRING  {   bslist              (0),
                                    bslocation          (1),
                                    transmit-power      (2),
                                    antenna-gain        (3),
                                    beam-width          (4),
                                    transmit-direction  (5),
                                    frequency-accuracy  (6),
                                    non-serving         (7)
                                     } (SIZE(1..16)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-GSM-RequestAssistanceData field descriptions
requestedAD
This parameter specifies the GSM E-CID assistance data requested. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is requested; a zero-value means not requested. The following assistance data types are included: bslist: include base station and cell information bslocation: include the location of each base station if available transmit-power: include the transmit power for each cell if available antenna-gain: include the antenna gain for each cell if available beam-width: include the beam width for each cell if available transmit-direction: include the transmit direction for each cell if available frequency-accuracy: include the frequency accuracy for each cell if available non-serving: include information for non-serving GSM networks in addition to the serving GSM network (or include information for multiple GSM networks if the serving network is either unknown or not GSM)

6.5.6.4 GSM ECID Location Information

– *OMA-LPPe-ECID-GSM-ProvideLocationInformation*

The *OMA-LPPe-ECID-GSM-ProvideLocationInformation* is used to provide ECID measurements (UE-assisted) for one or more GSM access types and at both current and historic times.

```
-- ASN1START

OMA-LPPe-ECID-GSM-ProvideLocationInformation ::= SEQUENCE {
    ecid-GSM-CombinedLocationInformation    SEQUENCE (SIZE (1..maxGSMECIDSize))
                                            OF OMA-LPPe-ECID-GSM-LocationInformationList    OPTIONAL,
    ecid-GSM-Error                          OMA-LPPe-ECID-GSM-Error                         OPTIONAL,
    ...
}

OMA-LPPe-ECID-GSM-LocationInformationList ::= SEQUENCE {
    ecid-GSM-LocationInformation    OMA-LPPe-ECID-GSM-LocationInformation,
    relativeTimeStamp               INTEGER (0..65535)  OPTIONAL,
    servingFlag                     BOOLEAN,
    ...
}

maxGSMECIDSize  INTEGER ::= 64

-- ASN1STOP
```

OMA-LPPe-ECID-GSM-ProvideLocationInformation field descriptions
ecid-GSM-CombinedLocationInformation
This parameter provides E-CID measurements for one or more GSM networks at the current time and/or for historic times. This parameter supports part of the Location ID and Multiple Location IDs parameters in SUPL 2.0.
ecid-GSM-Error
This parameter provides error information when not all requested GSM E-CID measurements can be reported. This parameter should be included when some but not all requested measurements are reported and shall be included when no requested measurements are reported.
relativeTimeStamp
This parameter shall be included for historic GSM E-CID measurements and provides the time of the historic measurements relative to current time in units of 0.01 seconds. If absent, current time is implied which is equivalent to a relativeTimeStamp of zero. Current time refers to the time when the target sends GSM E-CID measurements to the server.
servingFlag
This parameter indicates whether a set of E-CID measurements were obtained for a serving GSM access network (TRUE) or a non-serving GSM access network (FALSE). A target device capable of multiple radio support may indicate more than one type of serving access network for the same time instant.

6.5.6.5 GSM ECID Location Information Elements

– *OMA-LPPe-ECID-GSM-LocationInformation*

The IE *OMA-LPPe-ECID-GSM-LocationInformation* is used by the target device to provide E-CID measurements for a serving or non-serving GSM network to the server.

```
-- ASN1START


OMA-LPPe-ECID-GSM-LocationInformation ::= SEQUENCE {
    cellGlobalIdGERAN       CellGlobalIdGERAN,
    rxLevel                 INTEGER (0..63)                 OPTIONAL,
    tA                      INTEGER(0..255)                 OPTIONAL,
    nMR-GERAN               OMA-LPPe-NMR-GERAN              OPTIONAL,
    ...
}

OMA-LPPe-NMR-GERAN ::= SEQUENCE (SIZE (1..15)) OF SEQUENCE {
    cellNonUniqueIDGERAN    OMA-LPPe-CellNonUniqueIDGERAN,
    cellLocalIDGERAN        OMA-LPPe-CellLocalIdGERAN               OPTIONAL,
    rxLevel                 INTEGER (0..63),
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ECID-GSM-LocationInformation* field descriptions**			
cellGlobalIdGERAN			
This field provides the GERAN global cell ID of the measured cell which is either the serving cell or a cell in a non-serving GSM network that is treated like a serving cell for the purpose of reporting measurements.			
rxLevel			
This field specifies the received signal level for a measured cell. Rx-level is encoded according to [45.008] as:			
0:	<		-110 dBm.
1:	-110 dBm	to	-109 dBm.
2:	-109 dBm	to	-108 dBm.
…			
62:	-49 dBm	to	-48 dBm.
63:	>= -48 dBm.		
tA			
This field specifies the timing advance of the measured cell in units of 48/13µs (length of a GSM bit). This provides an approximation for the round trip propagation time between the target and the base station of the measured cell.			
nMR-GERAN			
This field provides the GERAN Network Measurements Report for up to 15 cells.			
cellNonUniqueIDGERAN			
This field provides the BSIC and BCCH for a measured cell.			
cellLocalIDGERAN			
This field provides the location area and cell ID of a measured cell and shall be included if available.			

– *OMA-LPPe-ECID-GSM-RequestLocationInformation*

The *OMA-LPPe-ECID-GSM-RequestLocationInformation* is used to request GSM ECID measurements (UE-assisted).

```
-- ASN1START

OMA-LPPe-ECID-GSM-RequestLocationInformation ::= SEQUENCE {
    requestedMeasurements   BIT STRING {    rxLevel     (0),
                                            tA          (1),
                                            nMR-GERAN   (2),
                                            non-serving (3),
```

```
                                        historic    (4) } (SIZE(1..8)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-GSM-RequestLocationInformation field descriptions
requestedMeasurements
This field specifies the GSM E-CID measurements requested. This is represented by a bit string, with a one-value at the bit position means the particular measurement is requested; a zero-value means not requested. The following measurement requests can be included. rxLevel: RX level tA: timing advance nMR-GERAN: network measurement report for neighboring cells non-serving: E-CID measurements for non-serving GSM networks (in addition to a serving GSM network) historic: historic GSM E-CID measurements (in addition to current measurements)

6.5.6.6 GSM ECID Capability Information

– *OMA-LPPe-ECID-GSM-ProvideCapabilities*

The *OMA-LPPe-ECID-GSM-ProvideCapabilities* is used by the target to provide its GSM ECID capabilities to the server.

```
-- ASN1START

OMA-LPPe-ECID-GSM-ProvideCapabilities ::= SEQUENCE {
    ecid-gsm-MeasSupported  BIT STRING {    rxLevel     (0),
                                            tA          (1),
                                            nMR-GERAN   (2),
                                            non-serving (3),
                                            historic    (4) } (SIZE(1..8)),
    ecid-gsm-ADSupported    BIT STRING  { bslist                (0),
                                          bslocation            (1),
                                          transmit-power        (2),
                                          antenna-gain          (3),
                                          beam-width            (4),
                                          transmit-direction    (5),
                                          frequency-accuracy    (6),
                                          non-serving           (7) } (SIZE(1..16)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-GSM-ProvideCapabilities field descriptions
ecid-gsm-MeasSupported
This field specifies the E-CID measurements supported by the target device for GSM. This is represented by a bit string, with a one-value at the bit position means the particular measurement is supported; a zero-value means not supported. A zero-value in all bit positions in the bit string means only the basic Cell ID positioning method is supported by the target device for GSM. The following bits are assigned for the indicated measurements. rxLevel: RX level tA: timing advance nMR-GERAN: network measurement report for neighboring cells non-serving: E-CID measurements for non-serving GSM networks (in addition to a serving GSM network) historic: historic GSM E-CID measurements

OMA-LPPe-ECID-GSM-ProvideCapabilities field descriptions
ecid-gsm-ADSupported
This field specifies the E-CID assistance data supported by the target device for GSM. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is supported; a zero-value means not supported. A zero-value in all bit positions or absence of this field means no assistance data is supported. The following bits are assigned for the indicated assistance data. bslist: base station and cell information bslocation: location of each base station transmit-power: transmit power for each cell antenna-gain: antenna gain for each cell beam-width: beam width for each cell transmit-direction: transmit direction for each cell frequency-accuracy: frequency accuracy for each cell non-serving: information for non-serving GSM networks in addition to the serving GSM network (or information for multiple GSM networks if the serving network is not GSM)

6.5.6.7 GSM ECID Capability Information Request

– *OMA-LPPe-ECID-GSM-RequestCapabilities*

The *OMA-LPPe-ECID-GSM-RequestCapabilities* is used to request GSM ECID capabilities information from the target.

```
-- ASN1START

OMA-LPPe-ECID-GSM-RequestCapabilities ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.6.8 GSM ECID Error Element

– *OMA-LPPe-ECID-GSM-Error*

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

```
-- ASN1START

OMA-LPPe-ECID-GSM-Error ::= CHOICE {
    locationServerErrorCauses       OMA-LPPe-ECID-GSM-LocationServerErrorCauses,
    targetDeviceErrorCauses         OMA-LPPe-ECID-GSM-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-ECID-GSM-LocationServerErrorCauses*

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

```
-- ASN1START

OMA-LPPe-ECID-GSM-LocationServerErrorCauses ::= SEQUENCE {
    cause       ENUMERATED  {   undefined,
                                requestedADNotAvailable,
                                notAllrequestedADAvailable,
                                ...
                            },
    mandatoryDataUnavailable            NULL        OPTIONAL,
    bsLocationsUnavailable              NULL        OPTIONAL,
    cellTransmitPowerUnavailable        NULL        OPTIONAL,
    callAntennaGainUnavailable          NULL        OPTIONAL,
    cellBeamWidthUnavailable            NULL        OPTIONAL,
    cellTransmitDirectionUnavailable    NULL        OPTIONAL,
    cellFrequencyAccuracyUnavailable    NULL        OPTIONAL,
    nonservingADUnavailable             NULL        OPTIONAL,
```

```
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-GSM-LocationServerErrorCauses field descriptions
cause
This field provides a GSM ECID specific error cause for the server applicable to provision of assistance data. If the cause value is '*requestedADNotAvailable*', none of the requested assistance data could be provided and no further information needs to be included. If the cause value is '*notAllRequestedADAvailable*', the server was able to provide some but not all requested GSM ECID assistance data. In this case, the server should include any of the specific error indications as applicable. Note that inclusion of these fields is applicable when some of the associated information can be provided for some base stations or cells but not for all base stations and cells.

– *OMA-LPPe-ECID-GSM-TargetDeviceErrorCauses*

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

```
-- ASN1START

OMA-LPPe-ECID-GSM-TargetDeviceErrorCauses ::= SEQUENCE {
    cause       ENUMERATED {    undefined,
                                requestedMeasurementsNotAvailable,
                                notAllrequestedMeasurementsPossible,
                                ...
                            },
    rxLevelMeasurementNotPossible       NULL        OPTIONAL,
    taMeasurementNotPossible            NULL        OPTIONAL,
    nMRMeasurementNotPossible           NULL        OPTIONAL,
    non-servingMeasurementsNotAvailable NULL        OPTIONAL,
    historicMeasurementsNotAvailable    NULL        OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-GSM-TargetDeviceErrorCauses field descriptions
cause
This field provides a GSM ECID specific error cause. If the cause value is '*requestedMeasurementsNotAvailable*', none of the requested measurements could be provided and no further information needs to be included. If the cause value is '*notAllRequestedMeasurementsPossible*', the target device was able to provide some but not all requested GSM ECID measurements. In this case, the target device should include any of the '*rxLevelMeasurementNotPossible*', '*taMeasurementNotPossible*', '*nMRMeasurementNotPossible*', '*non-servingMeasurementsNotAvailable'* or '*historicMeasurementsNotAvailable*' fields, as applicable.

6.5.7 UTRA Enhanced Cell ID Positioning

This section defines support for UTRA ECID.

6.5.7.1 UTRA ECID Assistance Data

– *OMA-LPPe-ECID-UTRA-ProvideAssistanceData*

The IE *OMA-LPPe-ECID-UTRA-ProvideAssistanceData* is used to provide assistance for UE-based and UE-assisted UTRA ECID based methods.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-ProvideAssistanceData ::= SEQUENCE {
    ecid-UTRA-NetworkData   SEQUENCE (SIZE (1..maxUTRANetworks))
                                        OF OMA-LPPe-ECID-UTRA-NetworkData       OPTIONAL,
    ecid-UTRA-Error         OMA-LPPe-ECID-UTRA-Error                            OPTIONAL,
    ...
```

```
}

maxUTRANetworks INTEGER ::= 8

-- ASN1STOP
```

6.5.7.2 UTRA ECID Assistance Data Elements

– *OMA-LPPe-ECID-UTRA-NetworkData*

The IE *OMA-LPPe-ECID-UTRA-NetworkData* is used by the location server to provide Node B and/or HNB information for one UTRA network as part of UTRA ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-NetworkData ::= SEQUENCE {
    plmn-Identity           SEQUENCE {
                                mcc     SEQUENCE (SIZE (3))     OF INTEGER (0..9),
                                mnc     SEQUENCE (SIZE (2..3))  OF INTEGER (0..9)
                            },
    multiple-PLMNs          BOOLEAN,
    reference-location      OMA-LPPe-ReferencePoint     OPTIONAL,   --Cond nodeBlocations
    ecid-utra-nodeB-list    SEQUENCE (SIZE (1..maxUTRAnodeBs))
                                                        OF OMA-LPPe-ECID-UTRA-NodeBData OPTIONAL,
    ecid-utra-HNB-list      SEQUENCE (SIZE (1..maxUTRAHNBs)) OF OMA-LPPe-ECID-UTRA-HNBData  OPTIONAL,
    ...
}

maxUTRAnodeBs   INTEGER ::= 32

maxUTRAHNBs     INTEGER ::= 128

-- ASN1STOP
```

Conditional presence	Explanation
nodeBlocations	The field is mandatory when one or more Node B or HNB locations are provided for the network and a default reference point is not provided in LPPe common IEs.

***OMA-LPPe-ECID-UTRA-NetworkData* field descriptions**
plmn-Identity This field identifies the PLMN as defined in [23.003]. For a network supporting multiple PLMNs, this field identifies the first listed (i.e. primary) PLMN.
multiple-PLMNs This field indicates whether the network supports multiple PLMNs (true) or not (false).
reference-Location This field specifies an arbitrary reference location for the UTRA network. If this field is absent, the reference location is provided by the default reference point in LPPe common IEs.
ecid-utra-nodeB-list This parameter provides information for one or more Node Bs belonging to the indicated UTRA network. Either ecid-utra-nodeB-list or ecid-utra-HNB-list or both shall be included.
ecid-utra-HNB-list This parameter provides information for one or more HNBs belonging to the indicated UTRA network. Either ecid-utra-nodeB-list or ecid-utra-HNB-list or both shall be included.

– *OMA-LPPe-ECID-UTRA-NodeBData*

The IE *OMA-LPPe-ECID-UTRA-NodeBData* is used by the location server to provide information for one UTRA Node B or several collocated Node Bs as part of UTRA ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-NodeBData ::= SEQUENCE {
    relative-location               OMA-LPPe-RelativeLocation       OPTIONAL,
    ecid-utra-nodeB-CellData        SEQUENCE (SIZE (1..maxUTRAMacroCells)) OF
```

```
                                                                    OMA-LPPe-ECID-UTRA-CellData,
    ...
}

maxUTRAMacroCells   INTEGER ::= 8

-- ASN1STOP
```

***OMA-LPPe-ECID-UTRA-NodeBData* field descriptions**
relative-location This field provides the location and optional uncertainty in location of the antenna of the UTRA Node B relative to the reference location for the network. For a Node B with multiple antennas or a set of collocated Node Bs, the location can be averaged. This field shall be provided if requested and available.
ecid-utra-nodeB-CellData This field provides information for one or more UTRA macro or pico cells sharing a common Node B antenna or using antennas in close proximity to one another.

– *OMA-LPPe-ECID-UTRA-HNBData*

The IE *OMA-LPPe-ECID-UTRA-HNBData* is used by the location server to provide information for one UTRA HNB as part of UTRA ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-HNBData ::= SEQUENCE {
    relative-location               OMA-LPPe-RelativeLocation       OPTIONAL,
    location-reliability            INTEGER (1..100)                OPTIONAL,
    coverageArea                    OMA-LPPe-WLANFemtoCoverageArea  OPTIONAL,
    ecid-utra-HNB-CellData          OMA-LPPe-ECID-UTRA-CellData,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ECID-UTRA-HNBData* field descriptions**
relative-location This field provides the location and optional uncertainty in location of the antenna of the HNB relative to the reference location for the network.
location-reliability The field provides the reliability R of the HNB location. The probability that the HNB location has not changed is given as a percentage. R may be based on historic change or persistence of the HNB location over a period of time and the time interval since the HNB location was last provided to or verified by the server. Note that location reliability is distinct from location accuracy and refers to the possibility of an HNB having been moved to a new location. This field shall be provided if requested and available.
coverageArea This parameter provides the coverage area of the HNB. This parameter shall be provided if requested and available.
ecid-utra-HNB-CellData This field provides information for the HNB femtocell.

– *OMA-LPPe-ECID-UTRA-CellData*

The IE *OMA-LPPe-ECID-UTRA-CellData* is used by the location server to provide information for one UTRA macro, pico or femto cell as part of UTRA ECID assistance data.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-CellData ::= SEQUENCE {
    cellIdentity                    BIT STRING (SIZE (32))  OPTIONAL, --Cond AtLeastOne
    modeSpecificInfo                CHOICE {
                    fdd
                        SEQUENCE {
                            primaryCPICH-Scrambling-Code    OMA-LPPe-OTDOA-UTRA-PrimaryScramblingCode,
                            primaryCPICH-Tx-Power           INTEGER (-127..128)     OPTIONAL,
                            uarfcn-dl                       ARFCN-ValueUTRA,
```

```
                            ...
                            },
                    tdd
                        SEQUENCE {
                            cellParametersID            OMA-LPPe-OTDOA-UTRA-CellParametersID,
                            primaryCCPCH-Tx-Power       INTEGER (-127..128)         OPTIONAL,
                            uarfcn-nt                   ARFCN-ValueUTRA,
                            ...
                            }
        }   OPTIONAL, --Cond AtLeastOne
    antenna-gain                    INTEGER (-127..128)             OPTIONAL,
    beam-width                      INTEGER (1..360)                OPTIONAL,
    transmit-direction              INTEGER (0..360)                OPTIONAL,
    frequency-accuracy              INTEGER (0..100)                OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
AtLeastOne	At least one of the fields with the condition "AtLeastOne" must be present.

***OMA-LPPe-ECID-UTRA-CellData* field descriptions**
cellIdentity This field defines the identity of the cell within the context of the PLMN as defined in [25.331]. The size of the bit string allows for the 32-bit extended UTRAN cell ID; in case the cell ID is shorter, the first bits of the string are set to 0.
primaryCPICH-Scrambling-Code This field provides the scrambling code for the primary CPICH and is applicable to FDD only.
primaryCPICH-Tx-Power This field specifies the transmit power for the primary CPICH in dBm and is applicable to FDD only. This field shall be provided if requested and available.
uarfcn-dl This field provides the downlink UARFCN for FDD and is encoded as defined in [25.101].
cellParametersID This field provides the cell parameter ID (0-127) for TDD as defined in [25.331].
primaryCCPCH-Tx-Power This field provides the transmit power for the primary CCPCH for TDD as defined in [25.331]. This field shall be provided if requsted and available.
uarfcn-nt This field provides the UARFCN for TDD and is encoded as defined in [25.102].
antenna-gain This field specifies the antenna gain in dBi. This field is applicable to a macro or pico cell only and shall be provided if requested and available.
beam-width This field specifies the engineered horizontal width of the antenna beam in degrees. This field is applicable to a macro or pico cell only and shall be provided if requested and available.
transmit-direction This field specifies the direction of the center of the main transmission lobe in degrees clockwise from north (0-359). A value of 360 indicates omnidirectional transmission. This field is applicable to a macro or pico cell only and shall be provided if requested and available.
frequency-accuracy This field specifies the minimum frequency accuracy of the cell in units of 0.005 ppm. A value of zero indicates frequency accuracy is outside the provided range.

6.5.7.3 UTRA ECID Assistance Data Request

– *OMA-LPPe-ECID-UTRA-RequestAssistanceData*

The *OMA-LPPe-ECID-UTRA-RequestAssistanceData* is used to request assistance for UE-based and UE-assisted UTRA

ECID based methods.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-RequestAssistanceData ::= SEQUENCE {
    nBrequestedAD       BIT STRING  {   bslist              (0),
                                        bslocation          (1),
                                        transmit-power      (2),
                                        antenna-gain        (3),
                                        beam-width          (4),
                                        transmit-direction  (5),
                                        frequency-accuracy  (6),
                                        non-serving         (7) } (SIZE(1..16)) OPTIONAL,
    hNBrequestedAD      BIT STRING  {   bslist              (0),
                                        bslocation          (1),
                                        locationreliability (2),
                                        transmit-power      (3),
                                        frequency-accuracy  (4),
                                        coveragearea        (5),
                                        non-serving         (6) } (SIZE(1..16)) OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ECID-UTRA-RequestAssistanceData* field descriptions**
nBrequestedAD
This parameter specifies the UTRA E-CID assistance data requested for node Bs associated with macro and pico cells. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is requested; a zero-value means not requested. If this parameter is absent, no assistance data is requested for macro or pico cells. The following assistance data types are included: bslist: include mandatory Node B and cell information bslocation: include the location of each Node B if available transmit-power: include the transmit power for each cell if available antenna-gain: include the antenna gain for each cell if available beam-width: include the beam width for each cell if available transmit-direction: include the transmit direction for each cell if available frequency-accuracy: include the frequency accuracy for each cell if available non-serving: include information for non-serving UTRA networks in addition to the serving UTRA network (or include information for multiple UTRA networks if the serving network is either unknown or not UTRA)
hNBrequestedAD
This parameter specifies the UTRA E-CID assistance data requested for HNBs associated with femto cells. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is requested; a zero-value means not requested. If this parameter is absent, no assistance data is requested for femto cells. The following assistance data types are included: bslist: include mandatory HNB and cell information bslocation: include the location of each HNB if available locationreliability: include the reliability of HNB location if available transmit-power: include the transmit power for each cell if available frequency-accuracy: include the frequency accuracy for each cell if available coveragearea: include the coverage area for each HNB if available non-serving: include information for non-serving UTRA networks in addition to the serving UTRA network (or include information for multiple UTRA networks if the serving network is either unknown or not UTRA)

6.5.7.4 UTRA ECID Location Information

– *OMA-LPPe-ECID-UTRA-ProvideLocationInformation*

The *OMA-LPPe-ECID-UTRA-ProvideLocationInformation* is used to provide ECID measurements (UE-assisted) for one or more UTRA access networks and at both current and historic times.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-ProvideLocationInformation ::= SEQUENCE {
    ecid-UTRA-CombinedLocationInformation       SEQUENCE (SIZE (1..maxECIDUTRASize))
                                          OF OMA-LPPe-ECID-UTRA-LocationInformationList   OPTIONAL,
    ecid-Error      OMA-LPPe-ECID-UTRA-Error    OPTIONAL,
    ...
}

OMA-LPPe-ECID-UTRA-LocationInformationList ::= SEQUENCE {
    ecid-utra-LocationInformation       OMA-LPPe-ECID-UTRA-LocationInformation,
    relativeTimeStamp                   INTEGER (0..65535)  OPTIONAL,
    servingFlag                         BOOLEAN,
    ...
}

maxECIDUTRASize INTEGER ::= 64

-- ASN1STOP
```

***OMA-LPPe-ECID-UTRA-ProvideLocationInformation* field descriptions**
ecid-UTRA-CombinedLocationInformation
This parameter provides E-CID measurements for one or more UTRA access networks at the current time and/or for historic times. This parameter supports part of the Location ID and Multiple Location IDs parameters in SUPL 2.0.
ecid-Error
This parameter provides error information when not all requested UTRA E-CID measurements can be reported. This parameter should be included when some but not all requested measurements are reported and shall be included when no requested measurements are reported.
relativeTimeStamp
This parameter shall be included for historic UTRA E-CID measurements and provides the time of the historic measurements relative to current time in units of 0.01 seconds. If absent, current time is implied which is equivalent to a relativeTimeStamp of zero. Current time refers to the time when the target sends UTRA E-CID measurements to the server.
servingFlag
This parameter indicates whether a set of E-CID measurements were obtained for a serving UTRA access network (TRUE) or non-serving access network (FALSE). A target device with multiple radio support may indicate more than one type of serving access network for the same time instant.

6.5.7.5 UTRA ECID Location Information Elements

– *OMA-LPPe-ECID-UTRA-LocationInformation*

The IE *OMA-LPPe-ECID-UTRA-LocationInformation* is used by the target device to provide E-CID measurements for a serving or non-serving UTRA network to the server.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-LocationInformation ::= SEQUENCE {
    cellGlobalIdUTRA        CellGlobalIdEUTRA-AndUTRA,
    frequencyInfo           OMA-LPPe-UTRA-FrequencyInfo                     OPTIONAL,
    primaryScramblingCode   OMA-LPPe-OTDOA-UTRA-PrimaryScramblingCode       OPTIONAL,   --Cond FDD
    measuredResultsList     OMA-LPPe-ECID-UTRA-MeasuredResultsList          OPTIONAL,
    cellParametersId        OMA-LPPe-OTDOA-UTRA-CellParametersID            OPTIONAL,   --Cond TDD
    utratimingAdvance       OMA-LPPe-ECID-UTRA-UTRATimingAdvance            OPTIONAL,   --Cond TDD
    ...
}

OMA-LPPe-ECID-UTRA-UTRATimingAdvance ::= SEQUENCE {
    tA                      INTEGER (0..8191),
    tAResolution            OMA-LPPe-ECID-UTRA-TAResolution            OPTIONAL,
    chipRate                OMA-LPPe-ECID-UTRA-ChipRate                OPTIONAL,
    ...
}
```

```
OMA-LPPe-ECID-UTRA-TAResolution ::= ENUMERATED {
    res1-0chip,
    res0-5chip,
    res0-125chip,
    ...
}

OMA-LPPe-ECID-UTRA-ChipRate ::= ENUMERATED {
    tdd128,
    tdd384,
    tdd768,
    ...
}


OMA-LPPe-UTRA-FrequencyInfo ::= SEQUENCE {
    modeSpecificInfo        OMA-LPPe-UTRA-ModeSpecificInfo,
    ...
}

OMA-LPPe-UTRA-ModeSpecificInfo ::= CHOICE {
    fdd         OMA-LPPe-UTRA-FrequencyInfoFDD,
    tdd         OMA-LPPe-UTRA-FrequencyInfoTDD,
    ...
}

OMA-LPPe-UTRA-FrequencyInfoFDD ::= SEQUENCE {
    uarfcn-UL       ARFCN-ValueUTRA     OPTIONAL,
    uarfcn-DL       ARFCN-ValueUTRA,
    ...}

OMA-LPPe-UTRA-FrequencyInfoTDD ::= SEQUENCE {
    uarfcn-Nt       ARFCN-ValueUTRA,
    ...
}

OMA-LPPe-ECID-UTRA-MeasuredResultsList ::= SEQUENCE (SIZE (1..maxFreq)) OF
                                                        OMA-LPPe-ECID-UTRA-MeasuredResults

OMA-LPPe-ECID-UTRA-MeasuredResults ::= SEQUENCE {
    frequencyInfo               OMA-LPPe-UTRA-FrequencyInfo,
    utra-CarrierRSSI            OMA-LPPe-ECID-UTRA-CarrierRSSI                  OPTIONAL,
    cellMeasuredResultsList     OMA-LPPe-ECID-UTRA-CellMeasuredResultsList      OPTIONAL,
    ...
}

OMA-LPPe-ECID-UTRA-CellMeasuredResultsList ::= SEQUENCE (SIZE (1..utra-maxCellMeas)) OF
                                                    OMA-LPPe-ECID-UTRA-CellMeasuredResults

OMA-LPPe-ECID-UTRA-CarrierRSSI ::= INTEGER(0..127)

OMA-LPPe-ECID-UTRA-CellMeasuredResults ::= SEQUENCE {
    cellIdentity        BIT STRING (SIZE (32))      OPTIONAL,
    modeSpecificInfo    CHOICE
    {
        fdd
                SEQUENCE {
                        primaryCPICH-Info   OMA-LPPe-OTDOA-UTRA-PrimaryScramblingCode,
                        cpich-Ec-N0         OMA-LPPe-ECID-UTRA-CPICH-Ec-N0          OPTIONAL,
                        cpich-RSCP          OMA-LPPe-ECID-UTRA-CPICH-RSCP           OPTIONAL,
                        pathloss            OMA-LPPe-ECID-UTRA-Pathloss             OPTIONAL,
                        ...
                },
        tdd
                SEQUENCE {
                        cellParametersID    OMA-LPPe-OTDOA-UTRA-CellParametersID,
                        primaryCCPCH-RSCP   OMA-LPPe-ECID-UTRA-PrimaryCCPCH-RSCP    OPTIONAL,
                        pathloss            OMA-LPPe-ECID-UTRA-Pathloss             OPTIONAL,
                        ...
                }
    },
    ...
```

```
}

OMA-LPPe-ECID-UTRA-PrimaryCCPCH-RSCP ::= INTEGER(0..127)

OMA-LPPe-ECID-UTRA-CPICH-Ec-N0 ::= INTEGER(0..63)

OMA-LPPe-ECID-UTRA-CPICH-RSCP ::= INTEGER(0..127)

OMA-LPPe-ECID-UTRA-Pathloss ::= INTEGER(46..173)

maxFreq INTEGER ::= 8

-- ASN1STOP
```

Conditional presence	Explanation
FDD	The field may optionally be included for FDD. The field shall be omitted for TDD.
TDD	The field may optionally be included for TDD. The field shall be omitted for FDD.

***OMA-LPPe-ECID-UTRA-LocationInformation* field descriptions**
cellGlobalIdUTRA
This field provides the UTRAN global cell ID of the measured cell which is either the serving cell or a cell in a non-serving UTRA network that is treated like a serving cell for the purpose of reporting measurements.
frequencyInfo
For FDD, this parameter provides the downlink and optionally the uplink UARFCN which is encoded as defined in [25.101]. For TDD, this parameter provides the UARFCN which is encoded as defined in [25.102]. This information should be provided if available.
primaryScramblingCode
This field provides the scrambling code for the primary CPICH and is applicable to FDD only. This information should be provided if applicable.
measuredResultsList
This parameter provides the inter-frequency measured results list information as defined in [25.331]. It contains the following information. List of 1 to 8 frequencies with the following optional parameters included for each frequency: frequencyInfo: if missing this is the same as reported for the measured cell in *OMA-LPPe-ECID-UTRA-LocationInformation* utra-CarrierRSSI: UTRA Carrier RSSI level value in the range 0-76 as defined and encoded in [25.133] for FDD and [25.123] for TDD. Values over 76 are spare (not used). cellMeasuredResultsList: measurement results for 1 to 32 other cells

***OMA-LPPe-ECID-UTRA-LocationInformation* field descriptions**

cellMeasuredResultsList

This parameter provides trhe following measurements for one UTRA cell.

Cell identity (28 or 32 bits, first 4 bits set to zero for a 28 bit cell ID)

For FDD the following:

primaryCPICH-Info: scrambling code (0-511) of the primary CPICH

cpich-Ec-N0: encoded value for CPICH_Ec/Io. This is the ratio of the received energy per PN chip for the CPICH to the total received power spectral density at the UE antenna connector. For a UE that is able to simultaneously receive signals from more than 1 carrier, CPICH_Ec/Io is defined for each carrier individually. The encoding is as defined in [25.133]. The value range for this field is 0-63, but values over 49 are not used. This field is optional.

cpich-RSCP: encoded value for the CPICH RSCP. Encoding is based on [25.331] and [25.133] as follows:

cpich-RSCP = 123 CPICH RSCP < -120 dBm

cpich-RSCP = 124 -120 ≤ CPICH RSCP < -119 dBm

cpich-RSCP = 125 -119 ≤ CPICH RSCP < -118 dBm

cpich-RSCP = 126 -118 ≤ CPICH RSCP < -117 dBm

cpich-RSCP = 127 -117 ≤ CPICH RSCP < -116 dBm

cpich-RSCP = 0 -116 ≤ CPICH RSCP < -115 dBm

cpich-RSCP = 1 -115 ≤ CPICH RSCP < -114 dBm

… … …

cpich-RSCP = 89 -27 ≤ CPICH RSCP < -26 dBm

cpich-RSCP = 90 -26 ≤ CPICH RSCP < -25 dBm

cpich-RSCP = 91 -25 ≤ CPICH RSCP dB

Value range of this field is 0-127 with values in the range 92-122 not used. This parameter is optional.

Pathloss: path loss in the range 46-158 dB. Values above 158 are spare. This field is optional.

For TDD the following:

cellParametersID: the cell parameter ID (0-127) as defined in [25.331]

primaryCCPCH-RSCP: encoded value for the primary CCPCH RSCP. Encoding is based on [25.331] and [25.123] as follows:

cpich-RSCP = 123 CPICH RSCP < -120 dBm

cpich-RSCP = 124 -120 ≤ CPICH RSCP < -119 dBm

cpich-RSCP = 125 -119 ≤ CPICH RSCP < -118 dBm

cpich-RSCP = 126 -118 ≤ CPICH RSCP < -117 dBm

cpich-RSCP = 127 -117 ≤ CPICH RSCP < -116 dBm

cpich-RSCP = 0 -116 ≤ CPICH RSCP < -115 dBm

cpich-RSCP = 1 -115 ≤ CPICH RSCP < -114 dBm

… … …

cpich-RSCP = 89 -27 ≤ CPICH RSCP < -26 dBm

cpich-RSCP = 90 -26 ≤ CPICH RSCP < -25 dBm

cpich-RSCP = 91 -25 ≤ CPICH RSCP dB

Value range of this field is 0-127 with values in the range 92-122 not used. This parameter is optional.

pathloss: path loss in the range 46-158 dB. Values above 158 are spare. This field is optional.

OMA-LPPe-ECID-UTRA-LocationInformation field descriptions
cellParametersId
This field provides the cell parameter ID (0-127) as defined in [25.331]. This is optional for TDD and not applicable for FDD.
utraTimingAdvance
This field may only be included for TDD and provides the timing advance used by the UE. This is measured as defined in [25.225] for 1.28Mcps TDD (though applies also to 3.84 and 7.68 Mcps). Encoding uses the following fields: tA: timing advance in the range 0-8191 tAResolution: units for tA res1-0chip: 1.0 chips res0-5chip: 0.5 chips res0-125chip: 0.125 chips (default value if absent) chipRate : chip rate tdd128: 1.28 Mcps (default if absent) tdd384: 3.84 Mcps tdd768: 7.68 Mcps

6.5.7.6 UTRA ECID Location Information Request

– *OMA-LPPe-ECID-UTRA-RequestLocationInformation*

The *OMA-LPPe-ECID-UTRA-RequestLocationInformation* is used to request UTRA ECID measurements (UE-assisted).

```
-- ASN1START

OMA-LPPe-ECID-UTRA-RequestLocationInformation ::= SEQUENCE {
    requestedMeasurements       BIT STRING {    measuredResultsList         (0),
                                                tdd-timingAdvance           (1),
                                                mRL-utra-CarrierRSSI        (2),
                                                mRL-FDD-cpich-Ec-N0         (3),
                                                mRL-FDD-cpich-RSCP          (4),
                                                mRL-FDD-pathloss            (5),
                                                mRL-TDD-primaryCCPCH-RSCP   (6),
                                                mRL-TDD-pathloss            (7),
                                                non-serving                 (8),
                                                historic                    (9) } (SIZE(1..16)),
        ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-UTRA-RequestLocationInformation field descriptions
requestedMeasurements
This field specifies the UTRA E-CID measurements requested. This is represented by a bit string, with a one-value at the bit position means the particular measurement is requested; a zero-value means not requested. The following measurement requests can be included. measuredResultsList: inter-frequency measured results list information as defined in [25.331] tdd-timingAdvance: timing advance for TDD mRL-utra-CarrierRSSI: UTRA Carrier RSSI level in the measured results list mRL-FDD-cpich-Ec-N0: CPICH Ec/Io value for FDD in the measured results list mRL-FDD-cpich-RSCP: CPICH RSCP for FDD in the measured results list mRL-FDD-pathloss: pathloss for FDD in the measured results list mRL-TDD-primaryCCPCH-RSCP: primary CPICH RSCP for TDD in the measured results list mRL-TDD-pathloss: pathloss for TDD in the measured results list non-serving: E-CID measurements for non-serving UTRA networks (in addition to a serving network) historic: historic UTRA E-CID measurements (in addition to current measurements)

6.5.7.7 UTRA ECID Capability Information

– *OMA-LPPe-ECID-UTRA-ProvideCapabilities*

The *OMA-LPPe-ECID-UTRA-ProvideCapabilities* is used to provide the UTRA ECID capabilities of the target.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-ProvideCapabilities ::= SEQUENCE {
    ecid-utra-MeasSupported BIT STRING {    measuredResultsList             (0),
                                            tdd-timingAdvance               (1),
                                            mRL-utra-CarrierRSSI            (2),
                                            mRL-FDD-cpich-Ec-N0             (3),
                                            mRL-FDD-cpich-RSCP              (4),
                                            mRL-FDD-pathloss                (5),
                                            mRL-TDD-primaryCCPCH-RSCP       (6),
                                            mRL-TDD-pathloss                (7),
                                            non-serving                     (8),
                                            historic                        (9) } (SIZE(1..16)),
    ecid-utra-nodeB-ADSupported BIT STRING  { bslist                (0),
                                              bslocation            (1),
                                              transmit-power        (2),
                                              antenna-gain          (3),
                                              beam-width            (4),
                                              transmit-direction    (5),
                                              frequency-accuracy    (6),
                                              non-serving           (7) } (SIZE(1..16)),
    ecid-utra-HNB-ADSupported   BIT STRING  { bslist                (0),
                                              bslocation            (1),
                                              locationreliability   (2),
                                              transmit-power        (3),
                                              frequency-accuracy    (4),
                                              coveragearea          (5),
                                              non-serving           (6) } (SIZE(1..16)),
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ECID-UTRA-ProvideCapabilities* field descriptions**
ecid-utra-MeasSupported
This field specifies the E-CID measurements supported by the target device for UTRA. This is represented by a bit string, with a one-value at the bit position means the particular measurement is supported; a zero-value means not supported. A zero-value in all bit positions in the bit string means only the basic Cell ID positioning method is supported by the target device for UTRA. The following bits are assigned for the indicated measurements. measuredResultsList: inter-frequency measured results list information as defined in [25.331] tdd-timingAdvance: timing advance for TDD mRL-utra-CarrierRSSI: UTRA Carrier RSSI level in the measured results list mRL-FDD-cpich-Ec-N0: CPICH Ec/Io value for FDD in the measured results list mRL-FDD-cpich-RSCP: CPICH RSCP for FDD in the measured results list mRL-FDD-pathloss: pathloss for FDD in the measured results list mRL-TDD-primaryCCPCH-RSCP: primary CPICH RSCP for TDD in the measured results list mRL-TDD-pathloss: pathloss for TDD in the measured results list non-serving: E-CID measurements for non-serving UTRA networks (in addition to a serving network) historic: historic UTRA E-CID measurements

OMA-LPPe-ECID-UTRA-ProvideCapabilities field descriptions
ecid-utra-nodeB-ADSupported This field specifies the E-CID assistance data supported by the target device for UTRA node Bs. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is supported; a zero-value means not supported. A zero-value in all bit positions or absence of this field means no assistance data is supported. The following bits are assigned for the indicated assistance data. bslist: mandatory node B and cell information bslocation: location of each node B transmit-power: transmit power for each cell antenna-gain: antenna gain for each cell beam-width: beam width for each cell transmit-direction: transmit direction for each cell frequency-accuracy: frequency accuracy for each cell non-serving: information for non-serving UTRA networks in addition to the serving UTRA network (or information for multiple UTRA networks if the serving network is not UTRA)
ecid-utra-HNB-ADSupported This field specifies the E-CID assistance data supported by the target device for UTRA HNBs. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is supported; a zero-value means not supported. A zero-value in all bit positions or absence of this field means no assistance data is supported. The following bits are assigned for the indicated assistance data. bslist: mandatory HNB and cell information bslocation: location of each HNB locationreliability: location reliability of each HNB transmit-power: transmit power for each cell frequency-accuracy: frequency accuracy for each cell coveragearea: coverage area for each HNB non-serving: information for non-serving UTRA networks in addition to the serving UTRA network (or information for multiple UTRA networks if the serving network is not UTRA)

6.5.7.8 UTRA ECID Capability Information Request

– *OMA-LPPe-ECID-UTRA-RequestCapabilities*

The *OMA-LPPe-ECID-UTRA-RequestCapabilities* is used to request UTRA ECID capabilities information from the target.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-RequestCapabilities ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.7.9 UTRA ECID Error Element

– *OMA-LPPe-ECID-UTRA-Error*

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

```
-- ASN1START

OMA-LPPe-ECID-UTRA-Error ::= CHOICE {
    locationServerErrorCauses       OMA-LPPe-ECID-UTRA-LocationServerErrorCauses,
    targetDeviceErrorCauses         OMA-LPPe-ECID-UTRA-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-ECID-UTRA-LocationServerErrorCauses*

The IE *OMA-LPPe-ECID-UTRA-LocationServerErrorCauses* is used by the location server to provide UTRA E-CID error

reasons to the target device.

```
-- ASN1START

OMA-LPPe-ECID-UTRA-LocationServerErrorCauses ::= SEQUENCE {
    cause       ENUMERATED  {   undefined,
                                requestedADNotAvailable,
                                notAllrequestedADAvailable,
                                ...
                            },
    nodeBMandatoryDataUnavailable           NULL        OPTIONAL,
    nodeBLocationUnavailable                NULL        OPTIONAL,
    nodeBcellTransmitPowerUnavailable       NULL        OPTIONAL,
    nodeBcallAntennaGainUnavailable         NULL        OPTIONAL,
    nodeBcellBeamWidthUnavailable           NULL        OPTIONAL,
    nodeBcellTransmitDirectionUnavailable   NULL        OPTIONAL,
    nodeBcellFrequencyAccuracyUnavailable   NULL        OPTIONAL,
    nodeBnonservingADUnavailable            NULL        OPTIONAL,
    hNBMandatoryDataUnavailable             NULL        OPTIONAL,
    hNBLocationUnavailable                  NULL        OPTIONAL,
    hNBLocationReliabilityUnavailable       NULL        OPTIONAL,
    hNBcellTransmitPowerUnavailable         NULL        OPTIONAL,
    hNBcellFrequencyAccuracyUnavailable     NULL        OPTIONAL,
    hNBCoverageAreaUnavailable              NULL        OPTIONAL,
    hNBnonservingADUnavailable              NULL        OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ECID-UTRA-LocationServerErrorCauses* field descriptions**
cause
This field provides a UTRA ECID specific error cause for the server applicable to provision of assistance data. If the cause value is '*requestedADNotAvailable*', none of the requested assistance data could be provided and no further information needs to be included. If the cause value is '*notAllRequestedADAvailable*', the server was able to provide some but not all requested UTRA ECID assistance data. In this case, the server should include any of the specific error indications as applicable. Note that inclusion of these fields is applicable when some of the associated information can be provided for some node Bs or HNBs but not for all node Bs and HNBs.

– *OMA-LPPe-ECID-UTRA-TargetDeviceErrorCauses*

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

```
-- ASN1START

OMA-LPPe-ECID-UTRA-TargetDeviceErrorCauses ::= SEQUENCE {
    cause       ENUMERATED {    undefined,
                                requestedMeasurementsNotAvailable,
                                notAllrequestedMeasurementsPossible,
                                ...
                            },
    mRLMeasurementsNotPossible                          NULL        OPTIONAL,
    tdd-timingAdvanceMeasurementNotPossible             NULL        OPTIONAL,
    mRL-utra-CarrierRSSIMeasurementNotPossible          NULL        OPTIONAL,
    mRL-FDD-cpich-Ec-N0MeasurementNotPossible           NULL        OPTIONAL,
    mRL-FDD-cpich-RSCPMeasurementNotPossible            NULL        OPTIONAL,
    mRL-FDD-pathlossMeasurementNotPossible              NULL        OPTIONAL,
    mRL-TDD-primaryCCPCH-RSCPMeasurementNotPossible     NULL        OPTIONAL,
    mRL-TDD-pathlossMeasurementNotPossible              NULL        OPTIONAL,
    non-servingMeasurementsNotAvailable                 NULL        OPTIONAL,
    historicMeasurementsNotAvailable                    NULL        OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-UTRA-TargetDeviceErrorCauses field descriptions
cause
This field provides a UTRA ECID specific error cause. If the cause value is '*requestedMeasurementsNotAvailable*', none of the requested measurements could be provided and no further information needs to be included. If the cause value is '*notAllRequestedMeasurementsPossible*', the target device was able to provide some but not all requested UTRA ECID measurements. In this case, the target device should include any of the other fields as applicable. An error cause shall not be included for omission of TDD measurements for an FDD cell or omission of FDD measurements for a TDD cell since these are not considered to be errors.

6.5.8 WLAN Enhanced Cell ID Positioning

This section defines support for positioning using measurements related to a WLAN AP.

6.5.8.1 WLAN AP Assistance Data

– *OMA-LPPe-WLAN-AP-ProvideAssistanceData*

The *OMA-LPPe-WLAN-AP-ProvideAssistanceData* is used to provide assistance for UE-based and UE-assisted WLAN AP based methods.

```
-- ASN1START

OMA-LPPe-WLAN-AP-ProvideAssistanceData ::= SEQUENCE {
    wlan-DataSet    SEQUENCE (SIZE (1..maxWLANDataSets)) OF OMA-LPPe-WLAN-DataSet   OPTIONAL,
    wlan-AP-Error   OMA-LPPe-WLAN-AP-Error                                         OPTIONAL,
    ...
}

maxWLANDataSets INTEGER ::= 8

-- ASN1STOP
```

6.5.8.2 WLAN AP Assistance Data Elements

– *OMA-LPPe-WLAN-DataSet*

The IE *OMA-LPPe-WLAN-DataSet* is used by the location server to provide WLAN AP information for one set of WLAN APs.

```
-- ASN1START

OMA-LPPe-WLAN-DataSet ::= SEQUENCE {
    plmn-Identity               SEQUENCE {
                                    mcc     SEQUENCE (SIZE (3))     OF INTEGER (0..9),
                                    mnc     SEQUENCE (SIZE (2..3))  OF INTEGER (0..9)
                                    }   OPTIONAL,
    reference-point             OMA-LPPe-ReferencePoint     OPTIONAL,   --Cond APlocations
    supported-channels-11a      Supported-Channels-11a  OPTIONAL,
    supported-channels-11bg     Supported-Channels-11bg OPTIONAL,
    wlan-ap-list                SEQUENCE (SIZE (1..maxWLANAPs)) OF OMA-LPPe-WLAN-AP-Data,
    ...
}

maxWLANAPs  INTEGER ::= 128

Supported-Channels-11a ::= SEQUENCE {
    ch34    BOOLEAN,
    ch36    BOOLEAN,
    ch38    BOOLEAN,
    ch40    BOOLEAN,
    ch42    BOOLEAN,
    ch44    BOOLEAN,
    ch46    BOOLEAN,
    ch48    BOOLEAN,
    ch52    BOOLEAN,
    ch56    BOOLEAN,
    ch60    BOOLEAN,
    ch64    BOOLEAN,
```

```
    ch149   BOOLEAN,
    ch153   BOOLEAN,
    ch157   BOOLEAN,
    ch161   BOOLEAN
}

Supported-Channels-11bg ::= SEQUENCE {
    ch1  BOOLEAN,
    ch2  BOOLEAN,
    ch3  BOOLEAN,
    ch4  BOOLEAN,
    ch5  BOOLEAN,
    ch6  BOOLEAN,
    ch7  BOOLEAN,
    ch8  BOOLEAN,
    ch9  BOOLEAN,
    ch10 BOOLEAN,
    ch11 BOOLEAN,
    ch12 BOOLEAN,
    ch13 BOOLEAN,
    ch14 BOOLEAN
}

-- ASN1STOP
```

Conditional presence	Explanation
APlocations	The field is mandatory when one or more WLAN AP locations are provided for the WLAN AP set and a default reference point is not provided in LPPe common IEs.

***OMA-LPPe-WLAN-DataSet* field descriptions**
plmn-Identity
This field identifies any PLMN operator who manages the WLAN APs via any wide area PLMN owned by the operator and accessible from each of the WLAN APs. PLMN ID is defined in [23.003]. This field is optional.
reference-point
This field specifies a reference location for the locations of the WLAN APs in the data set. If this field is absent, the reference location is provided by the default reference point in LPPe common IEs.
supported-Channels-11a
This parameter defines the superset of all channels supported by all WLAN APs in the data set of type 801.11a. This parameter is optional.
supported-Channels-11bg
This parameter defines the superset of all channels supported by all WLAN APs in the data set of type 801.11b or 802.11g. This parameter is optional.
wlan-ap-list
This parameter provides information for one or more WLAN APs in the data set.

– *OMA-LPPe-WLAN-AP-Data*

The IE *OMA-LPPe-WLAN-AP-Data* is used by the location server to provide information for one WLAN AP as part of WLAN AP assistance data.

```
-- ASN1START

OMA-LPPe-WLAN-AP-Data ::= SEQUENCE {
    wlan-ap-id                      OMA-LPPe-WLAN-AP-ID,
    relative-location               OMA-LPPe-RelativeLocation       OPTIONAL,
    location-reliability            INTEGER (1..100)                OPTIONAL,
    wlan-ap-Type-Data               SEQUENCE (SIZE (1..maxWLANTypes)) OF OMA-LPPe-WLAN-AP-Type-Data,
    coverageArea                    OMA-LPPe-WLANFemtoCoverageArea  OPTIONAL,   --Cond oneonly
    ...
}

maxWLANTypes    INTEGER ::= 5

-- ASN1STOP
```

Conditional presence	Explanation
Oneonly	The field shall be provided when requested and available but shall be provided once only – either in *OMA-LPPe-WLAN-AP*-Data (applicable to all WLAN types) or in *OMA-LPPe-WLAN-AP-Type-Data* (applicable to each distinct WLAN type) but not in both

***OMA-LPPe-WLAN-AP-Data* field descriptions**
relative-location This field provides the location and optional uncertainty in location of the WLAN AP relative to the reference point for this data set. This field shall be provided if requested and available.
location-reliability The field provides the reliability R of the WLAN AP location. The probability that the WLAN AP location has not changed given as a percentage. R may be based on both historic change or persistence of the AP location over a period of time and the time interval since the AP location was last provided to or verified by the server. Note that location reliability is distinct from location accuracy and refers to the possibility of a WLAN AP having been moved to a new location. This field shall be provided if requested and available.
wlan-ap -Type-Data This field provides information for one or more WLAN AP types (e.g. for a multi-band and/or multimode device) sharing a common physical AP.
coverageArea This parameter provides the coverage area of the WLAN AP for each WLAN type supported

– *OMA-LPPe-WLAN-AP-Type-Data*

The IE *OMA-LPPe-WLAN-AP-Type-Data* is used by the location server to provide information for a particular type of WLAN AP.

```
-- ASN1START

OMA-LPPe-WLAN-AP-Type-Data ::= SEQUENCE {
    wlan-AP-Type                    OMA-LPPe-WLAN-AP-Type,
    transmit-power                  INTEGER (-127..128)         OPTIONAL,
    antenna-gain                    INTEGER (-127..128)         OPTIONAL,
    coverageArea                    OMA-LPPe-WLANFemtoCoverageArea  OPTIONAL,   --Cond oneonly
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
Oneonly	The field shall be provided when requested and available but shall be provided once only – either in *OMA-LPPe-WLAN-AP-Data* (applicable to all WLAN types) or in *OMA-LPPe-WLAN-AP-Type-Data* (applicable to each distinct WLAN type) but not in both

***OMA-LPPe-WLAN-AP-Type-Data* field descriptions**
wlan-AP-Type This field provides the type of the WLAN AP.
transmit-power This field specifies the transmit power of the WLAN AP for beacon frames in dBm. This field shall be provided if requested and available.
antenna-gain This field specifies the antenna gain in dBi. This field shall be provided if requested and available.
coverageArea This parameter provides the coverage area of the WLAN AP for a particular WLAN type

6.5.8.3 WLAN AP Assistance Data Request

– *OMA-LPPe-WLAN-AP-RequestAssistanceData*

The *OMA-LPPe-WLAN-AP-RequestAssistanceData* is used to request assistance for UE-based and UE-assisted WLAN AP location methods.

```
-- ASN1START

OMA-LPPe-WLAN-AP-RequestAssistanceData ::= SEQUENCE {
    requestedAD     BIT STRING  {     aplist                (0),
                                      aplocation            (1),
                                      locationreliability   (2),
                                      transmit-power        (3),
                                      antenna-gain          (4),
                                      coveragearea          (5),
                                      non-serving           (6) } (SIZE(1..16)),
    requestedAPTypes    OMA-LPPe-WLAN-AP-Type-List,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-WLAN-AP-RequestAssistanceData* field descriptions**
requestedAD
This parameter specifies the WLAN AP assistance data requested. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is requested; a zero-value means not requested. The following assistance data types are included: aplist: include mandatory WLAN AP information aplocation: include the location of each WLAN AP if available locationreliability: include the reliability of the WLAN AP location if available transmit-power: include the transmit power for each WLAN AP if available antenna-gain: include the antenna gain for each WLAN AP if available coveragearea: include the coverage area for each WLAN AP if available non-serving: include information for WLAN APs belonging to different operators than the serving WLAN AP in addition to WLAN APs belonging to the same operator (or include information for multiple WLAN AP data sets if the serving WLAN AP is not associated with a PLMN operator or if the target device is not served by a WLAN AP)
requestedAPTypes
This parameter lists the WLAN AP types for which assistance data is requested.

6.5.8.4 WLAN AP Location Information

– *OMA-LPPe-WLAN-AP-ProvideLocationInformation*

The *OMA-LPPe-WLAN-AP-ProvideLocationInformation* is used to provide measurements (UE-assisted) for one or more WLAN APs and at both current and historic times.

```
-- ASN1START

OMA-LPPe-WLAN-AP-ProvideLocationInformation ::= SEQUENCE {
    wlan-AP-CombinedLocationInformation SEQUENCE (SIZE (1..maxWLANAPSize)) OF
                                            OMA-LPPe-WLAN-AP-LocationInformationList    OPTIONAL,
    wlan-AP-Error                       OMA-LPPe-WLAN-AP-Error                          OPTIONAL,
    ...
}

OMA-LPPe-WLAN-AP-LocationInformationList ::= SEQUENCE {
    wlan-AP-LocationInformation         OMA-LPPe-WLAN-AP-LocationInformation,
    relativeTimeStamp                   INTEGER (0..65535)  OPTIONAL,
    servingFlag                         BOOLEAN,
    ...
}

maxWLANAPSize   INTEGER ::= 64
```

```
-- ASN1STOP
```

***OMA-LPPe-WLAN-AP-ProvideLocationInformation* field descriptions**
wlan-AP-CombinedLocationInformation
This parameter provides measurements for one or more WLAN APs at the current time and/or for historic times. This parameter supports part of the Location ID and Multiple Location IDs parameters in SUPL 2.0.
wlan-AP-Error
This parameter provides error information when not all requested WLAN AP measurements can be reported. This parameter should be included when some but not all requested measurements are reported and shall be included when no requested measurements are reported.
relativeTimeStamp
This parameter shall be included for historic WLAN AP measurements and provides the time of the historic measurements relative to current time in units of 0.01 seconds. If absent, current time is implied which is equivalent to a relativeTimeStamp of zero. Current time refers to the time when the target sends WLAN AP measurements to the server.
servingFlag
This parameter indicates whether a set of WLAN AP measurements were obtained for a serving WLAN AP (TRUE) or a non-serving WLAN AP (FALSE). A target device with multiple radio support may indicate more than one type of serving access for the same time instant.

6.5.8.5 WLAN AP Location Information Elements

– *OMA-LPPe-WLAN-AP-LocationInformation*

The IE *OMA-LPPe-WLAN-AP-LocationInformation* is used by the target device to provide measurements to the server for a serving or non-serving WLAN AP. Measurements are based on those defined in [IEEE 802.11].

```
-- ASN1START

OMA-LPPe-WLAN-AP-LocationInformation ::= SEQUENCE {
    apMACAddress            OMA-LPPe-WLAN-AP-ID,
    apSSID                  OCTET STRING (SIZE (1..32))     OPTIONAL,
    apSignaltoNoise         INTEGER(-127..128)              OPTIONAL,
    apDeviceType            OMA-LPPe-WLAN-AP-Type           OPTIONAL,
    apPHYtype               OMA-LPPe-WLAN-AP-PHY-Type       OPTIONAL,
    apSignalStrength        INTEGER(-127..128)              OPTIONAL,
    apChannelFrequency      INTEGER(0..256)                 OPTIONAL,
    apRoundTripDelay        OMA-LPPe-WLAN-RTD               OPTIONAL,
    ueTransmitPower         INTEGER(-127..128)              OPTIONAL,
    ueAntennaGain           INTEGER (-127..128)             OPTIONAL,
    apReportedLocation      OMA-LPPe-WLAN-ReportedLocation  OPTIONAL,
    ...,
    apTransmitPower         INTEGER (-127..128) OPTIONAL,
    apAntennaGain           INTEGER (-127..128) OPTIONAL,
    ueSignaltoNoise         INTEGER (-127..128) OPTIONAL,
    ueSignalStrength        INTEGER (-127..128) OPTIONAL,
    apSignalStrengthDelta   INTEGER (0..1) OPTIONAL, -- Cond APSSDelta
    ueSignalStrengthDelta   INTEGER (0..1) OPTIONAL, -- Cond UESSDelta
    apSignaltoNoiseDelta    INTEGER (0..1) OPTIONAL, -- Cond APSNDelta
    ueSignaltoNoiseDelta    INTEGER (0..1) OPTIONAL, -- Cond UESNDelta
    operatingClass          INTEGER (0..255) OPTIONAL,
    ueMacAddress                BIT STRING (SIZE (48)) OPTIONAL
}

OMA-LPPe-WLAN-AP-PHY-Type ::= ENUMERATED {  unknown, any, fhss, dsss, irbaseband, ofdm, hrdsss, erp,
                                            ht, ihv, ... }

OMA-LPPe-WLAN-RTD ::= SEQUENCE {
    rTDValue     INTEGER(0..16777215),
    rTDUnits     OMA-LPPe-WLAN-RTDUnits,
    rTDAccuracy  INTEGER(0..255)        OPTIONAL,
    ...
}
```

```
OMA-LPPe-WLAN-RTDUnits ::= ENUMERATED {
    microseconds,
    hundredsofnanoseconds,
    tensofnanoseconds,
    nanoseconds,
    tenthsofnanoseconds,
    ...
}

OMA-LPPe-WLAN-ReportedLocation ::= SEQUENCE {

    locationDataLCI                OMA-LPPe-WLAN-LocationDataLCI          OPTIONAL,
    ...
}


OMA-LPPe-WLAN-LocationDataLCI ::= SEQUENCE {
    latitudeResolution      BIT STRING (SIZE (6)),
    latitude                BIT STRING (SIZE (34)),
    longitudeResolution     BIT STRING (SIZE (6)),
    longitude               BIT STRING (SIZE (34)),
    altitudeType            BIT STRING (SIZE (4)),
    altitudeResolution      BIT STRING (SIZE (6)),
    altitude                BIT STRING (SIZE (30)),
    datum                   BIT STRING (SIZE (8)),
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
APSSDelta	This parameter is conditional and may be used if the apSignalStrength IE is used. Otherwise this parameter must not be used.
UESSDelta	This parameter is conditional and may be used if the ueSignalStrength IE is used. Otherwise this parameter must not be used.
APSNDelta	This parameter is conditional and may be used if the apSignaltoNoiseIE is used. Otherwise this parameter must not be used.
UESNDelta	This parameter is conditional and may be used if the ueSignaltoNoise IE is used. Otherwise this parameter must not be used.

***OMA-LPPe-WLAN-AP-LocationInformation* field descriptions**
apMACAddress
This field provides the 48 bit MAC address of the reported WLAN AP (which is identical to the BSSID of the AP).
apSSID
This field provides the SSID of the wireless network served by the AP.
apSignaltoNoise
This field provides the AP signal to noise ratio of a beacon, probe response or measurement pilot frame in dB as measured at the target.
apDeviceType
This field provides the AP device type – 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac or 802.11ad. The AP device type refers to the device type being used for signalling as opposed to the capability of the AP (for instance an 802.11n capable AP in e.g., 802.11a signalling mode).

OMA-LPPe-WLAN-AP-LocationInformation **field descriptions**
apPHYtype
This field provides the IEEE 802.11 PHY and media type. The enumerated values are as follows: *unknown* specifies an unknown or uninitialized PHY type. *any* specifies any PHY type. *fhss* specifies a frequency-hopping spread-spectrum (FHSS) PHY. *dsss* specifies a direct sequence spread spectrum (DSSS) PHY type. *irbaseband* specifies an infrared (IR) baseband PHY type. *ofdm* specifies an orthogonal frequency division multiplexing (OFDM) PHY type. *hrdsss* specifies a high-rate DSSS (HRDSSS) PHY type. *erp* specifies an extended rate PHY type (ERP). *ht* specifies the 802.11n PHY type. *ihv* specifies a PHY type that is developed by an independent hardware vendor (IHV).
apSignalStrength
This field provides the AP signal strength (RSSI) of a beacon frame, probe response frame or measurement pilot frame measured at the target in dBm on the channel indicated by *apChannelFrequency* field.
apChannelFrequency
This field provides the AP channel number identification of the reported WLAN AP.
apRoundTripDelay
This field provides the measured round trip delay between the target and WLAN AP and optionally the accuracy expressed as the standard deviation of the delay. Units for each of these are 1000ns, 100ns, 10ns, 1ns or 0.1ns.
ueTransmitPower
This field provides the transmit power used by the target to access the WLAN AP in dBm
.***ueAntennaGain***
This field provides the antenna gain of the target in dBi for transmission to the WLAN AP
apReportedLocation
This field provides the location of the WLAN AP,

***OMA-LPPe-WLAN-AP-LocationInformation* field descriptions**
locationDataLCI
This field provides the reported location of the AP in form of the Location Configuration Information (LCI) defined in [IEEE 802.11][RFC 3825] and includes the following subfields: *latitudeResolution*: 6-bits indicating the number of valid bits in the fixed-point value of *latitude*. (This value is the number of high-order Latitude bits that should be considered valid. Any bits entered to the right of this limit should not be considered valid. Values above decimal 34 are undefined and reserved.) *latitude*: A 34-bits fixed point value consisting of 9-bits of integer and 25-bits of fraction indicating the Latitude (+/- 90 degrees) of the AP. *longitudeResolution*: 6-bits indicating the number of valid bits in the fixed-point value of *longitude*. (This value is the number of high-order Longitude bits that should be considered valid. Any bits entered to the right of this limit should not be considered valid. Values above decimal 34 are undefined and reserved.) *longitude*: A 34-bits fixed point value consisting of 9-bits of integer and 25-bits of fraction indicating the Longitude (+/- 180 degrees) of the AP. *altitudeType*: Defines the altitude type. Codes defined are: 1: Meters of altitude. 2: Building floors of altitude. *altitude* value 0.0 represents the floor level associated with ground level. *altitudeResolution*: 6-bits indicating the number of valid bits in the *altitude*. (This value is the number of high-order Altitude bits that should be considered valid. Any bits entered to the right of this limit should not be considered valid. Values above decimal 30 are undefined and reserved.) *altitude*: A 30-bit fixed point value consiting of 22-bits of integer and 8-bits of fraction indicating the Altitude of the AP in units defined by *altitudeType*. *datum*: Defines the map datum used for the coordinates. Codes defined are: 1: World Geodetic System 1984 (WGS-84) 2: North American Datum 1983 (NAD-83) with North American Vertical Datum 1988 (NAVD-88) 3: North American Datum 1983 (NAD-83) with Mean Lower Low Water (MLLW) vertical datum.
apTransmitPower
This field provides the power the AP transmits on a beacon, probe response or measurement pilot frame in dBm.
apAntennaGain
This field provides the antenna gain of the AP in dBi
ueSignaltoNoise
This field provides the target's signal to noise ratio measured at the AP in dB.
ueSignalStrength
This field provides the target's signal strength (RSSI) measured at the AP on the channel indicated by the *apChannelFrequency* field in dBm.
apSignalStrengthDelta
This parameter is used when the AP's signal strength (measured at the target) resolution is 0.5 dB (as opposed to 1.0 dB when this parameter is not used). Range: INTEGER (0..1), Units: 0.5 dB The AP signal strength is then: (*apSignalStrength* + *apSignalStrengthDelta*).
ueSignalStrengthDelta
This parameter is used when the target's signal strength (measured at the AP) resolution is 0.5 dB (as opposed to 1.0 dB when this parameter is not used). Range: INTEGER (0..1), Units: 0.5 dB The target signal strength is then: (*ueSignalStrength* + *ueSignalStrengthDelta*).

OMA-LPPe-WLAN-AP-LocationInformation field descriptions
apSignaltoNoiseDelta
This parameter is used when the AP's signal to noise ratio (measured at the target) resolution is 0.5 dB (as opposed to 1.0 dB when this parameter is not used). Range: INTEGER (0..1), Units: 0.5 dB
The AP signal to noise ratio is then: (*apSignaltoNoise* + *apSignaltoNoiseDelta*).
ueSignaltoNoiseDelta
This parameter is used when the target's signal to noise ratio (measured at the AP) resolution is 0.5 dB (as opposed to 1.0 dB when this parameter is not used). Range: INTEGER (0..1), Units: 0.5 dB
The target signal to noise ratio is then: (*ueSignaltoNoise* + *ueSignaltoNoiseDelta*).
operatingClass
This parameter defines the Operating Class as defined in [IEEE 802.11].
ueMacAddress
This parameter defines the target's MAC address.

6.5.8.6 WLAN AP Location Information Request

– *OMA-LPPe-WLAN-AP-RequestLocationInformation*

The IE *OMA-LPPe-WLAN-AP-RequestLocationInformation* is used to request WLAN AP measurements (UE-assisted).

```
-- ASN1START

OMA-LPPe-WLAN-AP-RequestLocationInformation ::= SEQUENCE {
    requestedMeasurements   BIT STRING {
                                          apSSID      (0),
                                          apSN        (1),
                                          apDevType   (2),
                                          apPhyType   (3),
                                          apRSSI      (4),
                                          apChanFreq  (5),
                                          apRTD       (6),
                                          ueTP        (7),
                                          ueAG        (8),
                                          apRepLoc    (9),
                                          non-serving (10),
                                          historic    (11),
                                          apTP        (12),
                                          apAG        (13),
                                          ueSN        (14),
                                          ueRSSI      (15)} (SIZE(1..16)),
    ... ,
    additionalRequestedMeasurements BIT STRING {
                                          oc          (0),
                                          ueMacAddr   (1)} (SIZE(1..16)) OPTIONAL
}

-- ASN1STOP
```

OMA-LPPe-WLAN-AP-RequestLocationInformation field descriptions
requestedMeasurements This field specifies the WLAN AP measurements requested. This is represented by a bit string, with a one-value at the bit position means the particular measurement is requested; a zero-value means not requested. The following measurement requests can be included. apSSID: SSID of the WLAN apSN: AP S/N received at the target apDevType: AP Device type apPhyType: AP PHY type apRSSI: AP signal strength at the target apChanFreq: AP channel/frequency of Tx/Rx apRTD: Round Trip Delay between target and AP ueTP: target transmit power ueAG: target antenna gain apRepLoc: AP Location as reported by AP non-serving: measurements for non-serving WLAN APs (in addition to a serving WLAN AP) historic: historic WLAN AP measurements (in addition to current measurements) apTP: AP transmit power apAG: AP antenna gain ueSN: UE S/N received at the AP ueRSSI: target signal strength at the AP
additionalRequestedMeasurements This field specifies additional WLAN AP measurements that are requested. This is represented by a bit string, with a one-value at the bit position means the particular measurement is requested; a zero-value means not requested. The following measurement requests can be included. oc: operating class ueMacAddr: UE MAC address

6.5.8.7 WLAN AP Capability Information

– *OMA-LPPe-WLAN-AP-ProvideCapabilities*

The IE *OMA-LPPe-WLAN-AP-ProvideCapabilities* is used by the target to provide its capabilities for WLAN AP positioning to the server.

```
-- ASN1START

OMA-LPPe-WLAN-AP-ProvideCapabilities ::= SEQUENCE {
    wlan-ecid-MeasSupported BIT STRING  {
                                        apSSID      (0),
                                        apSN        (1),
                                        apDevType   (2),
                                        apPhyType   (3),
                                        apRSSI      (4),
                                        apChanFreq  (5),
                                        apRTD       (6),
                                        ueTP        (7),
                                        ueAG        (8),
                                        apRepLoc    (9),
                                        non-serving (10),
                                        historic    (11),
                                        apTP        (12),
                                        apAG        (13),
                                        ueSN        (14),
                                        ueRSSI      (15)}   (SIZE(1..16)),
    wlan-types-Supported        OMA-LPPe-WLAN-AP-Type-List      OPTIONAL,
    ap-Capability               OMA-LPPe-WLAN-AP-Capability     OPTIONAL,
    wlan-ap-ADSupported BIT STRING  {aplist                 (0),
                                     aplocation             (1),
                                     locationreliability    (2),
                                     transmit-power         (3),
                                     antenna-gain           (4),
                                     coveragearea           (5),
                                     non-serving            (6) } (SIZE(1..16)),
    ...,
```

```
    additional-wlan-ecid-MeasSupported  BIT STRING {
                                            oc          (0),
                                            ueMacAddr   (1)} (SIZE(1..16)) OPTIONAL

}

OMA-LPPe-WLAN-AP-Capability ::= SEQUENCE {
    apMACAddress            OMA-LPPe-WLAN-AP-ID,
    apTypes                 OMA-LPPe-WLAN-AP-Type-List,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-WLAN-AP-ProvideCapabilities* field descriptions**
wlan-ecid-MeasSupported This field specifies the E-CID measurements supported by the target device when accessing a WLAN AP. This is represented by a bit string, with a one-value at the bit position means the particular measurement is supported; a zero-value means not supported. A zero-value in all bit positions in the bit string means only the basic WLAN positioning method is supported by the target device which is reporting of the WLAN AP identity. The following bits are assigned for the indicated measurements. apSSID: SSID of the WLAN apSN: AP S/N received at the target apDevType: AP Device type apPhyType: AP PHY type apRSSI: AP signal strength at the target apChanFreq: AP channel/frequency of Tx/Rx apRTD: Round Trip Delay between target and AP ueTP: target transmit power ueAG: target antenna gain apRepLoc: AP Location as reported by AP non-serving: measurements for a non-serving WLAN AP (in addition to a serving WLAN AP) historic: historic WLAN AP measurements apTP: AP transmit power apAG: AP antenna gain ueSN: UE S/N received at the AP ueRSSI: target signal strength at the AP
wlan-types-Supported This field provides the WLAN AP types supported by the target device when functioning as a WLAN station. This is represented by a bit string, with a one-value at the bit position means the particular WLAN type is supported; a zero-value means not supported. This field shall be provided if the supported WLAN AP types are available.
ap-Capability This parameter if present indicates that the target can function as a WLAN AP (e.g. as a mobile broadband router). The parameter provides the MAC address of the target and the WLAN types supported when functioning as an AP.
wlan-ap-ADSupported This field specifies the WLAN AP assistance data supported by the target device. This is represented by a bit string, with a one-value at the bit position means the particular assistance data is supported; a zero-value means not supported. A zero-value in all bit positions or absence of this field means no assistance data is supported. The following bits are assigned for the indicated assistance data. aplist: mandatory WLAN AP data aplocation: location of each WLAN AP locationreliability: reliability of WLAN AP location transmit-power: transmit power for each WLAN AP antenna-gain: antenna gain for each WLAN AP coveragearea: coverage area for each WLAN AP non-serving: information for WLAN APs belonging to a different operator than the serving WLAN AP (or information for multiple WLAN AP data sets if the serving WLAN AP is not associated with a PLMN operator or if the target device is not served by a WLAN AP)

OMA-LPPe-WLAN-AP-ProvideCapabilities field descriptions
additional-wlan-ecid-MeasSupported This field specifies the additional E-CID measurements supported by the target device when accessing a WLAN AP. This is represented by a bit string, with a one-value at the bit position means the particular measurement is supported; a zero-value means not supported. A zero-value in all bit positions in the bit string means only the basic WLAN positioning method is supported by the target device which is reporting of the WLAN AP identity. The following bits are assigned for the indicated measurements. oc: operating class ueMacAddr: UE MAC address

6.5.8.8 WLAN AP Capability Information Request

– *OMA-LPPe-WLAN-AP-RequestCapabilities*

The IE *OMA-LPPe-WLAN-AP-RequestCapabilities* is used to request WLAN AP positioning capabilities information from the target.

```
-- ASN1START

OMA-LPPe-WLAN-AP-RequestCapabilities ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.8.9 WLAN AP Error Element

– *OMA-LPPe-WLAN-AP-Error*

The IE *OMA-LPPe-WLAN-AP-Error* is used by the location server or target device to provide error reasons for WLAN AP positioning to the target device or location server, respectively.

```
-- ASN1START

OMA-LPPe-WLAN-AP-Error ::= CHOICE {
    locationServerErrorCauses       OMA-LPPe-WLAN-AP-LocationServerErrorCauses,
    targetDeviceErrorCauses         OMA-LPPe-WLAN-AP-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

– *WLAN-AP-LocationServerErrorCauses*

The IE *WLAN-AP-LocationServerErrorCauses* is used by the location server to provide error reasons for WLAN AP positioning to the target device.

```
-- ASN1START

OMA-LPPe-WLAN-AP-LocationServerErrorCauses ::= SEQUENCE {
    cause                               ENUMERATED  {undefined,
                                                     requestedADNotAvailable,
                                                     notAllrequestedADAvailable,
                                                     ...
                                                     },
    apMandatoryDataUnavailable          NULL        OPTIONAL,
    apLocationsUnavailable              NULL        OPTIONAL,
    apLocationReliabilityUnavailable    NULL        OPTIONAL,
    apTransmitPowerUnavailable          NULL        OPTIONAL,
    apAntennaGainUnavailable            NULL        OPTIONAL,
    apCoverageAreaUnavailable           NULL        OPTIONAL,
    nonservingADUnavailable             NULL        OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-WLAN-AP-LocationServerErrorCauses* field descriptions**
cause
This field provides a WLAN AP specific error cause for the server applicable to provision of assistance data. If the cause value is '*requestedADNotAvailable*', none of the requested assistance data could be provided and no further information needs to be included. If the cause value is '*notAllRequestedADAvailable*', the server was able to provide some but not all requested WLAN AP assistance data. In this case, the server should include any of the specific error indications as applicable. Note that inclusion of these fields is applicable when some of the associated information can be provided for some WLAN APs but not for all WLAN APs.

– *WLAN-AP-TargetDeviceErrorCauses*

The IE *WLAN-AP-TargetDeviceErrorCauses* is used by the target device to provide error reasons for WLAN AP positioning to the location server.

```
-- ASN1START

OMA-LPPe-WLAN-AP-TargetDeviceErrorCauses ::= SEQUENCE {
    cause                                   ENUMERATED {undefined,
                                                        requestedMeasurementsNotAvailable,
                                                        notAllrequestedMeasurementsPossible,
                                                        ...
                                                        },
    apSSIDnotAvailable                  NULL        OPTIONAL,
    apSNMeasurementNotPossible          NULL        OPTIONAL,
    apDevTypeNotAvailable               NULL        OPTIONAL,
    apPhyTypeNotAvailable               NULL        OPTIONAL,
    apRSSIMeasurementNotPossible            NULL        OPTIONAL,
    apChanFreqNotAvailable              NULL        OPTIONAL,
    apRTDMeasurementNotPossible         NULL        OPTIONAL,
    ueTPNotAvailable                        NULL        OPTIONAL,
    ueAGNotAvailable                        NULL        OPTIONAL,
    apRecLocNotAvailable                    NULL        OPTIONAL,
    non-servingMeasurementsNotAvailable NULL        OPTIONAL,
    historicMeasurementsNotAvailable        NULL        OPTIONAL,
    ...,
    apTPNotAvailable                        NULL        OPTIONAL,
    apAGNotAvailable                        NULL        OPTIONAL,
    ueSNNotAvailable                        NULL        OPTIONAL,
    ueRSSINotAvailable                  NULL        OPTIONAL,
    ocNotAvailable                      NULL        OPTIONAL,
    ueMACAddressNotAvailable                NULL        OPTIONAL
}

-- ASN1STOP
```

OMA-LPPe-WLAN-AP-TargetDeviceErrorCauses field descriptions
cause
This field provides a WLAN AP specific error cause. If the cause value is '*requestedMeasurementsNotAvailable*', none of the requested measurements could be provided and no further information needs to be included. If the cause value is '*notAllRequestedMeasurementsPossible*', the target device was able to provide some but not all requested WLAN AP measurements. In this case, the target device should indicate those measurements that could not be obtained.

6.5.9 WiMax Enhanced Cell ID Positioning

This section defines support for WiMax ECID.

6.5.9.1 WiMax ECID Location Information

– *OMA-LPPe-ECID-WiMax-ProvideLocationInformation*

The *OMA-LPPe-ECID-WiMax-ProvideLocationInformation* is used to provide ECID measurements (UE-assisted) for one or more WiMax access networks and at both current and historic times.

```
-- ASN1START

OMA-LPPe-ECID-WiMax-ProvideLocationInformation ::= SEQUENCE {
    ecid-wimax-CombinedLocationInformation  SEQUENCE (SIZE (1..maxWiMaxECIDSize)) OF
                                            OMA-LPPe-ECID-WiMax-LocationInformationList OPTIONAL,
    ecid-wimax-Error                        OMA-LPPe-ECID-WiMax-Error                   OPTIONAL,
    ...
}

OMA-LPPe-ECID-WiMax-LocationInformationList ::= SEQUENCE {
    ecid-wimax-LocationInformation      OMA-LPPe-ECID-WiMax-LocationInformation,
    relativeTimeStamp                   INTEGER (0..65535)  OPTIONAL,
    servingFlag                         BOOLEAN,
    ...
}

maxWiMaxECIDSize    INTEGER ::= 1264

-- ASN1STOP
```

OMA-LPPe-ECID-WiMax-ProvideLocationInformation field descriptions
ecid-wimax-CombinedLocationInformation
This parameter provides E-CID measurements for one or more WiMax networks at the current time and/or for historic times. This parameter supports part of the Location ID and Multiple Location IDs parameters in SUPL 2.0.
ecid-wimax-Error
This parameter provides error information when not all requested WiMax E-CID measurements can be reported. This parameter should be included when some but not all requested measurements are reported and shall be included when no requested measurements are reported.
relativeTimeStamp
This parameter shall be included for historic WiMax E-CID measurements and provides the time of the historic measurements relative to current time in units of 0.01 seconds. If absent, current time is implied which is equivalent to a relativeTimeStamp of zero. Current time refers to the time when the target sends WiMax E-CID measurements to the server.
servingFlag
This parameter indicates whether a set of E-CID measurements were obtained for a serving WiMax access network (TRUE) or a non-serving WiMax access network (FALSE). A target device with multiple radio support may indicate more than one type of serving access network for the same time instant.

6.5.9.2 WiMax ECID Location Information Elements

– *OMA-LPPe-ECID-WiMax-LocationInformation*

The IE *OMA-LPPe-ECID-WiMax-LocationInformation* is used by the target device to provide E-CID measurements for a serving or non-serving WiMax network to the server.

```
-- ASN1START


OMA-LPPe-ECID-WiMax-LocationInformation ::= SEQUENCE {
    wimaxBsID       OMA-LPPe-ECID-WiMax-WimaxBsID,
    wimaxRTD        OMA-LPPe-ECID-WiMax-WimaxRTD        OPTIONAL,
    wimaxNMRList    OMA-LPPe-ECID-WiMax-WimaxNMRList    OPTIONAL,
    ...
}

OMA-LPPe-ECID-WiMax-WimaxBsID ::= SEQUENCE {
    bsID-MSB        BIT STRING (SIZE(24))       OPTIONAL,
    bsID-LSB        BIT STRING (SIZE(24)),
    ...
}

OMA-LPPe-ECID-WiMax-WimaxRTD ::= SEQUENCE {
    rTD             INTEGER (0..65535),
    rTDstd          INTEGER (0..1023)       OPTIONAL,
    ...
}

OMA-LPPe-ECID-WiMax-WimaxNMRList ::= SEQUENCE  (SIZE (1..maxWimaxBSMeas)) OF
                                                                    OMA-LPPe-ECID-WiMax-WimaxNMR

OMA-LPPe-ECID-WiMax-WimaxNMR ::= SEQUENCE {
    wimaxBsID       OMA-LPPe-ECID-WiMax-WimaxBsID,
    relDelay        INTEGER (-32768..32767)             OPTIONAL,
    relDelaystd     INTEGER (0..1023)                   OPTIONAL,
    rSSI            INTEGER (0..255)                    OPTIONAL,
    rSSIstd         INTEGER (0..63)                     OPTIONAL,
    bSTxPower       INTEGER (0..255)                    OPTIONAL,
    cINR            INTEGER (0..255)                    OPTIONAL,
    cINRstd         INTEGER (0..63)                     OPTIONAL,
    bSLocation      OMA-LPPe-WLAN-ReportedLocation      OPTIONAL,
    ...
}

maxWimaxBSMeas INTEGER ::= 32

-- ASN1STOP
```

***OMA-LPPe-ECID-WiMax-LocationInformation* field descriptions**
wimaxBsID
This field provides the identifier for the primary WiMax base station for which measurements are being reported. The ID contains 48 bits. The least significant 24 bits (bsID-LSB) are provided and optionally the most significant 24 bits (bsID-MSB). If not provided, bsID-MSB is assumed to be identical to that for the current serving BS or camped on network value.
wimaxRTD
This field provides the Round Trip Delay (rTD) between the target device and the WiMax BS in units of 10 ns and with a range of 0 -65535. The field also optionally includes the Standard deviation of the Round Trip Delay measurement (rTDstd) in units of 10 ns and with a range of 0-1023.

OMA-LPPe-ECID-WiMax-LocationInformation field descriptions
wimaxNMRList
This field provides a network measurement report for up to 32 other neighbour WiMax base stations. For each neighbour base station, the following parameters can be included: wimaxBsID: base station ID encoded as for wimaxBsID above. This parameter is mandatory. relDelay: Relative Delay as measured by the target device between the neighboring BS and the primary BS in units of 10 ns. This measurement is not applicable for the primary BS. The range is -32768 to 32767. This parameter is optional. relDelaystd: Standard deviation of the Relative delay in units of 10 ns, range 0-1023. This parameter is optional. rSSI: received signal strength of the neighbour BS at the target device in dBm. This is expressed in steps of 0.25 dBm, starting from -103.75 dBm. Encoded range is 0 -255. This parameter is optional. rSSIstd: standard deviation of BS signal strength received at the target device in dB. Range is 0-63. bSTxPower: the equivalent isotropic transmit power of the neighbour BS in steps of 0.25 dBm and starting from -103.75 dBm. Encoded range is 0-255. This parameter is optional. cINR: Carrier to Noise and Interference Ratio in dB of the neighbour BS as received at the target device. Range is 0-255. This parameter is optional. cINRstd: standard deviation in dB of the BS Carrier to Noise and Interference Ratio as received at the target device. Range is 0-63. bSLocation: Location of the neighbour BS as reported by the neighbour BS. This is optional and contains the following fields. locationEncodingDescriptor: either LCI as in [RFC3825] or ASN.1 as in [X.694] locationData: location value in the format defined in locationEncodingDescriptor and optional location accuracy in units of 0.1 meters.

6.5.9.3 WiMax ECID Location Information Request

– *OMA-LPPe-ECID-WiMax-RequestLocationInformation*

The *OMA-LPPe-ECID-WiMax-RequestLocationInformation* is used to request WiMax ECID measurements (UE-assisted).

```
-- ASN1START

OMA-LPPe-ECID-WiMax-RequestLocationInformation ::= SEQUENCE {
    requestedMeasurements   BIT STRING {    rTD             (0),
                                            rTDstd          (1),
                                            nMR             (2),
                                            nMRrelDelay     (3),
                                            nMRrelDelaystd  (4),
                                            nMRrSSI         (5),
                                            nMRrSSIstd      (6),
                                            nMRbSTxPower    (7),
                                            nMRcINR         (8),
                                            nMRcINRstd      (9),
                                            nMRbSLocation   (10),
                                            non-serving     (11),
                                            historic        (12) } (SIZE(1..16)),
        ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-WiMax-RequestLocationInformation field descriptions
requestedMeasurements This field specifies the WiMax E-CID measurements requested. This is represented by a bit string, with a one-value at the bit position means the particular measurement is requested; a zero-value means not requested. The following measurement requests can be included. rTD; round trip delay to a primary (e.g. serving) BS rTDstd: standard deviation of round trip delay nMR: network measurement report for neighbouring BSs nMRrelDelay: Relative Delay between the neighboring BS and the primary BS nMRrelDelaystd: Standard deviation of the Relative delay nMRrSSI: received signal strength of the neighbour BS nMRrSSIstd: standard deviation of BS signal strength nMRbSTxPower: transmit power of the neighbour BS nMRcINR: Carrier to Noise and Interference Ratio of the neighbour BS nMRcINRstd: standard deviation of the BS Carrier to Noise and Interference Ratio bSLocation: Location of the neighbour BS as reported by the neighbour BS non-serving: E-CID measurements for non-serving WiMax base stations (in addition to a serving base station) historic: historic WiMax E-CID measurements (in addition to current measurements)

6.5.9.4 WiMax ECID Capability Information

– *OMA-LPPe-ECID-WiMax-ProvideCapabilities*

The *OMA-LPPe-ECID-WiMax-ProvideCapabilities* is used by the target to provide its WiMax ECID capabilities to the server.

```
-- ASN1START

OMA-LPPe-ECID-WiMax-ProvideCapabilities ::= SEQUENCE {
    ecid-wimax-MeasSupported    BIT STRING {    rTD             (0),
                                                rTDstd          (1),
                                                nMR             (2),
                                                nMRrelDelay     (3),
                                                nMRrelDelaystd  (4),
                                                nMRrSSI         (5),
                                                nMRrSSIstd      (6),
                                                nMRbSTxPower    (7),
                                                nMRcINR         (8),
                                                nMRcINRstd      (9),
                                                nMRbSLocation   (10),
                                                non-serving     (11),
                                                historic        (12) } (SIZE(1..16)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-ECID-WiMax-ProvideCapabilities field descriptions
ecid-wimax- MeasSupported
This field specifies the E-CID measurements supported by the target device for WiMax. This is represented by a bit string, with a one-value at the bit position means the particular measurement is supported; a zero-value means not supported. A zero-value in all bit positions in the bit string means only the basic Cell ID positioning method is supported by the target device for WiMax. The following bits are assigned for the indicated measurements. rTD; round trip delay to a primary (e.g. serving) BS rTDstd: standard deviation of round trip delay nMR: network measurement report for neighbouring BSs nMRrelDelay: Relative Delay between the neighboring BS and the primary BS nMRrelDelaystd: Standard deviation of the Relative delay nMRrSSI: received signal strength of the neighbour BS nMRrSSIstd: standard deviation of BS signal strength nMRbSTxPower: transmit power of the neighbour BS nMRcINR: Carrier to Noise and Interference Ratio of the neighbour BS nMRcINRstd: standard deviation of the BS Carrier to Noise and Interference Ratio nMRbSLocation: Location of the neighbour BS as reported by the neighbour BS non-serving: E-CID measurements for non-serving WiMax base stations (in addition to a serving base station) historic: historic WiMax E-CID measurements

6.5.9.5 WiMax ECID Capability Information Request

– *OMA-LPPe-ECID-WiMax-RequestCapabilities*

The *OMA-LPPe-ECID-WiMax-RequestCapabilities* is used to request WiMax ECID capabilities information from the target.

```
-- ASN1START

OMA-LPPe-ECID-WiMax-RequestCapabilities ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.9.6 WiMax ECID Error Element

– *OMA-LPPe-ECID-WiMax -Error*

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

```
-- ASN1START

OMA-LPPe-ECID-WiMax-Error ::= CHOICE {
    locationServerErrorCauses       OMA-LPPe-ECID-WiMax-LocationServerErrorCauses,
    targetDeviceErrorCauses         OMA-LPPe-ECID-WiMax-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

– *OMA-LPPe-ECID-WiMax-LocationServerErrorCauses*

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

```
-- ASN1START

OMA-LPPe-ECID-WiMax-LocationServerErrorCauses ::= SEQUENCE {
    cause       ENUMERATED  {undefined,
                            ...
                            },
    ...
}
```

```
-- ASN1STOP
```

– *OMA-LPPe-ECID-WiMax-TargetDeviceErrorCauses*

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

```
-- ASN1START

OMA-LPPe-ECID-WiMax-TargetDeviceErrorCauses ::= SEQUENCE {
    cause                                   ENUMERATED {    undefined,
                                                            requestedMeasurementsNotAvailable,
                                                            notAllrequestedMeasurementsPossible,
                                                            ...
                                                        },
    rTDMeasurementNotPossible               NULL        OPTIONAL,
    rTDstdMeasurementNotPossible            NULL        OPTIONAL,
    nMRMeasurementNotPossible               NULL        OPTIONAL,
    nMRrelDelayMeasurementNotPossible       NULL        OPTIONAL,
    nMRrelDelaystdMeasurementNotPossible    NULL        OPTIONAL,
    nMRrSSIMeasurementNotPossible           NULL        OPTIONAL,
    nMRrSSIstdMeasurementNotPossible        NULL        OPTIONAL,
    nMRbSTxPowerMeasurementNotPossible      NULL        OPTIONAL,
    nMRcINRMeasurementNotPossible           NULL        OPTIONAL,
    nMRcINRstdMeasurementNotPossible        NULL        OPTIONAL,
    nMRbSLocationNotAvailable               NULL        OPTIONAL,
    non-servingMeasurementsNotAvailable     NULL        OPTIONAL,
    historicMeasurementsNotAvailable        NULL        OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-ECID-WiMax-TargetDeviceErrorCauses* field descriptions**
cause   This field provides a WiMax ECID specific error cause. If the cause value is '*requestedMeasurementsNotAvailable*', none of the requested measurements could be provided and no further information needs to be included. If the cause value is '*notAllRequestedMeasurementsPossible*', the target device was able to provide some but not all requested WiMax measurements. In this case, the target device should indicate the requested measurements that could not be provided.

6.5.10 Sensor Positioning

6.5.10.1 Sensor Assistance Data

– *OMA-LPPe-Sensor-ProvideAssistanceData*

The *OMA-LPPe-Sensor-ProvideAssistanceData* is used to provide assistance for sensor-based methods.

```
-- ASN1START

OMA-LPPe-Sensor-ProvideAssistanceData ::= SEQUENCE {
    ...,
    atmosphericPressureAD   OMA-LPPe-AtmosphericPressureAD  OPTIONAL
}

-- ASN1STOP
```

***OMA-LPPe-Sensor-ProvideAssistanceData* field descriptions**
atmosphericPressureAD   This field is used to provide reference atmospheric pressure at nominal sea level, [EGM96] to the target.

6.5.10.2 Sensor Assistance Data Elements

– *OMA-LPPe-AtmosphericPressureAD.*

The *OMA-LPPe-AtmosphericPressureAD* is used to provide reference atmospheric pressure at nominal sea level, [EGM96]

to the target.

```
-- ASN1START

OMA-LPPe-AtmosphericPressureAD ::= SEQUENCE {
    referencePressure               INTEGER (-20000..10000),
    period      SEQUENCE {
                pressureValidityPeriod          OMA-LPPe-ValidityPeriod,
                referencePressureRate           INTEGER (-128..127)     OPTIONAL,
                ...
                }       OPTIONAL,
    area        SEQUENCE {
                pressureValidityArea            OMA-LPPe-PressureValidityArea,
                gN-pressure                     INTEGER (-128..127)     OPTIONAL,
                gE-pressure                     INTEGER (-128..127)     OPTIONAL,
                ...
                }       OPTIONAL,
    ...
}

OMA-LPPe-PressureValidityArea ::= SEQUENCE {
    centerPoint         Ellipsoid-Point, -- coordinates of the center of the rectangular validity area
    validityAreaWidth           INTEGER (1..128), -- units in Kilometers
    validityAreaHeight          INTEGER (1..128), -- units in Kilometers
    ...
}


-- ASN1STOP
```

OMA-LPPe-AtmosphericPressureAD **field descriptions**
referencePressure   This field specifies the atmospheric pressure (Pa) at nominal sea level, [EGM96] to the target. If *pressureValidityArea* is provided, the *referencePressure* applies to the center of the *pressureValidityArea*. The pressure within the *pressureValidityArea* outside the center can be calculated using the pressure gradients (*gN-pressure* and *gE-pressure*) if provided. If no northward and eastward pressure gradients are provided, the pressure is assumed to be constant throughout the pressureValidityArea. If no *referencePressureRate* is provided, the pressure is assumed to be constant at each location throughout the *pressureValidityPeriod*. The scale factor is 1 Pa. The value is added to the nominal pressure of 101325 Pa.
pressureValidityPeriod   This field specifies the start time and duration of the reference pressure validity period. If this parameter is not present, the atmospheric pressure assistance data is valid only at precisely the time the assistance data is received at the target.
referencePressureRate   This field specifies the rate of change of pressure. When this field is included, the referencePresssure applies only at the start of the pressureValidityPeriod. The scale factor is 10 Pa/hour,
pressureValidityArea   This field specifies the area within which the provided atmospheric reference pressure is valid. If this field is not present, the provided atmospheric reference pressure is only valid at the target's position at the moment the atmospheric reference pressure is provided.   The pressure validity area is a rectangle defined by its Center Point (*centerPoint*), width (*validityAreaWidth*) and height (*validityAreaHeight*). Width is measured from the center along the latitude and height is measured from the center along the longitude. Width and height are measured as the total width and height of the rectangle. The scale factor is Km.
gN-pressure   This field specifies the northward gradient of the reference pressure calculated from the center of the *pressureValidityArea*. The scale factor is 10 Pa/Km. If this field is not provided, the gradient is assumed to be zero.
gE-pressure   This field specifies the eastward gradient of the reference pressure calculated from the center of the *pressureValidityArea*. The scale factor is 10 Pa/Km. If this field is not provided, the gradient is assumed to be zero.

6.5.10.3 Sensor Assistance Data Request

– *OMA-LPPe-Sensor-RequestAssistanceData*

The *OMA-LPPe-Sensor-RequestAssistanceData* is used to request assistance for sensor-based methods.

```
-- ASN1START

OMA-LPPe-Sensor-RequestAssistanceData ::= SEQUENCE {
    ...,
    pressureSensorAD                    OMA-LPPe-PressureSensorAD   OPTIONAL
}

-- ASN1STOP
```

6.5.10.4 Sensor Assistance Data Request Elements

– *OMA-LPP-PressureSensorAD*.

The *OMA-LPPe-PressureSensorAD* is used to request atmospheric reference pressure assistance data.

```
-- ASN1START

OMA-LPPe-PressureSensorAD ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.10.5 Sensor Location Information

– *OMA-LPPe-Sensor-ProvideLocationInformation*

The *OMA-LPPe-Sensor-ProvideLocationInformation* is used to provide location information for sensor-based methods.

```
-- ASN1START

OMA-LPPe-Sensor-ProvideLocationInformation ::= SEQUENCE {
    motionStateList         OMA-LPPe-Sensor-MotionStateList     OPTIONAL,
    sensorError             OMA-LPPe-Sensor-Error               OPTIONAL,
    ...,
    atmosphericPressure     OMA-LPPe-AtmosphericPressure        OPTIONAL
}

-- ASN1STOP
```

***OMA-LPPe-Sensor-ProvideLocationInformation* field descriptions**
motionStateList This field is used to provide one or more motion states to the server. The motion state may indicate e.g. that the target is stationary or that it is moving in a car.
sensorError This field is used to provide error information on the sensor location information.
atmosphericPressure This field is used to provide the atmospheric pressure as measured by the target's pressure sensor. This field shall be included if requested and available.

6.5.10.6 Sensor Location Information Elements

– *OMA-LPPe-Sensor-MotionStateList*

The *OMA-LPPe-Sensor-MotionStateList* carries target motion state information. The list allows for reporting up to eight motion state elements. Each element contains one primary motion state (the one with the highest sustained velocity) and optionally multiple secondary motion states in order to be able to describe, say, that the person carrying the target is walking (secondary motion) in a train (primary motion). The confidence represents the confidence of the primary motion state if no secondary motion state is included or the combination of primary+secondary, in case the secondary motion state is included.

```
-- ASN1START


OMA-LPPe-Sensor-MotionStateList ::= SEQUENCE (SIZE(1..8)) OF OMA-LPPe-Sensor-MotionStateElement

OMA-LPPe-Sensor-MotionStateElement ::= SEQUENCE {
    primaryMotionState      ENUMERATED{
                                unknown,
                                stationary,
                                pedestrian,
                                running,
                                cycling,
                                car,
                                train,
                                aeroplane,
                                boat,
                                fidgeting,
                                ...
                                },
    confidence              INTEGER(0..99),
    secondaryMotionState    BIT STRING {
                                stationary  (0),
                                pedestrian  (1),
                                running     (2),
                                cycling     (3),
                                car         (4),
                                train       (5),
                                aeroplane   (6),
                                boat        (7),
                                fidgeting   (8) } (SIZE(1..16)) OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-Sensor-MotionStateList* field descriptions**
primaryMotionState This field specifies the primary motion state, i.e. the one with the heighest sustained speed.
confidence This field specifies the confidence that the target is in the indicated motion state (primary+secondary). Confidence is encoded as a truncated percentage. An encoded value of 0 therefore represents a confidence C where 0% <=C <1% percent. An encoded value of 1 represents a confidence C where 1%<=C<2%, and so on. An encoded value of 99 represents a confidence C where 99%<=C<100%.
secondaryMotionState This field specifies one or more seconday motion states. Secondary motion states are indicated by the bit string, in which each bit position indicates a distinct secondary motion. The presence of two or more secondary motion states indicates that all occur simultaneously – e.g. fidgeting while stationary on a train. Note: a secondary motion state which is set to false implies that the target is asserting that the motion state is not in effect.

– OMA-LPPe-AtmosphericPressure

The *OMA-LPPe-AtmosphericPressure* represents the atmospheric pressure measured by the target.

```
-- ASN1START
```

```
OMA-LPPe-AtmosphericPressure ::= SEQUENCE {
    pressureMeasurement             OMA-LPPe-PressureMeasurement,
    pressureStats                   PressureStats       OPTIONAL,
    calibrationPoints               CalibrationPoints   OPTIONAL,
    ...}


PressureStats ::= SEQUENCE {
    sensorMeanPressure      INTEGER     (30000..115000),
    sensorStddevPressure    INTEGER     (0..2000)       OPTIONAL,
    duration                INTEGER     (5..40),
...}

CalibrationPoints ::= SEQUENCE (SIZE (1..10)) OF SEQUENCE {
    pressure        OMA-LPPe-PressureMeasurement,
    time            UTCTime,
    location        EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,
    motionState     OMA-LPPe-Sensor-MotionStateList     OPTIONAL,
    velocity        Velocity                            OPTIONAL,
    locationSource  OMA-LPPe-LocationSource             OPTIONAL,
    ...
}


-- ASN1STOP
```

OMA-LPPe-AtmosphericPressure **field descriptions**
pressureMeasurement This field provides an instantaneous current atmospheric pressure at the target.
pressureStats This field corresponds to the mean and (optional) standard deviation of the sensor(s) pressure measurement without any added or subtracted adjustment that prevailed for a time period (duration) immediately before the pressure measurement reported by the target was obtained. The scale factor for mean and standard deviation is 1 Pa. Time units are in seconds. For the pressureStats to be reported, the duration must be at least 5 seconds (maximum duration is 40 seconds). This field enables a server to remove noise from the current pressure measurement through averaging and evaluate the stability of the current pressure measurement (e.g. whether increasing or decreasing). A target may obtain the statistics while performing any other measurements requested by the server. The current pressure measurement (in *pressureMeasurement*) should be obtained exactly at the end of the duration for *pressureStats*.
calibrationPoints This parameter provides a sequence of up to 10 calibration points for the target where both a 3D location and a pressure measurement were obtained by the target. Each calibration point includes the following mandatory and conditional fields. pressure: the measured pressure in units of Pa (mandatory) time: UTC time (mandatory) location: location of the target which must have been obtained without use of either the pressure measurement or a terrain map (mandatory) motionState: the motion state of the target (mandatory if available) velocity: the velocity of the target (mandatory if available) locationSource: the source(s) of the reported location (mandatory if available) This parameter enables the server to calibrate the barometric sensor for the target and/or estimate its accuracy and stability. This parameter is compiled from historic pressure and location data stored in the target prior to reporting an atmospheric pressure measurement to the server. The parameter shall be included when calibration points are available. If possible, one calibration point should be reported for each of the last 10 days starting with the current day and should each correspond to the 3D location with minimum uncertainty volume obtained each day which may be approximated by the product of the X, Y and Z uncertainty values. A target that is unable to report 10 calibration points over a 10 day period should report up to 10 calibration points over a shorter or longer period in the same manner. If possible, a target that is environmentally aware (e.g. via use of other sensor data) should not report calibration points that appear to correspond to indoor or in vehicle locations when other calibration points are available that appear to correspond to outdoor locations.

– OMA-LPPe-PressureMeasurement

The *OMA-LPPe-PressureMeasurement* is used to define an atmospheric pressure measurement.

```
-- ASN1START
```

```
OMA-LPPe-PressureMeasurement ::= SEQUENCE {
    sensorMeasurement               INTEGER (30000..115000),
    adjustment                      INTEGER (-5000..5000)           OPTIONAL,
    uncertainty                     SEQUENCE {
                                    range       INTEGER (0..1000),
                                    confidence  INTEGER (1..100)
                                    }                               OPTIONAL,
    temperature                     INTEGER (-100..150)             OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-PressureMeasurement field descriptions
sensorMeasurement This field specifies the measured atmospheric pressure in units of Pa (corresponding to a numerical altitude resolution of about 0.1m at sea level). This field shall be obtained from the measured atmospheric pressure output of one or more sensors on the target prior to any adjustment made externally to the sensor(s).
adjustment This field specifies any adjustment in units of Pa applied by a target to the output of the sensor(s) to produce a more accurate atmospheric pressure. The adjustment may be enabled by previous calibration by the target of the sensor output using a known reference atmospheric pressure for a known location and altitude, by more accurate temperature related calibration data from the vendor of the sensor or by other means. The more accurate atmospheric pressure is obtained as follows and is not reported directly but only via the measurement and adjustment components: accurate atmospheric pressure = sensorMeasurement + adjustment The adjustment shall be provided whenever applied. If there is no adjustment, a target may omit the adjustment field. When omitted, a server shall assume a value of zero for the adjustment.
uncertainty This field provides the expected range for the pressure measurement and the confidence as a percentage that the true pressure lies in a range of (measurement + adjustment – range) to (measurement + adjustment + range). This field is optional and shall be provided if available.
temperature This field provides the temperature in degrees Celsius associated with the sensor(s) used for the pressure measurement and shall be provided if available. Note that the sensor temperature is internal to the target and may differ from the temperature outside the target if a different sensor is used to measure outside temperature.

6.5.10.7 Sensor Location Information Request

– *OMA-LPPe-Sensor-RequestLocationInformation*

The *OMA-LPPe-Sensor-RequestLocationInformation* is used to request location information for sensor-based methods.

```
-- ASN1START

OMA-LPPe-Sensor-RequestLocationInformation ::= SEQUENCE {
    motionStateReq          OMA-LPPe-Sensor-MotionStateRequest  OPTIONAL, --Cond MotionSateReq
    ...,
    atmosphericPressureReq  OMA-LPPe-AtmosphericPressureRequest OPTIONAL --Cond AtmosphericPressureReq
}

-- ASN1STOP
```

Conditional presence	Explanation
MotionStateReq	The field is mandatory present if the server requests for primary motion state measurements; otherwise it is not present.
AtmosphericPressureReq	The field is mandatory present if the server requests for atmospheric pressure measurements; otherwise it is not present.

OMA-LPPe-Sensor-RequestLocationInformation field descriptions
motionStateReq
This field is used to request the motion state of the target. The motion state may indicate e.g. that the target is stationary or that it is moving in a car.

6.5.10.8 Sensor Location Information Request Elements

– *OMA-LPPe-Sensor-MotionStateRequest*

The *OMA-LPPe-Sensor-MotionStateRequest* is used to request motion state information.

```
-- ASN1START

OMA-LPPe-Sensor-MotionStateRequest ::= SEQUENCE {
    secondaryMotionStateRequest     NULL    OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-Sensor-MotionStateRequest field descriptions
secondaryMotionStateRequest
This field is used to request the secondary motion state of the target.

– *OMA-LPPe-AtmosphericPressureRequest*

The *OMA-LPPe-AtmosphericPressureRequest* is used to request atmospheric pressure (as measured by the target) information.

```
-- ASN1START

OMA-LPPe-AtmosphericPressureRequest ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.10.9 Sensor Capability Information

– *OMA-LPPe-Sensor-ProvideCapabilities*

The *OMA-LPPe-Sensor-ProvideCapabilities* is used to provide capabilities for sensor-based methods.

```
-- ASN1START

OMA-LPPe-Sensor-ProvideCapabilities ::= SEQUENCE {
    motionStateSupport                  NULL        OPTIONAL, --Cond MotionStateSupport
    secondarySupport                        NULL        OPTIONAL, --Cond SecondarySupport
    ...,
    atmosphericPressureADSupport            NULL    OPTIONAL, --Cond AtmosphericPressureADSupport
    atmosphericPressureSupport          NULL        OPTIONAL  --Cond AtmosphericPressureSupport
}

-- ASN1STOP
```

Conditional presence	Explanation
MotionStateSupport	The field is mandatory present if the target supports motion state measurements; otherwise it is not present.
SecondarySupport	The field is mandatory present if the target supports secondary motion state measurements; otherwise it is not present.
AtmosphericPressureADSupport	The field is mandatory present if the target supports atmosphericc pressure assistance data; otherwise it is not present.
AtmosphericPressureSupport	The field is mandatory present if the target supports atmospheric pressure measurements; otherwise it is not present.

6.5.10.10 Sensor Capability Information Elements

Void.

6.5.10.11 Sensor Capability Information Request

– *OMA-LPPe-Sensor-RequestCapabilities*

The *OMA-LPPe-Sensor-RequestCapabilities* is used to provide capabilities for sensor-based methods.

```
-- ASN1START

OMA-LPPe-Sensor-RequestCapabilities ::= SEQUENCE {
    ...
}

-- ASN1STOP
```

6.5.10.12 Sensor Error Elements

– *OMA-LPPe-Sensor-Error*

The *OMA-LPPe-Sensor-Error* is used to provide Sensor Error Reasons to the server.

```
-- ASN1START


OMA-LPPe-Sensor-Error ::= CHOICE {
    targetError         OMA-LPPe-Sensor-TargetError,
    ...
}

OMA-LPPe-Sensor-TargetError ::= SEQUENCE {
    motionStateError    ENUMERATED { primaryMotionStateNotAvailable,
                                     primaryMotionStateNotSupported,
                                     ... }  OPTIONAL,
    secondaryMotionStateError   ENUMERATED { secondaryMotionStateNotAvailable,
                                             secondaryMotionStateNotSupported,
                                     ... }  OPTIONAL,
    ...,
    atmosphericPressureError    ENUMERATED {pressureNotAvailable, pressureNotSupported,
                                    ...}        OPTIONAL
}

-- ASN1STOP
```

***OMA-LPPe-Sensor-Error* field descriptions**
targetError This field is used to provide target error information to the server.
motionStateError This field is used to provide error information on the motion state measurement to the server.

6.5.10.13 Common Sensor Information Elements

Void.

6.5.11 Short Range Node Positioning

This section defines support for positioning using measurements related to a Short Range Nodes (SRNs).

6.5.11.1 Short Range Node Assistance Data

– *OMA-LPPe-SRN-ProvideAssistanceData*

The *OMA-LPPe-SRN-ProvideAssistanceData* is used to provide assistance data for SRN (Short Range Node) UE-based and UE-assisted positioning.

```
-- ASN1START

OMA-LPPe-SRN-ProvideAssistanceData ::= SEQUENCE {
    srnGroup    CHOICE {
        srnGroupList            OMA-LPPe-SRN-SRNgroupList,
        srnGroupUpdateResponse  OMA-LPPe-SRN-SRNgroupUpdateResponse,
        ...
        }                                                   OPTIONAL,
    antennaPattern          OMA-LPPe-SRN-AntennaPattern     OPTIONAL,   --Cond AntennaPattReq
    srnError                OMA-LPPe-SRN-Error              OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
AntennaPattReq	The field is mandatory present if the target device requests for antenna pattern information, otherwise the field is not present.

***OMA-LPPe-SRN-ProvideAssistanceData* field descriptions**
srnGroupList This field is used to provide information on the relative locations and optionally orientations of the SRNs. This choice shall be included, if the target device requests for SRN group information and this information is available at the server.
srnGroupUpdateResponse This field is used to provide response to the target's SRN group information update request. This choice shall be included if the target device requests for SRN group information update and this information is available at the server.
antennaResponse This field is used to provide the spatial response for a certain SRN antenna type.
srnError This field is used to provide SRN error causes related to the assistance data requests.

6.5.11.2 Short Range Node Assistance Data Elements

– *OMA-LPPe-SRN-SRNgroupList*

The IE *OMA-LPPe-SRN-SRNgroupList* is used to provide assistance data for one or more groups of positioning SRNs in the local area. For example, one SRN group might consist of all the SRNs located in one floor of a building. Up to 64 groups can be provided in the same IE.

```
-- ASN1START

OMA-LPPe-SRN-SRNgroupList ::= SEQUENCE {
    incompleteFlag          BOOLEAN,
    defaultReferencePoint   OMA-LPPe-ReferencePoint                OPTIONAL, --Cond IfNoRefPoint
    groupList               SEQUENCE (SIZE (1..64)) OF OMA-LPPe-SRN-SRNgroup,
    ...
    }

OMA-LPPe-SRN-SRNgroup ::= SEQUENCE {
    srnGroupID                      OMA-LPPe-SRN-SRNgroupUniqueID                       OPTIONAL,
    defaultSRNtype                  OMA-LPPe-SRN-SRNtype                                OPTIONAL,
    referencePoint                  OMA-LPPe-ReferencePoint                             OPTIONAL,
```

```
    globalOrientation               NULL                                                    OPTIONAL,
    srnsInGroupList                 SEQUENCE (SIZE (1..1024)) OF OMA-LPPe-SRN-SRNinfo,
    ...
}

OMA-LPPe-SRN-SRNinfo ::= SEQUENCE {
    srnID                   OMA-LPPe-SRN-SRNid,
    srnType                 OMA-LPPe-SRN-SRNtype                OPTIONAL,   --Cond NotDefaultType
    relativePosition        OMA-LPPe-RelativeLocation,
    orientation             OMA-LPPe-Orientation                OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
NotDefaultType	The field is mandatory present, if the SRN is of different type than the *defaultSRNtype* IE, otherwise the field is not present.
IfNoRefPoint	The field is mandatory present, if any of the groups is missing a reference point. Otherwise it is not present.

OMA-LPPe-SRN-SRNgroupList **field descriptions**
incompleteFlag
This field specifes, if the server was able to provide all the groups to the target the server would have wanted to (TRUE) or not (FALSE). For example, it might happen that when the target requests for groups near to a geographic position, there are more groups nearby than can be carried in a single message if AD segmentation is not supported.
defaultReferencePoint
This field specifies the default reference location for the location of all SRNs in the *groupList* IE, if the *groupList* IE does not contain any reference point. If this field is absent, the default reference location is provided by the default reference point in LPPe common IEs.
groupList
This field specifies the assistance data for one or more SRN goups.
srnGroupID
This field identifies the SRN group.
defaultSRNType
This field, if present, specifies the type of all SRNs in *srnsInGroupList* IE.
referencePoint
This field, if present, specifies the reference point for this SRN group. If this field is absent, the *defaultReferencePoint* IE in *OMA-LPPe-SRN-SRNgroupList* defines the reference point.
globalOrientation
This field, if present, indicates that the orientation given in the field orientation (in *OMA-LPPe-SRN-SRNInfo*) is with respect to the global coordinate system (see Appendix C.9.2). Otherwise, if this field is absent, the orientation information in *OMA-LPPe-SRN-SRNinfo* (if any) can only be used to deduce the relative orientation information of the SRNs.
srnsInGroupList
This field is used to provide the relative positions and optionally orientations of the SRNs in the group.
srnID
This field identifies the SRN.
srnType
This field specifies the type of the SRNs.
relativePosition
This field specifies the relative position of the SRN relative to the reference point.
orientation
This field, if present, specifies the orientations of the SRN. In case the *orientation* field is missing in all the records of the *srnsInGroupList* sequence, the orientation is assumed to be the same for all the SRNs, or no orienation information is provided. In case *globalOrientation* is included and only the first item in the *srnsInGroupList* sequence includes the orientation, all the SRNs are assumed to have the same global orientation.,

– *OMA-LPPe-SRN-SRNgroupUpdateResponse*

The IE *OMA-LPPe-SRN-SRNgroupUpdateResponse* is used only as a response to the SRN group data update request.

```
-- ASN1START

OMA-LPPe-SRN-SRNgroupUpdateResponse ::= SEQUENCE (SIZE (1..8)) OF
                                                    OMA-LPPe-SRN-SRNgroupUpdateResponseElement

OMA-LPPe-SRN-SRNgroupUpdateResponseElement ::= SEQUENCE {
    srnGroupID          OMA-LPPe-SRN-SRNgroupUniqueID                          OPTIONAL,
    targetDataValidity  ENUMERATED{ targetDataValid,
                                    targetDataInValidAndUpdatedDataWillBeProvided,
                                    targetDataInValidButServerWillNotProvideNewData,
                                    ...},
    updatedSRNgroup     OMA-LPPe-SRN-SRNgroup OPTIONAL, --Cond InvalidAndNewDataAvailable
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
InvalidAndNewDataAvailable	The field is mandatory present if the target data is out-of-date and the server provides updated data, otherwise the field is not present.

***OMA-LPPe-SRN-SRNgroupUpdateResponse* field descriptions**
srnGroupID This field specifies the group ID of which validity data is being provided. The group ID shall match with that in the request.
targetDataValidity This field indicates if the target data is valid (value 0) or that the data is out-of-date and new data will be provided (value 1). Value 2 indicates that data is invalid but no new data will be provided – this may be due to the server not having the new data or because in the request the target indicated that the target only wishes to receive an inidication that the data is invalid (*provideIndicationOnly*-field in the *IE OMA-LPPe-SRN-SRNGroupUpdateRequest*).
updatedSRNgroup This field provides the latest SRN group information in the case the target's current SRN group information is not valid and the server can provide up-to-date information. The updated group information overrides the previous group data. This may include replacing the previous *srnGroupID* parameter in the *OMA-LPPe-SRN-SRNgroup* with a new parameter (i.e. new group ID).

– *OMA-LPPe-SRN-AntennaPattern*

The IE *OMA-LPPe-SRN-AntennaPattern* is used for providing the target with the complex-valued antenna response. The coordinate system definition is SRN-specific.

```
-- ASN1START

OMA-LPPe-SRN-AntennaPattern ::= SEQUENCE (SIZE (1..8)) OF OMA-LPPe-SRN-AntennaPatternElement

OMA-LPPe-SRN-AntennaPatternElement::= SEQUENCE {
    identification      SEQUENCE {
                                vendorOrOperator        OMA-LPPe-VendorOrOperatorID,
                                antennaPatternID        INTEGER(0..65535),
                                ...
                            },
    antennaData         CHOICE {
                                antennaPattern      OMA-LPPe-SRN-AntennaPatternForChannels,
                                antennaContainer    OCTET STRING,
                                ...
                            },
    ...
}
```

```
OMA-LPPe-SRN-AntennaPatternForChannels ::= SEQUENCE {
    evenGrid            SEQUENCE {
                                inAzimuth       INTEGER(1..200),
                                inElevation     INTEGER(1..150)
                            } OPTIONAL, --Cond EvenGrid
    patternList         SEQUENCE (SIZE (1..maxChannels)) OF OMA-LPPe-SRN-ChannelResponse,
    ...
}

OMA-LPPe-SRN-ChannelResponse ::= SEQUENCE {
    channelNumber           INTEGER(1..maxChannels),
    responseInElevation     SEQUENCE (SIZE (7..901)) OF OMA-LPPe-SRN-ResponseInElevation,
    ...
}

OMA-LPPe-SRN-ResponseInElevation ::= SEQUENCE {
    elevation           INTEGER(0..900) OPTIONAL,   --Cond NotEven
    responseInAzimuth   SEQUENCE (SIZE (18..3601)) OF OMA-LPPe-SRN-ResponseInAzimuth,
    ...
}

OMA-LPPe-SRN-ResponseInAzimuth::= SEQUENCE {
    azimuth     INTEGER(0..3599)    OPTIONAL, --Cond NotEven
    response    OMA-LPPe-ComplexNumber,
    ...
    }

OMA-LPPe-ComplexNumber ::= SEQUENCE {
    amplitude   INTEGER(0..1000),
    phase       INTEGER(-1800..1799)
}

maxChannels INTEGER ::= 512

-- ASN1STOP
```

Conditional presence	Explanation
EvenGrid	The field is mandatory present if the antenna response grid spacing is even, otherwise the field is not present.
NotEven	The field is mandatory present if the antenna response grid spacing is not even, otherwise the field is not present.

***OMA-LPPe-SRN-AntennaResponse* field descriptions**
identification This field specifies for which SRN or group of SRNs the antenna pattern is given. It specifies the vendor specific unique antenna response ID. If the *OMA-LPPe-SRN-AntennaResponse* is provided as a response to a request, the identification shall match with the identification in the request.
antennaData This field specifies the antenna data for the given *identificatio*n IE.
evenGrid This field defines the antenna response grid in the case that an evenly-spaced grid is used for providind the spatial response.
inAzimuth This field defines the grid resolution in azimuth in case the antenna response is given in an evenly-spaced grid. Scale factor 0.1 degrees.
inElevation This field defines the grid resolution in elevation in case the antenna response is given in an evenly-spaced grid. Scale factor is 0.1 degrees.
patternList This field specifies the spatial antenna response.
channelNumber This field indicates the channel for which the response is given.

OMA-LPPe-SRN-AntennaResponse field descriptions
responseInElevation This field specifies the response at a given elevation angle.
elevation In the case of a non-even grid, this field defines the elevation angle of the antenna response. Scale factor 0.1 degrees. In case the field is not present, the first item in the *responseInElevation* sequence corresponds to the elevation angle zero with respect to the SRN axis. The second item corresponds to zero plus the elevation resolution defined in *inElevation* in *evenGrid*.
responseInAzimuth This field specifies the response at a given azimuth.
azimuth In the case of a non-even grid, this field defines the azimuth angle of the antenna response. Scale factor 0.1 degrees. In case the field is not present, the first item in the *responseInAzimuth* sequence corresponds to the azimuth angle zero with respect to the SRN axis. The second item corresponds to zero plus the azimuth resolution defined in *inAzimuth* in *evenGrid*.
response This field defines the complex-valued antenna response at the defined azimuth and elevation angles.
amplitude This field specifies the gain in the linear scale. Normalized so that the highest amplitude is 1000 over all the channels and spatial directions.
phase This field specifies the phase. The phase is normalized so that phase zero occurs coincides with the amplitude response of 1000 - all the other phase response values over all the channels and spatial directions are relative to this reference value. Scale factor 0.1 degrees.

6.5.11.3 Short Range Node Assistance Data Request

– *OMA-LPPe-SRN-RequestAssistanceData*

The IE *OMA-LPPe-SRN-RequestAssistanceData* is used to request assistance for SRN-based positioning.

```
-- ASN1START

OMA-LPPe-SRN-RequestAssistanceData ::= SEQUENCE {
    srnGroup    CHOICE {
        srnGroupRequest         OMA-LPPe-SRN-SRNgroupRequest,
        srnGroupUpdateRequest   OMA-LPPe-SRN-SRNgroupUpdateRequest,
        ...
    }   OPTIONAL,
    antennaPatternRequest   OMA-LPPe-SRN-AntennaPatternRequest      OPTIONAL,
    ...
}

-- ASN1STOP
```

6.5.11.4 Short Range Node Assistance Data Request Elements

– *OMA-LPPe-SRN-SRNgroupRequest*

The *OMA-LPPe-SRN-SRNgroupRequest* is used to request the relative positions and optionally orientations of the SRNs in the local SRN group. For the assistance data request purposes the target may (a) provide its approximate location to the server in either the *OMA-LPPe-CommonIEsRequestAssistanceData* parameter or in a separatethe Provide Location Information –message or (b) provide a list of observed SRN IDs in a Provide Location Information message. In case both the location and the observed SRN IDs are provided, the server shall primarily consider the SRN IDs. Note that it is recommended to provide the server information on the target SRN capabilities prior to the SRN assistance data request especially, if SRN assistance data is requested based on target position information.

```
-- ASN1START

OMA-LPPe-SRN-SRNgroupRequest ::= SEQUENCE {
    doNotProvideList    OMA-LPPe-SRN-SRNProvideList             OPTIONAL,
```

```
    doProvideList       OMA-LPPe-SRN-SRNProvideList             OPTIONAL,
    ...
}

OMA-LPPe-SRN-SRNProvideList ::= SEQUENCE {
    groupList       SEQUENCE (SIZE (1..256)) OF OMA-LPPe-SRN-SRNgroupUniqueID       OPTIONAL,
    categoryList    SEQUENCE (SIZE (1..16))  OF OMA-LPPe-SRN-Category               OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN-SRNgroupRequest **field descriptions**
doNotProvideList
This field specifies the list of SRN group IDs and/or SRN categories for which the target does not wish to receive assistance data. If this field and the *doProvideList* IE are both absent, the request is applicable to all groups available at the target location.
doProvideList
This field specifies the list of SRN group IDs and/or SRN categories for which the target requests assistance data. If this field and the *doNotProvideList* IE are both absent, the request is applicable to all groups available at the target location.

– *OMA-LPPe-SRN-SRNgroupUpdateRequest*

The IE *OMA-LPPe-SRN-SRNgroupUpdateRequest* is used for checking if the target's current SRN group information is valid.

```
-- ASN1START

OMA-LPPe-SRN-SRNgroupUpdateRequest ::= SEQUENCE (SIZE (1..64)) OF
                                            OMA-LPPe-SRN-SRNgroupUpdateRequestElement

OMA-LPPe-SRN-SRNgroupUpdateRequestElement ::= SEQUENCE {
    srnGroupID              OMA-LPPe-SRN-SRNgroupUniqueID,
    provideIndicationOnly   NULL    OPTIONAL,
    inTheGroup              SEQUENCE (SIZE (1..1024)) OF OMA-LPPe-SRN-SRNid     OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN-SRNgroupUpdateRequest **field descriptions**
srnGroupID
This field specifies the SRN group of interest.
provideIndicationOnly
This field indicates, if included, that in case the target has out-of-date data, the target only wishes to receive an indication that the current target data is out-of-date, not updated data.
inTheGroup
This field specifies a subset of the SRN IDs within the group. The field can be used in the server end to check that the group ID definitions in the target and server match.

– *OMA-LPPe-SRN-AntennaPatternRequest*

The *OMA-LPPe-SRN-AntennaPatternRequest* is used to request the complex-valued antenna response information.

```
-- ASN1START

OMA-LPPe-SRN-AntennaPatternRequest ::= SEQUENCE (SIZE (1..8)) OF
                                            OMA-LPPe-SRN-AntennaPatternRequestElement

OMA-LPPe-SRN-AntennaPatternRequestElement ::= SEQUENCE {
    antennaPatternID    SEQUENCE {
                                vendorOrOperator        OMA-LPPe-VendorOrOperatorID,
                                antennaPatternID        INTEGER(0..65535),
                                ...
                            },
    ...
```

```
}

-- ASN1STOP
```

OMA-LPPe-SRN-AntennaPatternRequest field descriptions
antennaPatternID   This field specifies the ID of the antenna pattern requested.

6.5.11.5 Short Range Node Location Information

– *OMA-LPPe-SRN-ProvideLocationInformation*

The *OMA-LPPe-SRN-ProvideLocationInformation* is used to provide positioning SRN measurements. Measurements can be provided for up to 64 SRNs.

```
-- ASN1START

OMA-LPPe-SRN-ProvideLocationInformation ::= SEQUENCE {
    srnMeasurementList      SEQUENCE (SIZE (1..64)) OF OMA-LPPe-SRN-MeasurementElement  OPTIONAL,
    srnError                OMA-LPPe-SRN-Error                                          OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN-ProvideLocationInformation field descriptions
srnMeasurementList   This field provides the SRN measurements at the current time and/or for historic times.
srnError   This field provides the SRN measurement error information when not all requested SRN measurements can be reported. This field should be included when some but not all requested measurements are reported and shall be included when no requested measurements are reported.

6.5.11.6 Short Range Node Location Information Elements

– *OMA-LPPe-SRN-MeasurementElement*

The *OMA-LPPe-SRN-MeasurementElement* is used to provide the server with the SRN measurements made by the target. Target may provide up to 64 sets of data per SRN. The target may decide the number of sets, for example, based on the movement information.

```
-- ASN1START

OMA-LPPe-SRN-MeasurementElement ::= SEQUENCE {
    srnID               OMA-LPPe-SRN-SRNid,
    srnCategory         OMA-LPPe-SRN-Category               OPTIONAL, --Cond IfKnown
    srnGroupID          OMA-LPPe-SRN-SRNgroupUniqueID       OPTIONAL, --Cond IfKnown
    measurementList     SEQUENCE (SIZE (1..64)) OF OMA-LPPe-SRN-srnMeasurementElement   OPTIONAL,
    ...
}

OMA-LPPe-SRN-srnMeasurementElement ::= SEQUENCE {
    relativeTimeStamp   INTEGER(0..1000)        OPTIONAL,   --Cond IfNotFirst
    rssi                INTEGER(-128..127)      OPTIONAL,
    rtd                 OMA-LPPe-WLAN-RTD       OPTIONAL,
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
IfKnown	The field is mandatory present if the target has the information; otherwise the field is not present.
IfNotFirst	The field is mandatory present if the measurement is not the first of the sequence; otherwise the field is not present.

***OMA-LPPe-SRN-MeasurementElement* field descriptions**
srnID This field identfies the SRN.
srnCategory This field specifies the category of the SRN being measured.
srnGroupID This field specifies the group of the SRN being measured.
measurementList This field includes up to 64 measurement sets.
relativeTimeStamp This parameter shall be included for historic SRN measurements and provides the time of the historic measurements relative to current time in units of 0.01 seconds. If absent, current time is implied which is equivalent to a relativeTimeStamp of zero.
rssi This field provides the Received Signal Strength Indicator. The interpretation and the scale are SRN-type specific.
rtd This field provides the measured round trip delay between the target and SRN, and optionally the accuracy expressed as the standard deviation of the delay.

6.5.11.7 Short Range Node Location Information Request

– *OMA-LPPe-SRN-RequestLocationInformation*

The *OMA-LPPe-SRN-RequestLocationInformation* is used to request SRN measurements.

```
-- ASN1START

OMA-LPPe-SRN-RequestLocationInformation ::= SEQUENCE {
    requestInfo     SEQUENCE (SIZE (1..16)) OF OMA-LPPe-SRN-ReqLocInfo-Category,
    ...
}

OMA-LPPe-SRN-ReqLocInfo-Category ::= SEQUENCE {
    category                OMA-LPPe-SRN-Category,
    multipleMeasurements    ENUMERATED{ forbidden(0),
                                        allowed(1),
                                        requested(2), ... }                 OPTIONAL,
    allowedMeasurements     OMA-LPPe-SRN-MeasurementMask                    OPTIONAL,
    historicMeasurementsRequested   NULL                                    OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-SRN-RequestLocationInformation* field descriptions**
requestInfo This field specifies the requested measurement information, e.g., allowed SRN categories.
category This field specifies the SRN category.
multipleMeasurements This field specifies if the target is forbidden, allowed, or requested to provide multiple measurement sets per SRN.
allowedMeasurements This field specifies the allowed SRN measurements.

OMA-LPPe-SRN-RequestLocationInformation field descriptions
historicMeasurementsRequested This field indicates, if the target should return historic SRN measurements.

6.5.11.8 Short Range Node Location Information Request Elements

Void.

6.5.11.9 Short Range Node Capability Information

– *OMA-LPPe-SRN-ProvideCapabilities*

The *OMA-LPPe-SRN-ProvideCapabilities* is used by the target to provide its LPPe SRN positioning capabilities to the server. Inclusion of an empty *OMA-LPPe-SRN-ProvideCapabilities* indicates the target does not support SRN positioning for either target assisted or target based mode.

```
-- ASN1START

OMA-LPPe-SRN-ProvideCapabilities ::= SEQUENCE {
    capabilitiesPerSRNCategory      SEQUENCE (SIZE (1..16)) OF
                                        OMA-LPPe-SRN-ProvideCapabilitiesElement OPTIONAL,
    ...
}

OMA-LPPe-SRN-ProvideCapabilitiesElement::= SEQUENCE {
    srnCategory                     OMA-LPPe-SRN-Category,
    supportedMeasurements           OMA-LPPe-SRN-MeasurementMask                    OPTIONAL,
    supportedAssistanceData         BIT STRING {
                                        srnGroup (0),
                                        antennaPattern (1) } (SIZE(1..16)),
    historicMeasurementsSupported   NULL    OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN-ProvideCapabilitiesElement field descriptions
capabilitiesPerSRNCategory This field specifies the target capabilities for each supported SRN category.
srnCategory This field specifies the supported SRN category. When capabilities are provided for two SRN categories A and B where B is a subset of A (e.g. A defines SRN technology only and B defines the same SRN technology and a vendor ID), the capabilities for B prevail over those for A in the case of B.
supportedMeasurements This field specifies the SRN measurements the target can provide. The field shall be included in case target-assisted mode is supported for the SRN category.
supportedAssistanceData This field specifies the SRN assistance data types supported by the target device for target based mode. This is represented by a bit string, with a one value at the bit position means the particular assistance data type is supported; a zero value means not supported.
historicMeasurementsSupported This field, if included, indicates support for reporting historic measurements.

6.5.11.10 Short Range Node Capability Information Elements

Void.

6.5.11.11 Short Range Node Capability Information Request

– *OMA-LPPe-SRN-RequestCapabilities*

The IE *OMA-LPPe-SRN-RequestCapabilities* is used to request LPPe SRN capabilities information from the target.

```
-- ASN1START
```

```
OMA-LPPe-SRN-RequestCapabilities ::= SEQUENCE {
    capabilitiesRequestedFor    SEQUENCE (SIZE (1..16)) OF OMA-LPPe-SRN-Category        OPTIONAL,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-SRN-RequestCapabilitiesElement* field descriptions**
capabilitiesRequestedFor   This field specifies the SRN categories for which the target capabilities are requested. If this field is absent, the capabilities for all SRN categories supported by the target are requested.

6.5.11.12 Short Range Node Error Elements

– *OMA-LPPe-SRN-Error*

The IE *OMA-LPPe-SRN-Error* is used by the target or server to provide SRN Error Reasons.

```
-- ASN1START

OMA-LPPe-SRN-Error ::= CHOICE {
    srnLocationServerErrorCauses    OMA-LPPe-SRN-LocationServerErrorCauses,
    srnTargetDeviceErrorCauses      OMA-LPPe-SRN-TargetDeviceErrorCauses,
    ...
}

-- ASN1STOP
```

***OMA-LPPe-SRN-Error* field descriptions**
srnLocationServerErrorCause   This field specifies the server error cause.
srnLocationTargetDeviceErrorCauses   This field specifies the target error cause.

– *OMA-LPPe-SRN-LocationServerErrorCauses*

The IE *OMA-LPPe-SRN-LocationServerErrorCauses* is used by the server to provide SRN Error Reasons to the target in the IE *OMA-LPPe-SRN-ProvideAssistanceData.*

```
-- ASN1START

OMA-LPPe-SRN-LocationServerErrorCauses ::= SEQUENCE {
    groupErrors         ENUMERATED{     undefined,
                                        someGroupOrCategoryOrSRNidUnknownOrUnsupported,
                                        allGroupAndCategoryOrSRNidUnknownOrUnsupported,
                                        noSRNgroupsNearby,
                                        ...}                                            OPTIONAL,
    groupUpdateErrors   ENUMERATED {    undefined,
                                        allSRNgroupIDsUnknown,
                                        allSRNgroupIDsknownButSomeSRNgroupVersionsUnknown,
                                        allSRNgroupIDsknownAndAllSRNgroupVersionsUnknown,
                                        someSRNgroupIDsUnknown,
                                        someSRNgroupVersionsUnknownAndAllSRNGroupVersionsUnknown,
                                        someSRNgroupIDsAndSomeSRNgroupVersionsUnknown,
                                        inTheGroupInformationDoesNotMatchWithGroupID,
                                        ...}                                            OPTIONAL,
    srnAntennaErrors    ENUMERATED {    undefined,
                                        someAntennaPatternIDsUnknown,
                                        allAntennaPatternIDsUnknown,
                                        ... }                                           OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN- LocationServerErrorCauses field descriptions
groupErrors This field specifies the server error causes related to the SRN group request.
groupUpdateErrors This field specifies the server error causes related to the SRN group update request.
srnAntennaErrors This field specifies the server error causes related to the SRN antenna pattern assistance.

– *OMA-LPPe-SRN-TargetDeviceErrorCauses*

The IE *OMA-LPPe-SRN-TargetDeviceErrorCauses* is used by the target to provide SRN Error Reasons to the server in the IE *OMA-LPPe-SRN-ProvideLocationInformation*.

```
-- ASN1START

OMA-LPPe-SRN-TargetDeviceErrorCauses ::= SEQUENCE {
    srnErrorsPerCategory        SEQUENCE (SIZE (1..16)) OF OMA-LPPe-SRN-TargetDeviceError,
    ...
}

OMA-LPPe-SRN-TargetDeviceError ::= SEQUENCE {
    category        OMA-LPPe-SRN-Category,
    srnErrors       ENUMERATED{ undefined,
                                requestedMeasurementsNotAvailable,
                                notAllrequestedMeasurementsPossible,
                                categoryNotSupported,
                                 ...},
    rssiNotAvailable                    NULL    OPTIONAL,
    rtdNotAvailable                     NULL    OPTIONAL,
    multipleSetsNotAvailable            NULL    OPTIONAL,
    historicMeasurementsNotAvailable    NULL    OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN-LocationServerErrorCauses field descriptions
srnErrors This field specifies the target error cause. If the *srnErrors* value is '*requestedMeasurementsNotAvailable*', none of the requested measurements could be provided and no further information needs to be included. If the *srnErrors* value is '*notAllrequestedMeasurementsPossible*', the target device was able to provide some but not all requested SRN measurements. In this case, the target device should indicate those measurements that could not be obtained.

6.5.11.13 Short Range Node Common Elements

Specifies SRN common elements.

– *OMA-LPPe-SRN-SRNgroupUniqueID*

The IE *OMA-LPPe-SRN-SRNgroupUniqueID* provides a unique ID for a SRN group.

```
-- ASN1START

OMA-LPPe-SRN-SRNgroupUniqueID ::= SEQUENCE {
    providerID          OMA-LPPe-VendorOrOperatorID,
    providerAssignedID  OCTET STRING,
    srnDataVersion      INTEGER (0..4294967295)         OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN-SRNgroupUniqueID field descriptions
providerID This field identifies the vendor or operator or other service provider for the SRN group.

OMA-LPPe-SRN-SRNgroupUniqueID field descriptions
providerAssignedID This field provides a unique ID relative to the particular provider.
srnDataVersion This field identifies the version of the SRN group data. The change in the version indicates the change in the group (removed SRNs, added SRNs, moved SRNs, modified SRNs).

– *OMA-LPPe-SRN-SRNtype*

The IE *OMA-LPPe-SRN-SRNtype* provides information about a particular SRN category and can be considered to be a specific instance of an SRN category.

```
-- ASN1START

OMA-LPPe-SRN-SRNtype ::= SEQUENCE {
    srnCategory             OMA-LPPe-SRN-Category,
    srnERP                  INTEGER(-300..500)                                  OPTIONAL,
    srnAntennaInfo          SEQUENCE {
                                    antennaPatternID        INTEGER(0..65535),
                                    switchingPatternID      INTEGER(0..65535)           OPTIONAL,
                                    ...
                                    }                                           OPTIONAL,
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN-SRNtype field descriptions
srnCategory This field identifies the SRN category.
srnERP This field specifies the effective radiated power. Scale factor 0.1 dB ref 1 mW.
srnAntennaInfo This field provides information about the SRN antenna type.
antennaPatternID This field provides a unique ID relative to the *srnVendorInformation* for the antenna pattern.
switchingPatternID This field provides a unique ID relative to the *srnVendorInformation* for the antenna switching pattern.

– *OMA-LPPe-SRN-Category*

The IE *OMA-LPPe-SRN-Category* identifies a particular SRN technology and where relevant an associated vendor. Vendors associated information can be used to further qualify the SRN technology type (e.g. in the case of "other") or indicate a specific SRN technology type supported in SRNs supplied by a particular vendor.

```
-- ASN1START

OMA-LPPe-SRN-Category ::= SEQUENCE {
    srnTechnologyType       OMA-LPPe-SRN-Technologies,
    srnVendorInformation    SEQUENCE {
                                    vendor          OMA-LPPe-VendorOrOperatorID,
                                    vendorInfo      OCTET STRING            OPTIONAL,
                                    ...
                                    }                                       OPTIONAL,   --Cond other
    ...
}

-- ASN1STOP
```

Conditional presence	Explanation
other	The field is mandatory present if *srnTechnologyType* IE is set to value 'other'. Otherwise it may optionally be present.

***OMA-LPPe-OMA-LPPe-SRN-SRNtype* field descriptions**
srnTechnologyType This field identifies the SRN RF technology.
srnVendorInformation This field provides information about an associated SRN vendor.

– *OMA-LPPe-SRN-SRNid*

The IE *OMA-LPPe-SRN-SRNid* provides an identidity for a particular SRN.

```
-- ASN1START

OMA-LPPe-SRN-SRNid ::= SEQUENCE {
    srn-id      CHOICE {
                            mac         BIT STRING(SIZE(48)),
                            nfc         SEQUENCE {
                                                manufacturer            BIT STRING(SIZE(8)),
                                                uniqueNumber            BIT STRING(SIZE(48)),
                                                ...
                                                },
                            mobileCode  SEQUENCE {
                                                registryID              BIT STRING(SIZE(12)),
                                                remainingPart           OCTET STRING(SIZE(1..16)),
                                                resolutionIdentifier    OCTET STRING(SIZE(1..18)),
                                                ...
                                                },
                            other       OCTET STRING,
                            ...
                        },
    ...
}

-- ASN1STOP
```

***OMA-LPPe-SRN-SRNid* field descriptions**
srn-id This field defines the SRN ID for a particular SRN.
mac This field defines the MAC address of the SRN for BT and BT LE as per [IEEE 802.15.1]
nfc This field defines the Manufacturer and Unique Number of the SRN for NFC as per [NFC1] and [NFC2].
mobileCode This field defines the Mobile Code Identifier (ICI) of the SRN for OMA Mobile Codes as defined in [OMA-MC].
other This field defines a vendor or operator specific SRN ID. The meaning of this field may be inferred from the SRN group ID (*OMA-LPPe-SRN-SRNgroupUniqueID*) and/or the SRN category (*OMA-LPPe-SRN-Category*).

– *OMA-LPPe-SRN-Technologies*

The IE *OMA-LPPe-SRN-Technologies* defines a particular SRN technology type.

```
-- ASN1START

OMA-LPPe-SRN-Technologies ::= SEQUENCE {
    srnTechnologies     ENUMERATED{ bt, btle, nfc, mobileCode, other, ... },
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN-Technologies field descriptions
srnTechnologies
This field spefies the particular SRN technology: bt: specifies the SRN technology is Bluetooth [IEEE 802.15.1]; btle: specifies the SRN technology is Bluetooth Low Energy [IEEE 802.15.1]; nfc: specifies the SRN technology is Near Field Communications [NFC1], [NFC2]; mobileCode: specifies the SRN technology is OMA Mobile Codes [OMA-MC]. other: specifies an vendor or operator specific SRN type that can be further defined in *OMA-LPPe-SRN-Category*

– *OMA-LPPe-SRN-MeasurementMask*

The IE *OMA-LPPe-SRN-MeasurementMask* defines SRN measurement types.

```
-- ASN1START

OMA-LPPe-SRN-MeasurementMask ::= SEQUENCE {
    srnMeasurements         BIT STRING {    rssi(0),
                                            rtd (1) } (SIZE(1..16)),
    ...
}

-- ASN1STOP
```

OMA-LPPe-SRN-MeasurementMask field descriptions
srnMeasurements
This field specifies a particular SRN measurement type. This is represented by a bit string, with a one value at the bit position means the particular measurement type is addressed (e.g., requested or supported); a zero value means not addressed (e.g., not requested or not supported).

6.6 (End of ASN.1 definition)

6.6.1 End of LPPE-PDU-Definitions

```
-- ASN1START

END

      -- ASN1STOP
```

Appendix A. Change History (Informative)

A.1 Approved Version History

Reference	Date	Description
n/a	n/a	No prior version

A.2 Draft/Candidate Version 1.1 History

Document Identifier	Date	Sections	Description
Draft Versions OMA-TS-LPPe-V1_1	17 Jan 2012	All	First baseline
	28 Fab 2012	6.2.1, 6.4.1, 6.4.2	• OMA-LOC-2012-0076-CR_LPPe_1.1_Local_Cell_Information
	14 Mar 2012	5.2.1.4, 6.4, Appendix E	• OMA-LOC-2012-0088-CR_LPPe_1.1_Broadcast_Restrictions • OMA-LOC-2012-0089-CR_LPPe_1.1_Broadcast_Capabilities_and_Information
	26 Apr 2012	6.4.1, 6.4.2	• OMA-LOC-2012-0112R03-CR_LPPe_1.1_TS_GroungMorphAssistance
	24 Sep 2012	6.4.2	• OMA-LOC-2012-0217R01-CR_LPPe_1.1_Session_ID_for_Periodic_Triggered_Assistance_Data_Transfer_with_Update
	16 Nov 2012	2.1, 4.2, 5.2.5.1, 5.2.5.2.2, 6.2.2.2, 6.4.1, 6.5.10	• OMA-LOC-2012-0243-CR_LPPe_1.1_GroundMorphologyModel_correction • OMA-LOC-2012-0245R01-CR_LPPe_1.1_VendorOrOperatorID_correction • OMA-LOC-2012-0257-CR_LPPe_1.1_CONR_A007_Messagecontent • OMA-LOC-2012-0258-CR_LPPe_1.1_CONR_A008_BroadcastSystemID • OMA-LOC-2012-0283-CR_LPPe_1.1_CONRR_corrections • OMA-LOC-2012-0291-CR_LPPe_1.1_CONRR_corrections • OMA-LOC-2012-0288-CR_LPPe_1.1_Local_Surface_Parameter_correction
	17 Nov 2012	6.4.1	Applied editor's note for OMA-LOC-2012-0258-CR_LPPe_1.1_CONR_A008_BroadcastSystemID
Candidate Version OMA-TS-LPPe-V1_1	11 Dec 2012	n/a	Status changed to Candidate by TP TP Ref# OMA-TP-2012-0450-INP_LPPe_1_1_ERP_and_ETR_for_Candidate_Approval
Draft Versions OMA-TS-LPPe-V1_1	24 Sep 2013	2.1, 6.4.1, 6.4.2, 6.5.8.5, 6.5.8.6, 6.5.8.7, 6.5.8.9	Incorporated CRs: OMA-LOC-2013-0121R01-CR_LPPe_1.1_WLAN_AP_Location_Information_Corrections OMA-LOC-2013-0147-CR_LPPe_1.1_Provide_Location_Information_Correction Editorial changes
	08 Oct 2013	n/a	Editorial changes
Candidate Version OMA-TS-LPPe-V1_1	08 Jan 2014	n/a	Status changed to Candidate by TP TP Ref # OMA-TP-2014-0006-INP_LPPe_V1_1_ERP_for_Notification
Draft Versions OMA-TS-LPPe-V1_1	23 Apr 2014	6.2.1, 6.4.1, 6.4.2, 6.5.2.3, 6.5.5.2	Incorporated CRs: OMA-LOC-2014-0065-CR_LPPe_1.1_EARFCN_Corrections OMA-LOC-2014-0071-CR_LPPe_1.1_Corrections
	28 Aug 2014	6.2.1, 6.5.10, ASN.1 corrections : throughout ASN.1 sections	Incorporated CRs: OMA-LOC-2014-0148R01-CR_LPPe_1.1_Pressure_Measurements OMA-LOC-2014-0137-CR_LPPe_1.1_TS_ASN.1_Corrections
	12 Dec 2014	6.5.10.2, 6.5.10.9, C.4.1	Incorporated CR: OMA-LOC-2014-0189-CR_LPPe_1.1_Barometric_and__Atmospheric_Pressure

Document Identifier	Date	Sections	Description
Candidate Version OMA-TS-LPPe-V1_1	14 Apr 2015	n/a	Status changed to Candidate by TP TP Ref # OMA-TP-2015-0075-INP_LPPe_V1_1_ERP_for_Notification
Draft Versions OMA-TS-LPPe-V1_1	13 Nov 2015	6.5.8.5	OMA-LOC-2015-0046-CR_LPPe_1.1_Clarification
Draft Versions OMA-TS-LPPe-V1_1	27 Jul 2016	6.4.1, 6.5.1.8, 6.5.8.5, 6.5.8.6, 6.5.8.7, 6.5.8.9	OMA-LOC-2016-0030-CR_LPPe_1.1_Indoor_Positioning_Correction_Part_I OMA-LOC-2016-0031-CR_LPPe_1.1_Indoor_Positioning_Correction_Part_II_Option_1
Draft Versions OMA-TS-LPPe-V1_1	8 Feb 2017	2.1	OMA-LOC-2017-0011-CR_LPPe_1_1_EGM96_reference
Draft Versions OMA-TS-LPPe-V1_1	19 Apr 2017	6.5	OMA-LOC-2017-0015R01-CR_LPPe_1.1_Editorial_Corrections
Draft Versions OMA-TS-LPPe-V1_1	30 Jun 2020	2.1, 3.3, 6.4, 6.5,	OMA-LOC-2020-0014R01-CR_LPPe1.1_Civic_Location
Candidate Versions OMA-TS-LPPe-V1_1	04 Aug 2020	n/a	Status changed to Candidate by LOC OMA-LOC-2020-0021-INP_LPP_Extensions_1.1_for_Candidate_Approval

Appendix B. Static Conformance Requirements (Normative)

The notation used in this appendix is specified in [SCRRULES].

B.1 SCR for LPPe Client

B.1.1 LPPe messages

Item	Function	Reference	Requirement
LPPe-MSG-C-001-M	Support message extension header	TS 6.2.2	
LPPe-MSG-C-002-M	Support version adaptation based on version and compatibility level	TS 4.2	
LPPe-MSG-C-003-M	Support of the extension to LPP Request Capabilities message	TS 6.2.2	
LPPe-MSG-C-004-M	Support of the extension to LPP Provide Capabilities message	TS 6.2.2	
LPPe-MSG-C-005-M	Support of the extension to LPP Request Assistance Data message	TS 6.2.2	
LPPe-MSG-C-006-M	Support of the extension to LPP Provide Assistance Data message	TS 6.2.2	
LPPe-MSG-C-007-M	Support of the extension to LPP Request Location Information message	TS 6.2.2	
LPPe-MSG-C-008-M	Support of the extension to LPP Provide Location Information message	TS 6.2.2	
LPPe-MSG-C-009-M	Support of the extension to LPP Error message	TS 6.2.2	
LPPe-MSG-C-010-M	Support of the extension to LPP Abort message	TS 6.2.2	
LPPe-MSG-C-011-M	Support reversed mode for Capability Exchange	TS 5.3	
LPPe-MSG-C-012-M	Support reversed mode for Location Information Exchange	TS 5.3	

B.1.2 LPPe procedures

Item	Function	Reference	Requirement
LPPe-PRO-C-001-O	Support of periodic assistance data	TS 5.2.1 TS 5.2.1.1	
LPPe-PRO-C-002-O	Support target update of periodic assistance data delivery parameters	TS 5.2.1.2	LPPe-PRO-C-001-O
LPPe-PRO-C-003-O	Support server update of periodic assistance data delivery parameters	TS 5.2.1.3	LPPe-PRO-C-001-O

Item	Function	Reference	Requirement
LPPe-PRO-C-004-O	Support of periodic location information	TS 5.2.2 TS 5.2.2.1	
LPPe-PRO-C-005-O	Support target update of periodic location information reporting parameters	TS 5.2.2.3	LPPe-PRO-C-004-O
LPPe-PRO-C-006-O	Support server update of periodic location information reporting parameters	TS 5.2.2.2	LPPe-PRO-C-004-O
LPP-PRO-C-007-O	Support assistance data segmentation procedures	TS 5.2.3	

B.1.3 LPPe Assistance Data

Item	Function	Reference	Requirement
LPPe-AD-C-001-O	Support of validity area	TS 6.4.1	
LPPe-AD-C-002-O	Support of validity period	TS 6.4.1	
LPPe-AD-C-003-O	Support of generic assistance container	TS 6.4.1	
LPPe-AD-C-004-O	Support of geographical coverage areas	TS 6.4.1	
LPPe-AD-C-005-O	Support of common AGNSS assistance data	TS 6.5.1.1 TS 6.5.1.3	
LPPe-AD-C-006-O	Support of generic AGNSS assistance data	TS 6.5.1.1 TS 6.5.1.3	
LPPe-AD-C-007-O	Support of local Klobuchar ionosphere model	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-C-001-O LPPe-AD-C-002-O
LPPe-AD-C-008-O	Support of ionosphere storm indication	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-C-001-O LPPe-AD-C-002-O
LPPe-AD-C-009-O	Support of wide area ionosphere surface	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-C-001-O LPPe-AD-C-002-O LPPe-PRO-C-001-O
LPPe-AD-C-010-O	Support troposphere delay	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-C-001-O LPPe-AD-C-002-O LPPe-AD-C-012-O
LPPe-AD-C-011-O	Support of troposphere surface parameters	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-C-001-O LPPe-AD-C-002-O LPPe-AD-C-012-O
LPPe-AD-C-012-O	Support of mapping function	TS 6.5.1.2 TS 6.5.1.4	
LPPe-AD-C-013-O	Support of altitude assistance	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-C-001-O LPPe-AD-C-002-O
LPPe-AD-C-014-O	Support of SV mechanics assistance	TS 6.5.1.2 TS 6.5.1.4	
LPPe-AD-C-015-O	Support of SV differential code biases	TS 6.5.1.2 TS 6.5.1.4	
LPPe-AD-C-016-O	Support of navigation	TS 6.5.1.2	

Item	Function	Reference	Requirement
	model degradation models	TS 6.5.1.4	
LPPe-AD-C-017-O	Support CCP assistance	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-C-001-O LPPe-PRO-C-001-O LPPe-PRO-C-002-O LPPe-PRO-C-003-O LPPe-AD-C-019-O
LPPe-AD-C-018-O	Support change of CCP reference station	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-C-017-O
LPPe-AD-C-019-O	Support of antenna information	1.1.1.1	
LPPe-AD-C-020-O	Support of coordinate-based navigation model	TS 6.5.1.2 TS 6.5.1.4	
LPPe-AD-C-021-O	Support assistance for UE-based LTE OTDOA	TS 6.5.2.1 TS 6.5.2.2 TS 6.5.2.3	
LPPe-AD-C-022-O	Support assistance for UE-based EOTD	TS 6.5.3.1 TS 6.5.3.2 TS 6.5.3.3	
LPPe-AD-C-023-O	Support assistance for UE-assisted EOTD	TS 6.5.2.1 TS 6.5.2.2 TS 6.5.2.3	
LPPe-AD-C-024-O	Support assistance for UE-based OTDOA-UTRA	TS 6.5.4.1 TS 6.5.4.2 TS 6.5.4.3	
LPPe-AD-C-025-O	Support assistance for UE-assisted OTDOA-UTRA	TS 6.5.4.1 TS 6.5.4.2 TS 6.5.4.3	
LPPe-AD-C-026-O	Support assistance for UE-based LTE ECID for eNodeBs	TS 6.5.5.5 TS 6.5.5.2 TS 6.5.5.3	
LPPe-AD-C-027-O	Support assistance for UE-based LTE ECID for Home eNodeBs	TS 6.5.5.1 TS 6.5.5.2 TS 6.5.5.3	LPPe-AD-C-004-O
LPPe-AD-C-028-O	Support assistance for UE-based GSM ECID	TS 6.5.6.1 TS 6.5.6.2 TS 6.5.6.3	
LPPe-AD-C-029-O	Support assistance for UE-based UTRA ECID for Node Bs	TS 6.5.7.1 TS 6.5.7.2 TS 6.5.7.3	LPPe-AD-C-004-O
LPPe-AD-C-030-O	Support assistance for UE-based UTRA ECID for Home Node Bs	TS 6.5.7.1 TS 6.5.7.2 TS 6.5.7.3	LPPe-AD-C-004-O
LPPe-AD-C-031-O	Support assistance for UE-based WLAN ECID	TS 6.5.8.1 TS 6.5.8.2 TS 6.5.8.3	LPPe-AD-C-004-O
LPPe-AD-C-032-O	Support assistance for UE-based BT (E)CID	TS 6.5.11.1	

Item	Function	Reference	Requirement
		TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-C-033-O	Support assistance data validity checking of assistance data for UE-based BT (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-C-034-O	Support assistance for UE-based BTLE (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-C-035-O	Support assistance data validity checking of assistance data for UE-based BTLE (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-C-036-O	Support assistance for UE-based NFC (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-C-037-O	Support assistance data validity checking of assistance data for UE-based NFC (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	

B.1.4 LPPe Location Information

Item	Function	Reference	Requirement
LPPe-LOC-C-001-O	Support high accuracy position representation	TS 6.4.1	
LPPe-LOC-C-002-O	Support high accuracy velocity representation	TS 6.4.1	
LPPe-LOC-C-003-O	Support IP address reporting	TS 6.4.2	
LPPe-LOC-C-004-O	Support location information container	TS 6.4.2	
LPPe-LOC-C-005-O	Support relative location change	TS 6.4.2	
LPPe-LOC-C-006-O	Support ionosphere observations	TS 6.5.1.6 TS 6.5.1.8	
LPPe-LOC-C-007-O	Support surface observations	TS 6.5.1.6 TS 6.5.1.8	
LPPe-LOC-C-008-O	Support HA GNSS measurements	TS 6.5.1.5 TS 6.5.1.8	LPPe-PRO-C-004-O LPPe-PRO-C-005-O LPPe-PRO-C-006-O LPPe-AD-C-018-O
LPPe-LOC-C-009-O	Support UE-based high accuracy GNSS positioning	6.5.1.8	LPPe-LOC-C-001-O LPPe-LOC-C-002-O LPPe-AD-C-017-O
LPPe-LOC-C-010-O	Support UE-based LTE	TS 6.5.2.4	LPPe-AD-C-021-O

Item	Function	Reference	Requirement
	OTDOA	TS 6.5.2.5 TS 6.5.2.6	
LPPe-LOC-C-011-O	Support UE-based EOTD	TS 6.5.3.4 TS 6.5.3.5 TS 6.5.3.6	LPPe-AD-C-022-O
LPPe-LOC-C-012-O	Support UE-assisted EOTD	TS 6.5.3.4 TS 6.5.3.5 TS 6.5.3.6	LPPe-AD-C-023-O
LPPe-LOC-C-013-O	Support UE-based OTDOA-UTRA	TS 6.5.4.4 TS 1.1.1.1 TS 6.5.4.6	LPPe-AD-C-024-O
LPPe-LOC-C-014-O	Support UE-assisted OTDOA-UTRA	TS 6.5.4.4 TS 1.1.1.1 TS 6.5.4.6	LPPe-AD-C-025-O
LPPe-LOC-C-015-O	Support UE-based LTE ECID	TS 6.5.5.4 TS 6.5.5.5 TS 6.5.5.6	LPPe-AD-C-026-O LPPe-AD-C-027-O
LPPe-LOC-C-016-O	Support historic reporting of LTE ECID measurements	TS 6.5.5.4 TS 6.5.5.5 TS 6.5.5.6	
LPPe-LOC-C-017-O	Support UE-based GSM ECID	TS 6.5.6.4 TS 6.5.6.5	LPPe-AD-C-028-O
LPPe-LOC-C-018-O	Support UE-assisted GSM ECID	TS 6.5.6.4 TS 6.5.6.5	
LPPe-LOC-C-019-O	Support historic reporting of GSM ECID measurements	TS 6.5.6.4 TS 6.5.6.5	
LPPe-LOC-C-020-O	Support UE-based UTRA ECID	TS 6.5.7.4 TS 6.5.7.5 TS 6.5.7.6	LPPe-AD-C-029-O LPPe-AD-C-030-O
LPPe-LOC-C-021-O	Support UE-assisted UTRA ECID	TS 6.5.7.4 TS 6.5.7.5 TS 6.5.7.6	
LPPe-LOC-C-022-O	Support historic reporting of UTRA ECID measurements	TS 6.5.7.4 TS 6.5.7.5 TS 6.5.7.6	
LPPe-LOC-C-023-O	Support UE-based WLAN ECID	TS 6.5.8.4 TS 6.5.8.5 TS 6.5.8.6	LPPe-AD-C-031-O
LPPe-LOC-C-024-O	Support UE-assisted WLAN ECID	TS 6.5.8.4 TS 6.5.8.5 TS 6.5.8.6	
LPPe-LOC-C-025-O	Support historic reporting of WLAN ECID measurements	TS 6.5.8.4 TS 6.5.8.5 TS 6.5.8.6	
LPPe-LOC-C-026-O	Support UE-assisted WiMax ECID	TS 6.5.7.1 TS 6.5.7.2	

Item	Function	Reference	Requirement
		TS 6.5.7.3	
LPPe-LOC-C-027-O	Support historic reporting of WiMax ECID measurements	TS 6.5.7.4 TS 6.5.7.5 TS 6.5.7.6	
LPPe-LOC-C-028-O	Support motion state	TS 6.5.10.5 TS 6.5.10.6 TS 6.5.10.7	
LPPe-LOC-C-029-O	Support UE-based BT (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	LPPe-AD-C-032-O LPPe-AD-C-033-O
LPPe-LOC-C-030-O	Support UE-assisted BT (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	
LPPe-LOC-C-031-O	Support UE-based BTLE (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	LPPe-AD-C-034-O LPPe-AD-C-035-O
LPPe-LOC-C-032-O	Support UE-assisted BTLE (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	
LPPe-LOC-C-033-O	Support UE-based NFC (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	LPPe-AD-C-036-O LPPe-AD-C-037-O
LPPe-LOC-C-034-O	Support UE-assisted NFC (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	
LPPe-LOC-C-035-O	Support UE-assisted Mobile Code –based positioning	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	
LPPe-LOC-C-036-O	Support historic measurement reporting for BT (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	
LPPe-LOC-C-037-O	Support historic measurement reporting for BTLE (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	
LPPe-LOC-C-038-O	Support historic measurement reporting for NFC (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	

Item	Function	Reference	Requirement
LPPe-LOC-C-039-O	Support historic measurement reporting for Mobile Codes	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	

B.2 SCR for LPPe Server

B.2.1 LPPe messages

Item	Function	Reference	Requirement
LPPe-MSG-S-001-M	Support message extension header	TS 6.2.2	
LPPe-MSG-S-002-M	Support version adaptation based on version and compatibility level	TS 4.2	
LPPe-MSG-S-003-M	Support of the extension to LPP Request Capabilities message	TS 6.2.2	
LPPe-MSG-S-004-M	Support of the extension to LPP Provide Capabilities message	TS 6.2.2	
LPPe-MSG-S-005-M	Support of the extension to LPP Request Assistance Data message	TS 6.2.2	
LPPe-MSG-S-006-M	Support of the extension to LPP Provide Assistance Data message	TS 6.2.2	
LPPe-MSG-S-007-M	Support of the extension to Request Location Information message	TS 6.2.2	
LPPe-MSG-S-008-M	Support of the extension to Provide Location Information message	TS 6.2.2	
LPPe-MSG-S-009-M	Support of the extension to LPP Error message	TS 6.2.2	
LPPe-MSG-S-010-M	Support of the extension to LPP Abort message	TS 6.2.2	
LPPe-MSG-S-011-M	Support reversed mode for Capability Exchange	TS 5.3	
LPPe-MSG-S-012-M	Support reversed mode for Location Information Exchange	TS 5.3	

B.2.2 LPPe procedures

Item	Function	Reference	Requirement
LPPe-PRO-S-001-O	Support of periodic assistance	TS 5.2.1 TS 5.2.1.1	
LPPe-PRO-S-002-O	Support target update of periodic assistance parameters	TS 5.2.1.2	LPPe-PRO-S-001-O
LPPe-PRO-S-003-O	Support server update of periodic assistance parameters	TS 5.2.1.3	LPPe-PRO-S-001-O
LPPe-PRO-S-004-O	Support of periodic measurements	TS 5.2.2 TS 5.2.2.1	
LPPe-PRO-S-005-O	Support target update of periodic measurement parameters	TS 5.2.2.3	LPPe-PRO-S-004-O
LPPe-PRO-S-006-O	Support server update of periodic measurement parameters	TS 5.2.2.2	LPPe-PRO-S-004-O
LPP-PRO-S-007-O	Support assistance data segmentation procedures	TS 5.2.3	

B.2.3 LPPe assistance data

Item	Function	Reference	Requirement
LPPe-AD-S-001-O	Support of validity area	TS 6.4.1	
LPPe-AD-S-002-O	Support of validity period	TS 6.4.1	
LPPe-AD-S-003-O	Support of generic assistance container	TS 6.4.1	
LPPe-AD-S-004-O	Support of geographical coverage areas	TS 6.4.1	
LPPe-AD-S-005-O	Support of common AGNSS assistance data	TS 6.5.1.1 TS 6.5.1.3	
LPPe-AD-S-006-O	Support of generic AGNSS assistance data	TS 6.5.1.1 TS 6.5.1.3	
LPPe-AD-S-007-O	Support of local Klobuchar ionosphere model	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-S-001-O LPPe-AD-S-002-O
LPPe-AD-S-008-O	Support of ionosphere storm indication	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-S-001-O LPPe-AD-S-002-O
LPPe-AD-S-009-O	Support of wide area ionosphere surface	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-S-001-O LPPe-AD-S-002-O LPPe-PRO-S-001-O LPPe-PRO-S-002-O LPPe-PRO-S-003-O
LPPe-AD-S-010-O	Support troposphere delay	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-S-001-O LPPe-AD-S-002-O LPPe-AD-S-012-O
LPPe-AD-S-011-O	Support of troposphere surface parameters	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-S-001-O LPPe-AD-S-002-O

Item	Function	Reference	Requirement
			LPPe-AD-S-012-O
LPPe-AD-S-012-O	Support of mapping function	TS 6.5.1.2 TS 6.5.1.4	
LPPe-AD-S-013-O	Support of altitude assistance	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-S-001-O LPPe-AD-S-002-O
LPPe-AD-S-014-O	Support of SV mechanics assistance	TS 6.5.1.2 TS 6.5.1.4	
LPPe-AD-S-015-O	Support of SV differential code biases	TS 6.5.1.2 TS 6.5.1.4	
LPPe-AD-S-016-O	Support of navigation model degradation models	TS 6.5.1.2 TS 6.5.1.4	
LPPe-AD-S-017-O	Support CCP assistance	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-S-001-O LPPe-PRO-S-001-O LPPe-PRO-S-002-O LPPe-PRO-S-003-O LPPe-AD-S-019-O
LPPe-AD-S-018-O	Support change of CCP reference station	TS 6.5.1.2 TS 6.5.1.4	LPPe-AD-S-017-O
LPPe-AD-S-019-O	Support of antenna information	1.1.1.1	
LPPe-AD-S-020-O	Support of coordinate-based navigation model	TS 6.5.1.2 TS 6.5.1.4	
LPPe-AD-S-021-O	Support assistance for UE-based LTE OTDOA	TS 6.5.2.1 TS 6.5.2.2 TS 6.5.2.3	
LPPe-AD-S-022-O	Support assistance for UE-based EOTD	TS 6.5.3.1 TS 6.5.3.2 TS 6.5.3.3	
LPPe-AD-S-023-O	Support assistance for UE-assisted EOTD	TS 6.5.2.1 TS 6.5.2.2 TS 6.5.2.3	
LPPe-AD-S-024-O	Support assistance for UE-based OTDOA-UTRA	TS 6.5.4.1 TS 6.5.4.2 TS 6.5.4.3	
LPPe-AD-S-025-O	Support assistance for UE-assisted OTDOA-UTRA	TS 6.5.4.1 TS 6.5.4.2 TS 6.5.4.3	
LPPe-AD-S-026-O	Support assistance for UE-based LTE ECID for eNodeBs	TS 6.5.5.1 TS 6.5.5.2 TS 6.5.5.3	
LPPe-AD-S-027-O	Support assistance for UE-based LTE ECID for Home eNodeBs	TS 6.5.5.1 TS 6.5.5.2 TS 6.5.5.3	LPPe-AD-S-004-O
LPPe-AD-S-028-O	Support assistance for UE-based GSM ECID	TS 6.5.6.1 TS 6.5.6.2 TS 6.5.6.3	

Item	Function	Reference	Requirement
LPPe-AD-S-029-O	Support assistance for UE-based UTRA ECID for Node Bs	TS 6.5.7.1 TS 6.5.7.2 TS 6.5.7.3	LPPe-AD-S-004-O
LPPe-AD-S-030-O	Support assistance for UE-based UTRA ECID for Home Node Bs	TS 6.5.7.1 TS 6.5.7.2 TS 6.5.7.3	LPPe-AD-S-004-O
LPPe-AD-S-031-O	Support assistance for UE-based WLAN ECID	TS 6.5.8.1 TS 6.5.8.2 TS 6.5.8.3	LPPe-AD-S-004-O
LPPe-AD-S-032-O	Support assistance for UE-based BT (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-S-033-O	Support assistance data validity checking of assistance data for UE-based BT (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-S-034-O	Support assistance for UE-based BTLE (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-S-035-O	Support assistance data validity checking of assistance data for UE-based BTLE (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-S-036-O	Support assistance for UE-based NFC (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	
LPPe-AD-S-037-O	Support assistance data validity checking of assistance data for UE-based NFC (E)CID	TS 6.5.11.1 TS 6.5.11.2 TS 6.5.11.3 TS 6.5.11.4	

B.2.4 LPPe location information

Item	Function	Reference	Requirement
LPPe-LOC-S-001-O	Support high accuracy position representation	TS 6.4.1	
LPPe-LOC-S-002-O	Support high accuracy velocity representation	TS 6.4.1	
LPPe-LOC-S-003-O	Support IP address reporting	TS 6.4.2	
LPPe-LOC-S-004-O	Support location information container	TS 6.4.2	
LPPe-LOC-S-005-O	Support relative location change	TS 6.4.2	
LPPe-LOC-S-006-O	Support ionosphere observations	TS 6.5.1.6 TS 6.5.1.8	

Item	Function	Reference	Requirement
LPPe-LOC-S-007-O	Support surface observations	TS 6.5.1.6 TS 6.5.1.8	
LPPe-LOC-S-008-O	Support HA GNSS measurements	TS 6.5.1.5 TS 6.5.1.8	LPPe-PRO-S-004-O LPPe-PRO-S-005-O LPPe-PRO-S-006-O LPPe-AD-S-018-O
LPPe-LOC-S-009-O	Support UE-based high accuracy GNSS positioning	6.5.1.8	LPPe-LOC-S-001-O LPPe-LOC-S-002-O LPPe-AD-S-017-O
LPPe-LOC-S-010-O	Support UE-based LTE OTDOA	TS 6.5.2.4 TS 6.5.2.5 TS 6.5.2.6	LPPe-AD-S-021-O
LPPe-LOC-S-011-O	Support UE-based EOTD	TS 6.5.3.4 TS 6.5.3.5 TS 6.5.3.6	LPPe-AD-S-022-O
LPPe-LOC-S-012-O	Support UE-assisted EOTD	TS 6.5.3.4 TS 6.5.3.5 TS 6.5.3.6	LPPe-AD-S-023-O
LPPe-LOC-S-013-O	Support UE-based OTDOA-UTRA	TS 6.5.4.4 TS 1.1.1.1 TS 6.5.4.6	LPPe-AD-S-024-O
LPPe-LOC-S-014-O	Support UE-assisted OTDOA-UTRA	TS 6.5.4.4 TS 1.1.1.1 TS 6.5.4.6	LPPe-AD-S-025-O
LPPe-LOC-S-015-O	Support UE-based LTE ECID	TS 6.5.5.4 TS 6.5.5.5 TS 6.5.5.6	LPPe-AD-S-026-O LPPe-AD-S-027-O
LPPe-LOC-S-016-O	Support historic reporting of LTE ECID measurements	TS 6.5.5.4 TS 6.5.5.5 TS 6.5.5.6	
LPPe-LOC-S-017-O	Support UE-based GSM ECID	TS 6.5.6.4 TS 6.5.6.5	LPPe-AD-S-028-O
LPPe-LOC-S-018-O	Support UE-assisted GSM ECID	TS 6.5.6.4 TS 6.5.6.5	
LPPe-LOC-S-019-O	Support historic reporting of GSM ECID measurements	TS 6.5.6.4 TS 6.5.6.5	
LPPe-LOC-S-020-O	Support UE-based UTRA ECID	TS 6.5.7.4 TS 6.5.7.5 TS 6.5.7.6	LPPe-AD-S-029-O LPPe-AD-S-030-O
LPPe-LOC-S-021-O	Support UE-assisted UTRA ECID	TS 6.5.7.4 TS 6.5.7.5 TS 6.5.7.6	
LPPe-LOC-S-022-O	Support historic reporting of UTRA ECID measurements	TS 6.5.7.4 TS 6.5.7.5 TS 6.5.7.6	
LPPe-LOC-S-023-O	Support UE-based	TS 6.5.8.4	LPPe-AD-S-031-O

Item	Function	Reference	Requirement
	WLAN ECID	TS 6.5.8.5 TS 6.5.8.6	
LPPe-LOC-S-024-O	Support UE-assisted WLAN ECID	TS 6.5.8.4 TS 6.5.8.5 TS 6.5.8.6	
LPPe-LOC-S-025-O	Support historic reporting of WLAN ECID measurements	TS 6.5.8.4 TS 6.5.8.5 TS 6.5.8.6	
LPPe-LOC-S-026-O	Support UE-assisted WiMax ECID	TS 6.5.7.1 TS 6.5.7.2 TS 6.5.7.3	
LPPe-LOC-S-027-O	Support historic reporting of WiMax ECID measurements	TS 6.5.7.4 TS 6.5.7.5 TS 6.5.7.6	
LPPe-LOC-S-028-O	Support motion state	TS 6.5.10.5 TS 6.5.10.6 TS 6.5.10.7	
LPPe-LOC-S-029-O	Support UE-based BT (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5.11.8	LPPe-AD-S-032-O LPPe-AD-S-033-O
LPPe-LOC-S-030-O	Support UE-assisted BT (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5	
LPPe-LOC-S-031-O	Support UE-based BTLE (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5	LPPe-AD-S-034-O LPPe-AD-S-035-O
LPPe-LOC-S-032-O	Support UE-assisted BTLE (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5	
LPPe-LOC-S-033-O	Support UE-based NFC (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5	LPPe-AD-S-036-O LPPe-AD-S-037-O
LPPe-LOC-S-034-O	Support UE-assisted NFC (E)CID	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5	
LPPe-LOC-S-035-O	Support UE-assisted Mobile Code –based positioning	TS 6.5.11.5 TS 6.5.11.6 TS 6.5.11.7 TS 6.5	

Appendix C. Use of Information Elements

C.1 Use of Validity Area Parameters

RLE (Run-Length Encoding) is an efficient method to encode areas. The building element of the area definition is a region of the grid. The size of the region, i.e. the number of degrees on each side of the region, is defined by 10/*RegionSizeInv*, where *RegionSizeInv* is given in the ValidityArea IE. Regions are rectangular in spherical coordinates, i.e. as many degrees in the north-south direction as in the east-west direction. A single region is described as a red box Figure 14.

The area to be described is fixed in the global coordinate system by expressing the coordinates of the north-west corner of the area. Let RS be the size of the grid region in degrees. Then

regionSizeInv = 10 / RS

And

North-West corner latitude in degrees = RS * *codedLatOfNWCorner* – 90 degrees

North-West corner longitude in degrees = RS * *codedLonOfNWCorner* – 180 degrees

And vice versa

codedLatOfNWCorner = floor ((North-West corner latitude in degrees + 90 degrees) / RS)

codedLonOfNWCorner = floor ((North-West corner longitude in degrees + 180 degrees) / RS)

The latitude in degrees is expressed in range [-90, 90] degrees and longitude in range [-180, 180) degrees.

Further, the width of the area is expressed in terms of how many regions fit into the area, i.e.

areaWidth = Area Width in degrees / RS.

NOTE: This assumes that the area width has been chosen appropriately so that it is divisible by RS.

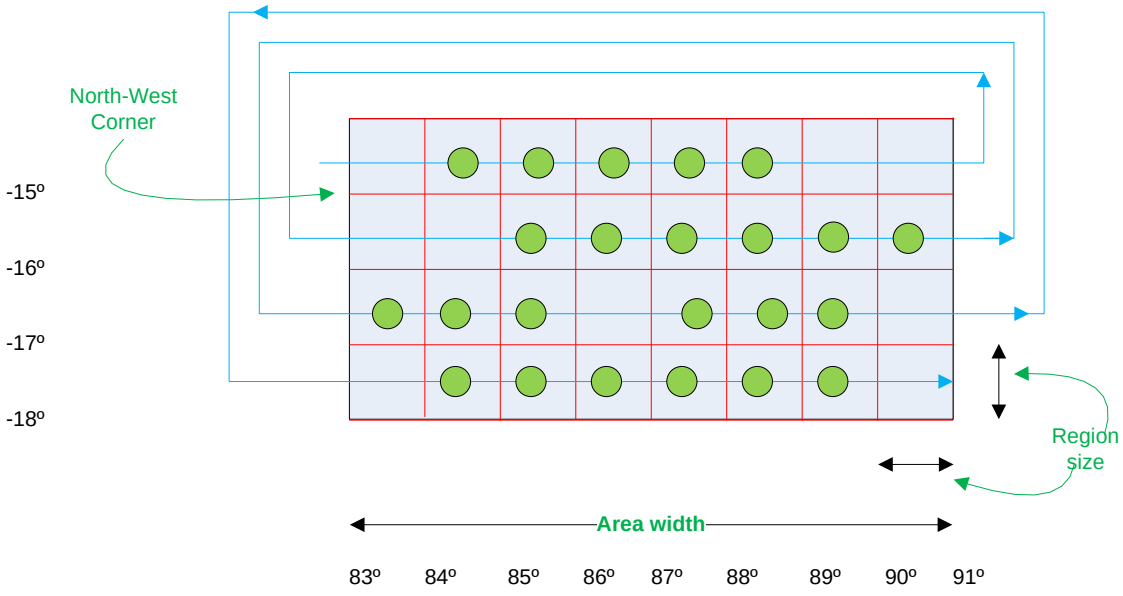


Figure 14: Run length encoding

In the example of Figure 14 RS = 1 degree, i.e. *regionSizeInv* = 10 / 1 = 10.

And the *areaWidth* = 8 degrees / RS = 8.

codedLatOfNWCorner = floor ((-15°+90°)/1°)=75. *codedLonOfNWCorner* = floor ((83°+180°)/1°) = 263.

The final aspect of the RLE encoding is to describe, in which regions the provided data is valid. In the case illustrated in Figure 14 the provided data is valid in regions marked with green dots. The blue line shows the order, in which the area is run through, i.e. always from left to right and starting from the upper left corner.

The *rleList* SHALL begin with the number of regions for which the data is not valid. Therefore, the first element in the *rleList* is "1". Note that if the data was valid in the first region (the region in the left upper corner), the first element would be "0".

Next, there are five regions for which the data is valid. Hence, the second element is "5". Next, there are four regions for which the data is not valid. Thus the next element is "4". Note that the knowing the width of the area in regions allows changing the line at the correct place. After this there are nine regions for which data is valid and the next element is "9".

The full *rleList*, therefore, is: 1 ; 5 ; 4 ; 9 ; 1 ; 3 ; 2 ; 6 ; 1.

In case there are more than 255 regions for which data is valid/non-valid, one can present this by "255 ; 0 ; x" denoting that there are 255+x regions for which data is valid/non-valid.

Finally, Figure 15 shows another example for which the *rleList* reads 0 ; 6 ; 4 ; 6 ; 1 ; 2 ; 1 ; 3 ; 2 ; 6 ; 1.

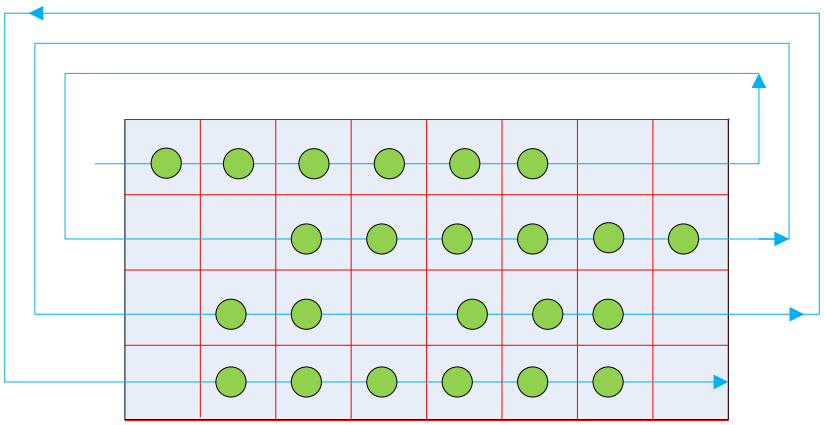


Figure 15: Run length encoding –example 2

C.2 Use of Ionospheric storm indications

The ionospheric storm indications are used for alerting the user on possible performance degradation due to high ionospheric activity. The storms tend to have high dynamics, and thus, the prediction may need to be divided in short validity periods, e.g. one hour periods. The prediction periods for the same area are listed in the IE StormList. The elements of StormList, OMA-*LPPe-AGNSS-StormElement*, comprise of the validity period and the *rleListIono* that indicates the ionospheric activity during the validity period, in each region in the area.

The area coding is carried out using a RLE list as above with the validity area. In this case, however, each region is assigned with an ionospheric index instead of Boolean valid/non-valid values. For example, if the first *rleIonoElement* in the *rleListIono* has the *ionoIndex* value G2 and *regionCount* value 11, it means that in the 11 first regions in the area, starting

from the North-West corner as explained above, the ionospheric activity level is G2, which means negligible effect on satellite navigation.

The NOAA ionospheric storm grading is as follows: G5 is an “extreme” storm, G4 “severe” and G3 “strong”. There are also G1 (minor) and G2 (moderate). Storms G3-G5 affect satellite navigation. G1 and G2 have negligible effect on satellite navigation. The values “unknown” and “none” describe the cases when there is no ionospheric data available or there is no activity, respectively. The NOAA storm definitions are available at http://www.swpc.noaa.gov/NOAAscales/ and from American Geophysical Union’s Eos (weekly newspaper of geophysics) Vol. 81, No. 29, July 18, 2000, Pages 322-328.

As an example, consider the case in Figure 16. In this scenario, the field *rleListIono* in the IE *OMA-LPPe-AGNSS-StormElement* would read {1,G3} ; {4,G4} ; {2,unknown} ; {1,G4} ; {2,G5} ; {1,G4} ; {2,G3} ; {1,G4} ; {1,G5} ; {6,G4} ; {2,G3} ; {1,none}.

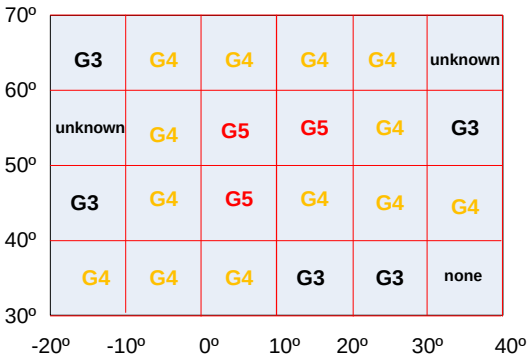


Figure 16: Ionosphere storm region

C.3 Use of periodic wide area ionosphere corrections

The ionosphere slant delay D^i in the units of TECU (10^{16} e$^-$/m^2) for the SV *i* at the target location can be given by

$$D^i = a_0 + e_1 \cdot \Delta e + n_1 \cdot \Delta n + e_2 \cdot (\Delta e)^2 + n_2 \cdot (\Delta n)^2 + en \cdot \Delta e \cdot \Delta n ,$$

where a_0, e_1, n_1, e_2, n_2 and en are the model coefficients. Further, Δe and Δn are the distances from the model reference position to the target position in the east and north directions expressed in kilometres, respectively. The distances are calculated along the surface of the geoid.

C.4 Troposphere Delay Model

The tropospheric delay is divided into two components, hydrostatic (dry) and non-hydrostatic (wet). Atmospheric gases that are in hydrostatic equilibrium cause the hydrostatic delay. This is usually the case for the dry gases and part of the water vapour. The wet delay, caused by water vapour that is not in hydrostatic equilibrium, varies widely, both spatially and temporally. Although the wet component is much smaller than the hydrostatic component, the uncertainties in the wet tropospheric delay modelling limit the achievable performance of the high precision GNSS applications given that carrier phase measurements themselves have an accuracy of a few millimeters.

Each of these components can be expressed as the product of the delay experienced by the radio signals in the zenith direction, the zenith delay, and a mapping function, which models the elevation angle dependence of the tropospheric delay:

$$\Delta(\varepsilon, h_{user}) = \Delta_{z,h}(\mathrm{h}_{\mathrm{user}}) \cdot \mathrm{m}_{\mathrm{h}}(\varepsilon) + \Delta_{z,w}(\mathrm{h}_{\mathrm{user}}) \cdot \mathrm{m}_{\mathrm{w}}(\varepsilon)$$

where $\Delta(\varepsilon, h_{user})$ is the tropospheric delay at a given SV elevation angle ε and user altitude h_{user}, $\Delta_{z,h}(h_{user})$ and $\Delta_{z,w}(h_{user})$ are, respectively, the hydrostatic and wet zenith delays at the user altitude, and $m_h(\varepsilon)$ and $m_w(\varepsilon)$ are the hydrostatic and wet mapping functions, respectively.

C.4.1 Mapping Zenith Delays to Target Altitude

The hydrostatic and wet zenith delays can be determined based on numerical weather predictions or some other meteorological data. Parameters for the troposphere zenith delay model are then determined by e.g. least-squares-fit of the computed zenith delay profiles. The model parameters are referred to the reference altitude h_{ref}. The zenith delays can be scaled to the user altitude as follows:

$$\Delta_{h,z}(h_{user}) = zh_0(h_{ref}) \cdot \exp(-e_h \cdot (h_{user} - h_{ref}))$$

$$\Delta_{w,z}(h_{user}) = zw_0(h_{ref}) \cdot \exp(-e_w \cdot (h_{user} - h_{ref}))$$

where $\Delta_{h,z}(h_{user})$ is hydrostatic and $\Delta_{w,z}(h_{user})$ wet zenith delays in meters at the user altitude h_{user}. The user altitude h_{user} is calculated with respect to the nominal sea level [EGM96]. The terms $zh_0(h_{ref})$ and $zw_0(h_{ref})$ are the hydrostatic and wet zenith delays at the reference altitude given in the IE *OMA-LPPe-AGNSS-LocalTroposphereDelayTimeElement.* Finally, the terms e_h and e_w are the exponential fit parameters for the hydrostatic and wet zenith delays.

C.4.1.1 Gradient Parameters

The total tropospheric slant delay can be considered as a combination of the azimuthally symmetric and asymmetric parts. Consequently, the notation for the neutral delay becomes

$$\Delta(\varepsilon, \phi, h_{user}) = \Delta_{z,h}(h_{user}) m_h(\varepsilon) + \Delta_{z,w}(h_{user}) m_w(\varepsilon) + m_a(\varepsilon) \cot \varepsilon \left[G_N \cos\phi + G_E \sin\phi \right]$$

where the tropospheric delay is first modelled into zenith direction and then projected into the direction of the satellite using a mapping function that is not only a function of the elevation angle, but also of azimuth angle ϕ, the angle counted clockwise from the true north. The m_a, which is a specific mapping function for the gradient terms can be chosen equal to m_h. The asymmetric components are determined by a horizontal gradient model, where G_N and G_E are the path delay gradient parameters in the North and East direction, respectively, from the IE *OMA-LPPe-AGNSS-LocalTroposphereDelayTimeElement*. These terms describe the total horizontal gradients, including both hydrostatic and wet components.

Horizontal gradients in the refractivity field result from pressure, temperature, and humidity gradients. Path delay exhibits thus both hydrostatic and wet gradients, though of different spatial scales and temporal correlation. Gradient parameters can be modelled either deterministically or stochastically as random walks in the estimation algorithm. Typically gradients are smaller than 1mm in zenith direction, which translates to a delay of a few centimeters at 10 degrees elevation. The importance of accounting for the azimuthal asymmetry increases, when the satellite elevation angle mask, i.e. the minimum elevation angle from which the measurements are accepted, decreases. This is because then the distance travelled in the troposphere increases.

C.4.2 Mapping Function

The tropospheric delay in the direction of zenith is scaled to lower elevation angles by using a mapping function defined by:

$$m(\varepsilon) = \frac{\Delta(\varepsilon)}{\Delta_z},$$

where ε is the elevation angle of the observed satellite from the horizon, $m(\varepsilon)$ is the mapping function, Δ_z is the zenith delay and $\Delta(\varepsilon)$ the slant delay. Δ_z is either computed from the surface parameters in the IE *OMA-LPPe-AGNSS-LocalSurfaceParameterList* or given as a parameter in the IE *OMA-LPPe-AGNSS-LocalTroposphereDelay*.

The approach taken here assumes a horizontally stratified atmosphere with separated mapping functions for the hydrostatic and the wet part. The total slant delay thus becomes:

$$\Delta(\varepsilon, h_{user}) = \Delta_{z,h}\left(h_{user}\right) \cdot m_h(\varepsilon) + \Delta_{z,w}\left(h_{user}\right) \cdot m_w(\varepsilon)$$

where the mapping functions are presented in the continued fraction expansion form proposed by Herring (Herring, T.A. 1992. Modeling Atmospheric Delays in the Analysis of Space Geodetic Data. In proceedings of the Symposium: Refraction of the Transatmospheric Signals in Geodesy, Hague, The Netherlands):

$$m(\varepsilon) = \frac{1 + \dfrac{a}{1 + \dfrac{b}{1+c}}}{\sin(\varepsilon) + \dfrac{a}{\sin(\varepsilon) + \dfrac{b}{\sin(\varepsilon)+c}}}$$

Three coefficients a, b, and c are enough to map zenith delays down to elevations of 3 degrees. The values for the hydrostatic and wet mapping functions can be derived from numerical weather prediction (NWP) models. The mapping function is independent of the target altitude.

The mapping function m_h is obtained using the mapping function parameters *ah*, *bh* and *ch* from the IE *OMA-LPPe-AGNSS-MappingFunctionParameters*. Likewise, m_w is obtained using the mapping function parameters *aw*, *bw* and *cw* from the IE *OMA-LPPe-AGNSS-MappingFunctionParameters*.

C.5 Satellite body-fixed coordinate frame

The satellite body fixed coordinate frame is defined as follows:

$$e_z = -\frac{\underline{r_{sat}}}{\left\|\underline{r_{sat}}\right\|},\ \underline{e_y} = \frac{\underline{e_z} \times \underline{e_{sun}}}{\left\|\underline{e_z} \times \underline{e_{sun}}\right\|},\ \underline{e_x} = \frac{\underline{e_y} \times \underline{e_z}}{\left\|\underline{e_y} \times \underline{e_z}\right\|},$$

where $\underline{e_{sun}} = \dfrac{\underline{r_{sun}} - \underline{r_{sat}}}{\left\|\underline{r_{sun}} - \underline{r_{sat}}\right\|}$ is the unit vector from the satellite to the sun. The vectors $\underline{r_{sun}}$ and $\underline{r_{sat}}$ are the sun and satellite positions in Earth-centered reference frame.

Figure 17 shows the resulting Satellite-fixed coordinate system. The unit vector e_z points from the satellite center of mass to the center of the Earth. The unit vector $\underline{e_y}$ is perpendicular to both e_z and $\underline{e_{sun}}$. The $\underline{e_y}$ thus (righ-hand convention) points away from the plane. Finally, $\underline{e_x}$ is perpendicular to both $\underline{e_y}$ and e_z and thus lies in the plane.

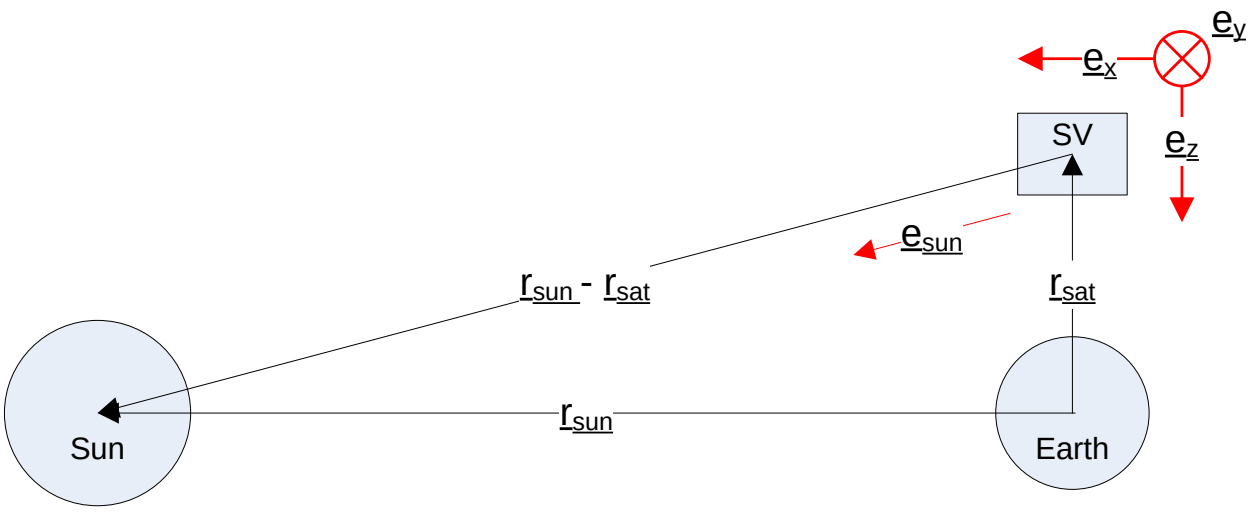


Figure 17: Satellite-fixed coordinate system

C.6 Navigation Degradation Models

C.6.1 Clock model Degradation Model

The clock model degradation at time t is modelled with the first-order polynomial

$$RMS_{CLOCK}(t) = cRMS_0 + cRMS_1(t - t_{oe}),$$

where t_{oe} is the time of ephemeris given in the Navigation Model parameters.

C.6.2 Orbit Model Degradation Model

The orbit model degradation at time t is modelled with the first-order polynomial

$$RMS_{ORBIT}(t) = oRMS_0 + oRMS_1(t - t_{oe}),$$

where t_{oe} is the time of ephemeris given in the Navigation Model parameters.

C.7 Solar radiation pressure

The acceleration a_{solar} due to the solar radiation experienced by the SV can be computed from

$$a_{solar} \sim P_{solar} \cdot (eA)_{eff} \cdot \frac{1}{m},$$

where P_{solar} is the solar radiation intensity at the Earth orbit, and $(eA)_{eff}$ the effective combined reflectivity and area. Lastly, m is the SV mass.

C.8 CRC16-IBM

The CRC16-IBM is calculated from an array of bytes using the polynomial $x^{16}+x^{15}+x^2+1$. The following code (in C) shows the reference implementation for calculating the CRC16-IBM.

```
#define WIDTH 16 /* Width of polynomial */
#define POLY 0x8005 /* Polynomial Bit #16 is set and hidden */
#define BYTE_BITS 8 /* Number of bits in byte */
#define TABLE_SIZE (1 << BYTE_BITS) /* Size of table */
#define MSB_MASK (1 << (WIDTH - 1)) /* Mask for high order bit in a word */

/* Table generated by 'crc16init()'  */
typedef uint16 Crc16;
static Crc16 table[TABLE_SIZE];

/* Initializes the table. Should be called once before the first call to 'crc16()' */
void crc16init(void)
                {
                Crc16 i;
                int j;
                for(i = 0; i < TABLE_SIZE; ++i)
                    {
                    Crc16 val = i << (WIDTH - BYTE_BITS);
                    for (j = 0; j < BYTE_BITS; ++j)
                                    val = (val << 1) ^ ((val & MSB_MASK) ? POLY : 0);
                    table[i] = val;
                    }
                    }

/* Calculates CRC16 of 'cnt' bytes from 'src' and returns result */
/*  Initial value of CRC16 is supplied by caller in 'crc' */
  Crc16 crc16(Crc16 crc, void const* src, int cnt)
                {
```

```
unsigned char const* s = (unsigned char const*)src;
while(cnt--)
    crc = (crc << BYTE_BITS)^ table[(crc >> (WIDTH - BYTE_BITS)) ^ *s++];

return crc;
}
```

C.9 Antenna information

LPPe allows for defining the antenna orientation with respect to the Earth-Fixed system with Euler Angles (α , β and γ).

C.9.1 Antenna reference frame

Figure 18 shows the reference coordinate system associated with the antenna. The coordinate system is defined so that the Z-axis co-incidences with the Antenna Plane normal vector and the Y-axis co-incidences with the Antenna Reference Direction. The X-axis is chosen so that the resulting X-Y-Z system is right-handed.

The plane and reference direction definitions are antenna vendor-specific.

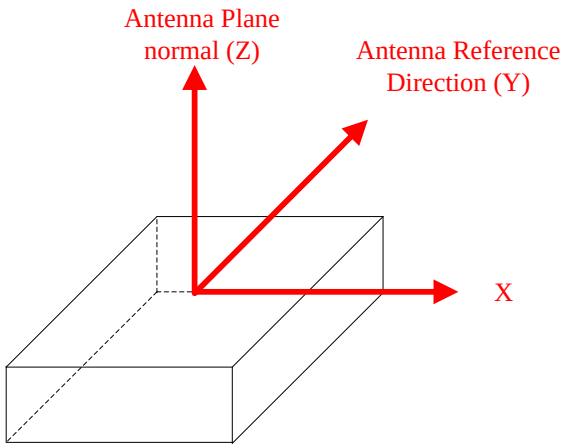


Figure 18: Antenna reference frame

C.9.2 Euler angles

Figure 19 shows the Euler Angles α , β and γ and their positive counter clock-wise directions (right-hand convention) with respect to the Earth-fixed East-North-Up right-handed coordinate system (blue axes).

The β denotes the counter-clockwise angle between the vertical direction and the antenna plane normal vector (Z). The β ranges from 0º (Vertical and Z parallel) to 180º (Vertical and Z anti-parallel).

The α denotes the counter-clockwise angle between East and Line of Nodes. The α ranges from 0º (East and Line of Nodes parallel) to 359º.

The γ denotes the counter-clockwise angle between X and Line of Nodes. The γ ranges from 0º (X and Line of Nodes parallel) to 359º.

Line of Nodes is shown in Figure 19 as being the line of intersection for the horizontal and antenna planes. Line of Nodes is

perpendicular to both Vertical and Z axes.

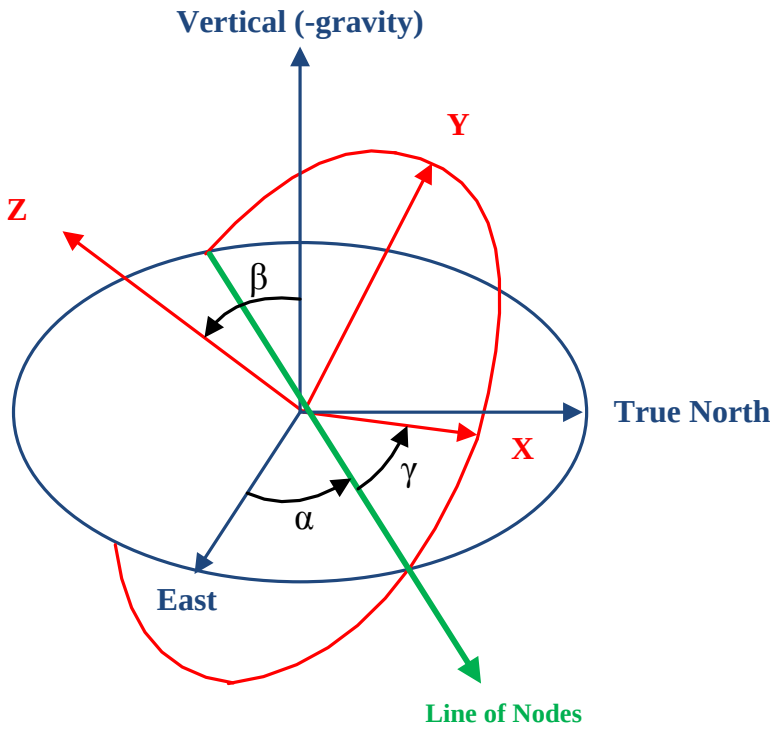


Figure 19: Euler Angles

Going from global coordinate system (East, True North, Vertical) to XYZ system in Figure 19 (extrinsic rotations):

- Rotate XYZ system about Vertical by γ. The X axis now makes angle γ with the East axis
- Rotate XYZ system about the East axis by β. The Z-axis now makes angle β with the Vertical
- Rotate XYZ system about the Vertical by α.

Alternatively, going from global coordinate system (East, True North, Vertical) to XYZ system in Figure 19 (intrinsic rotations):

- Rotate XYZ system about the Z-axis b α. The X-axis now lies on the Line of Nodes.
- Rotate XYZ system about the now-rotated X-axis b β. The Z-axis is now in its final direction. The X-axis is still on the Line of Node.
- Rotate the XYZ system about the new Z-axis by γ.

Note that in the gimbal lock situation (Z parallel or anti-parallel to β) the values of α and γ are not meaningful (non-unique) by themselves, but one considers the value of $\alpha + \gamma$ (when Z parallel to β) or $\alpha - \gamma$ (when Z anti-parallel to β), which are uniquely defined, respectively.

Appendix D. Example flows (informative)

D.1 Exemplary periodic data flows

D.1.1 CCP Assistance Data Transfer procedure – nominal case

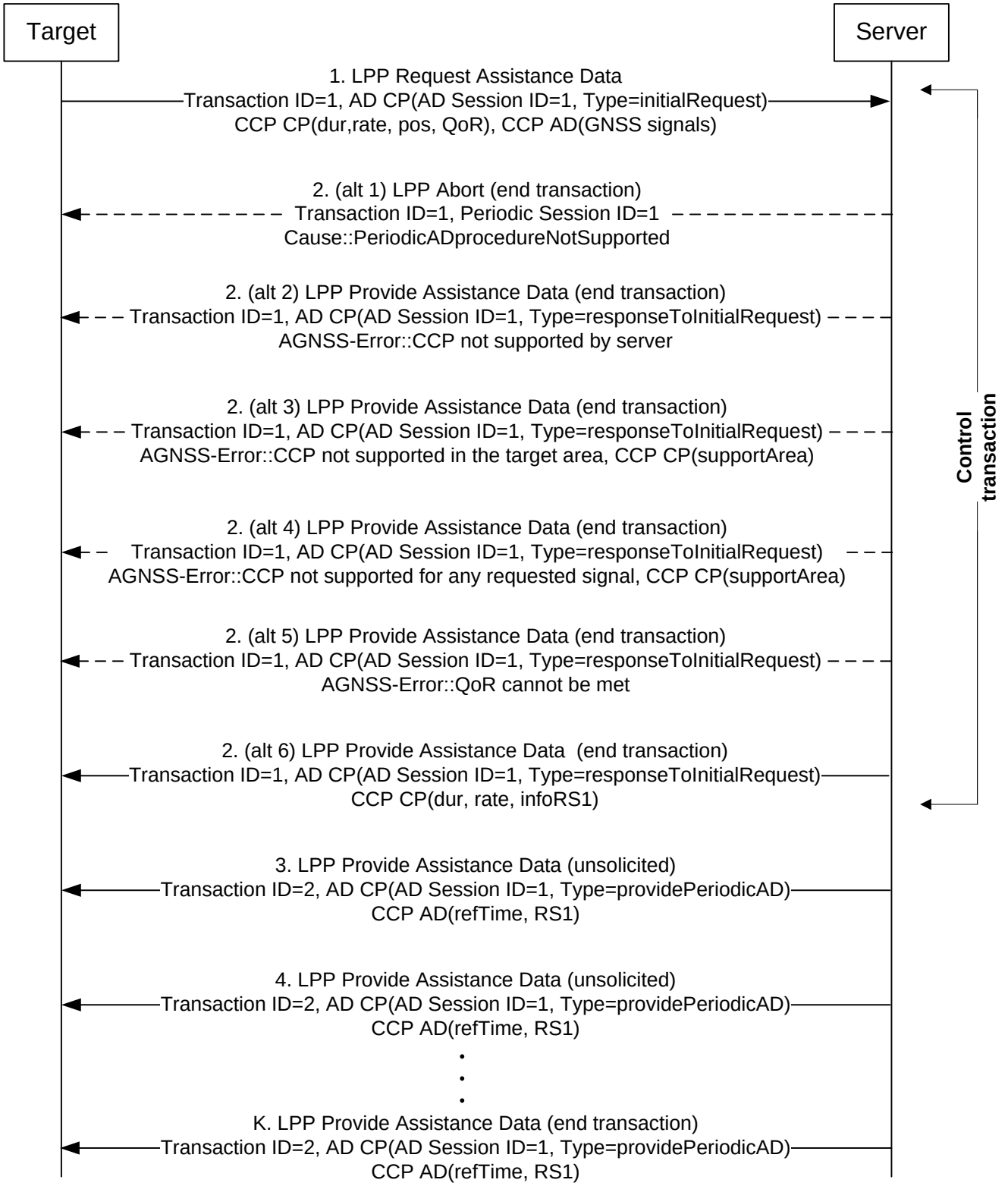


Figure 20: Assistance data transfer – nominal case

1. The target requests for the periodic AD and within that CCP assistance. The request contains the Periodic AD session ID in the AD control parameters (AD CP) and the requested duration, rate, QoR (quality-of-reference-

station) and the target position in the CCP-specific control parameters (CCP CP). Furthermore, the generic part of the AGNSS AD request carries the information for which GNSS signals the CCP AD is being requested.

The Periodic AD session ID (1 in this flow) in the AD CP allows for modifying the periodic AD session parameters (stopping, changing duration and rate of delivery) as well as changing reference stations within the CCP assistance session. The Periodic AD session ID binds the messaging associated with the single Periodic AD session together by making the Periodic AD session-related message exchange independent of the LPP transaction handling.

2. (alternative 1) In case the server does not support periodic AD, the server shall abort the ongoing procedure.

2. (alternative 2) In case the server does not support CCP assistance, the server shall send back LPP Provide Assistance Data with AGNSS error code "CCP not supported by server". The transaction gets terminated.

2. (alternative 3) In case the server does not support CCP assistance for the target area, the server shall send back LPP Provide Assistance Data with AGNSS error code "CCP not supported in the target area" as well as the CCP support area assistance. The transaction gets terminated.

2. (alternative 4) In case the server cannot provide the target with a CCP assistance for any requested GNSS signal, the server shall send back LPP Provide Assistance Data with AGNSS error code "CCP not supported for any requested signal". The transaction gets terminated.

2. (alternative 5) In case the server cannot provide the target with a CCP assistance at the requested QoR, the server shall send back LPP Provide Assistance Data with AGNSS error code "QoR cannot be met". The transaction gets terminated.

2. (alternative 6) The server sends LPP Provide AD message with the AD CP as well as the CCP-specific control parameters (CCP CP) in the common part of the AGNSS AD. The AD CP carries the periodic AD session ID. In the CCP CP the server provides back at least the duration, rate and information on the reference station RS1 for which CCP AD will be provided. The duration and rate may or may not be the same as requested. In case multi-reference support is indicated (in the capabilities), the server may provide CCP AD also for multiple reference stations.

3. Server starts to provide periodic CCP AD to the target for RS1. The common CCP AD carries the reference time and the generic CCP AD the assistance for the GNSS signals and for the reference stations in use.

   The actual CCP AD is provided to the target in a new transaction (ID=2). The AD session ID stays at ID=1.

4. The server continues to provide the target with periodic CCP AD.

K. Periodic session terminates, when the duration of the session expires.

D.1.2 CCP Assistance Data Transfer procedure – session abort by target/server

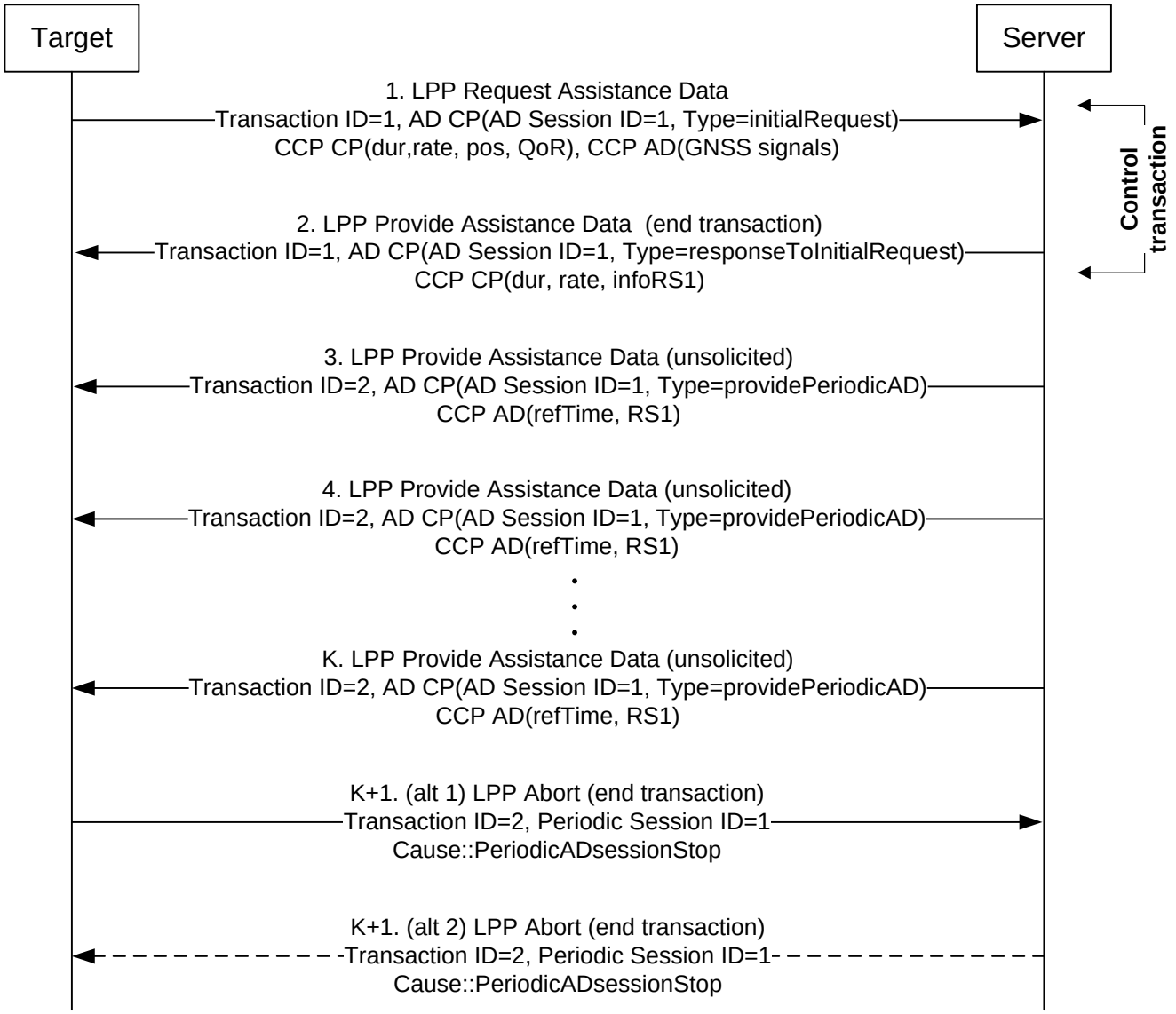


Figure 21: CCP assistance data transfer – session stop

1 - 4. As in the previous flow.

K. The server continues to provide the target with periodic CCP AD.

K+1. (alt 1) The target aborts the session prematurely.

K+1. (alt 2) The server aborts the session prematurely.

D.1.3 CCP Assistance Data Transfer procedure - session modification (target)

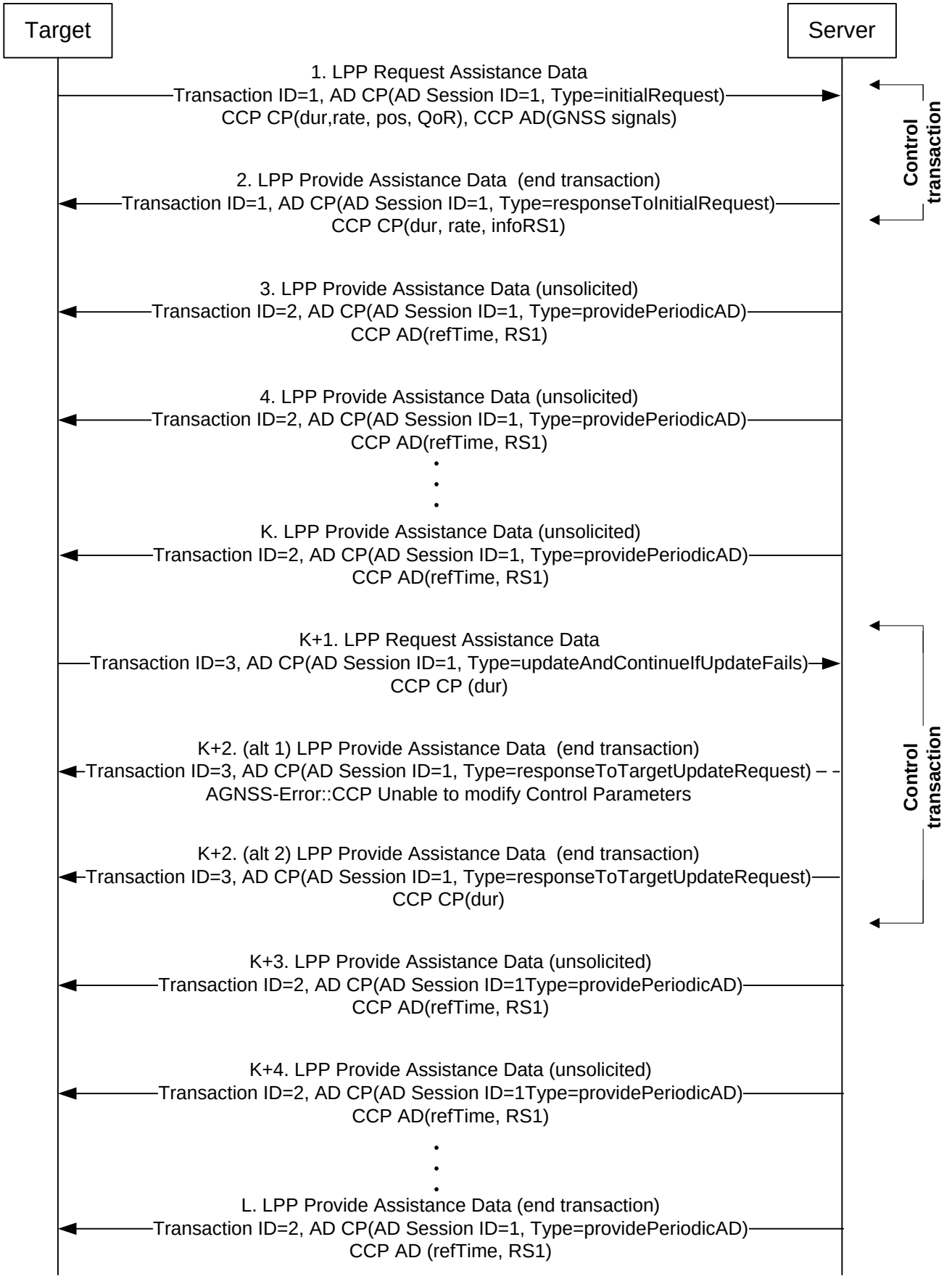


Figure 22: CCP assistance data transfer – session parameter modification (target)

1 - K. As in the previous flow.

K+1. The target requests the modification of the CCP CP (duration in this example). The request launches a new LPP transaction (ID=3), but the period AD session ID does not change (ID=1).

K+2. (alt 1) In case the server is unable to modify the CCP CP, the server shall return the error code "Unable to modify control parameters".

Note that in case the target had indicated "updateAndAbortIfUpdateFails" the provision of AD would have been aborted by server without any further Provide AD (or Abort/Error) messages.

K+2. (alt 2) The server sends LPP Provide AD message with the modified CCP Control Parameter (duration). The modified duration may or may not be the same as requested by the target.

K+3. The server continues to provide the target with periodic CCP AD in the transaction with ID=2 and periodic session ID=1.

K+4. The server continues to provide the target with periodic CCP AD in the transaction with ID=2 and periodic session ID=1.

L. The session terminates, when the duration expires.

D.1.4 CCP Assistance Data Transfer procedure - session modification (server)

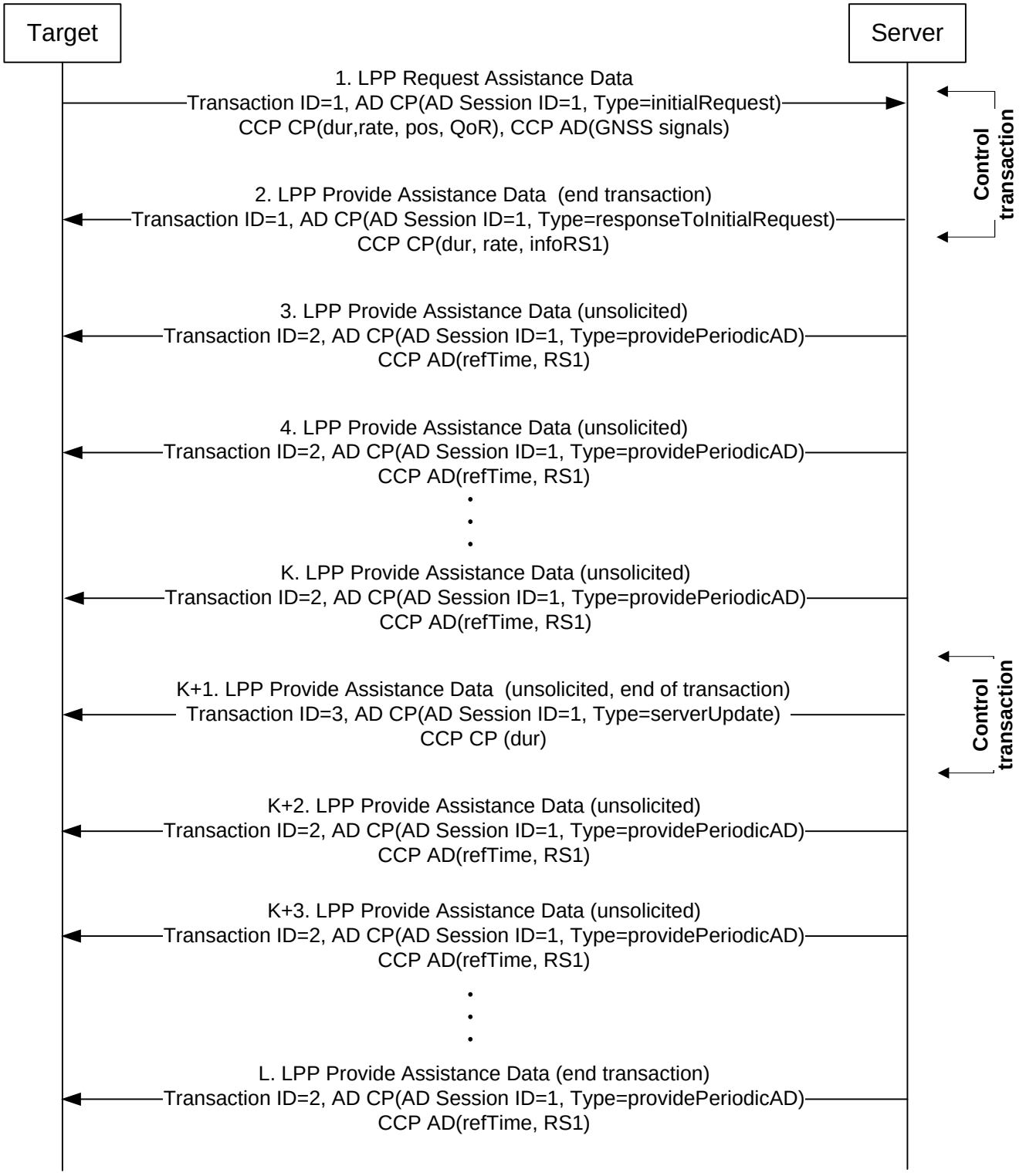


Figure 23: CCP assistance data transfer – session parameter modification (server)

1 - K. As in the previous flow.

K+1. The server sends LPP Provide AD message with the new CCP Control Parameters (duration in this example). The new duration overrides the previous duration.

The new duration is provided in a new LPP transaction (ID=3), but the periodic AD session ID does not change (ID=1).

K+2. The server continues to provide the target with periodic CCP AD in the transaction with ID=2 and periodic AD session ID=1.

K+3. The server continues to provide the target with periodic CCP AD in the transaction with ID=2 and periodic AD session ID=1.

L. The session terminates, when the duration expires.

D.1.5 CCP Assistance Data Transfer procedure - change of reference station

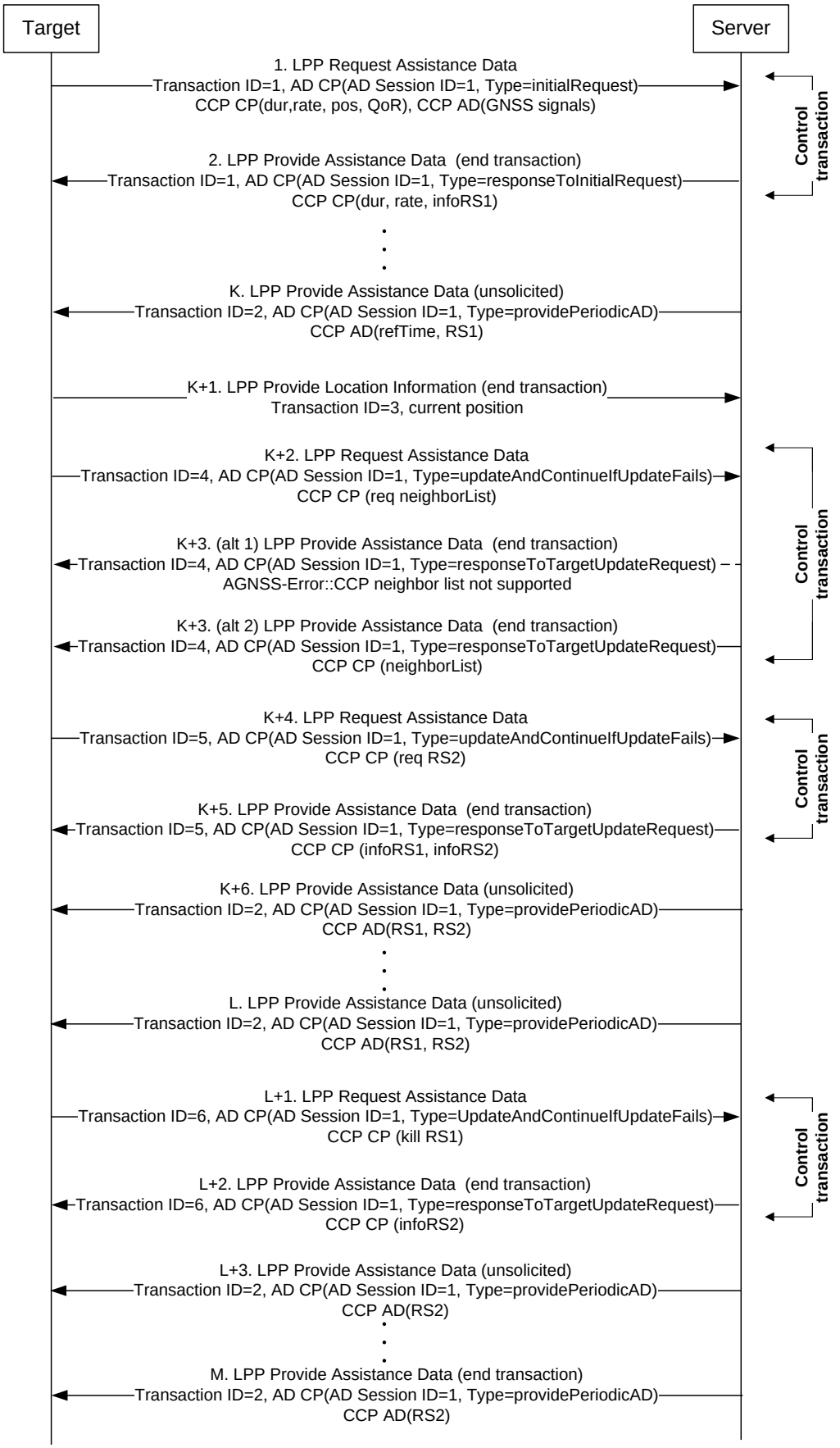


Figure 24: CCP assistance data transfer – change of reference station

1 - K. As in the previous flow

K+1. The target provides its current location to the server in the new transaction with ID=3

K+2. The target request for the neighbor list in the new transaction with ID=4

K+3. (alternative 1) The server indicates that the neighbor list is not supported. The session continues, but the target does not obtain the neighbor list. Note that in the further steps shown it is assumed that the target did receive the neighbor list, i.e. the rest of the call flow assumes alternative 2 in the step K+3.

Note that in case the target had indicated "updateAndAbortIfUpdateFails" the provision of AD would have been aborted by server without any further Provide AD (or Abort/Error) messages.

K+3. (alternative 2) The server provides the neighbor list

K+4. The target request for CCP AD for the RS2 in the new transaction with ID=5

K+5. The server provides the reference station information for the RS1 and RS2. This indicates that the server starts provide AD for the both reference stations.

Note that the call flow assumes that the AD update request is a successful one. See D.1.6 for a failure case.

K+6. The server provides CCP AD for RS1 and RS2

(target performs operations required to change the reference station)

L. The server provides CCP AD for RS1 and RS2

L+1. The target request for killing the CCP AD delivery for the RS1 in the new transaction with ID=6

L+2. The server confirms the change by providing the RS information only for the RS2 in the CCP CP

L+3. The server provides CCP AD for RS2 in the transaction with ID=2. The periodic AD session ID has stayed the same throughout the session.

M. The periodic AD assistance session terminates, when the duration expires.

D.1.6 CCP Assistance Data Transfer procedure - change of reference station (fail)

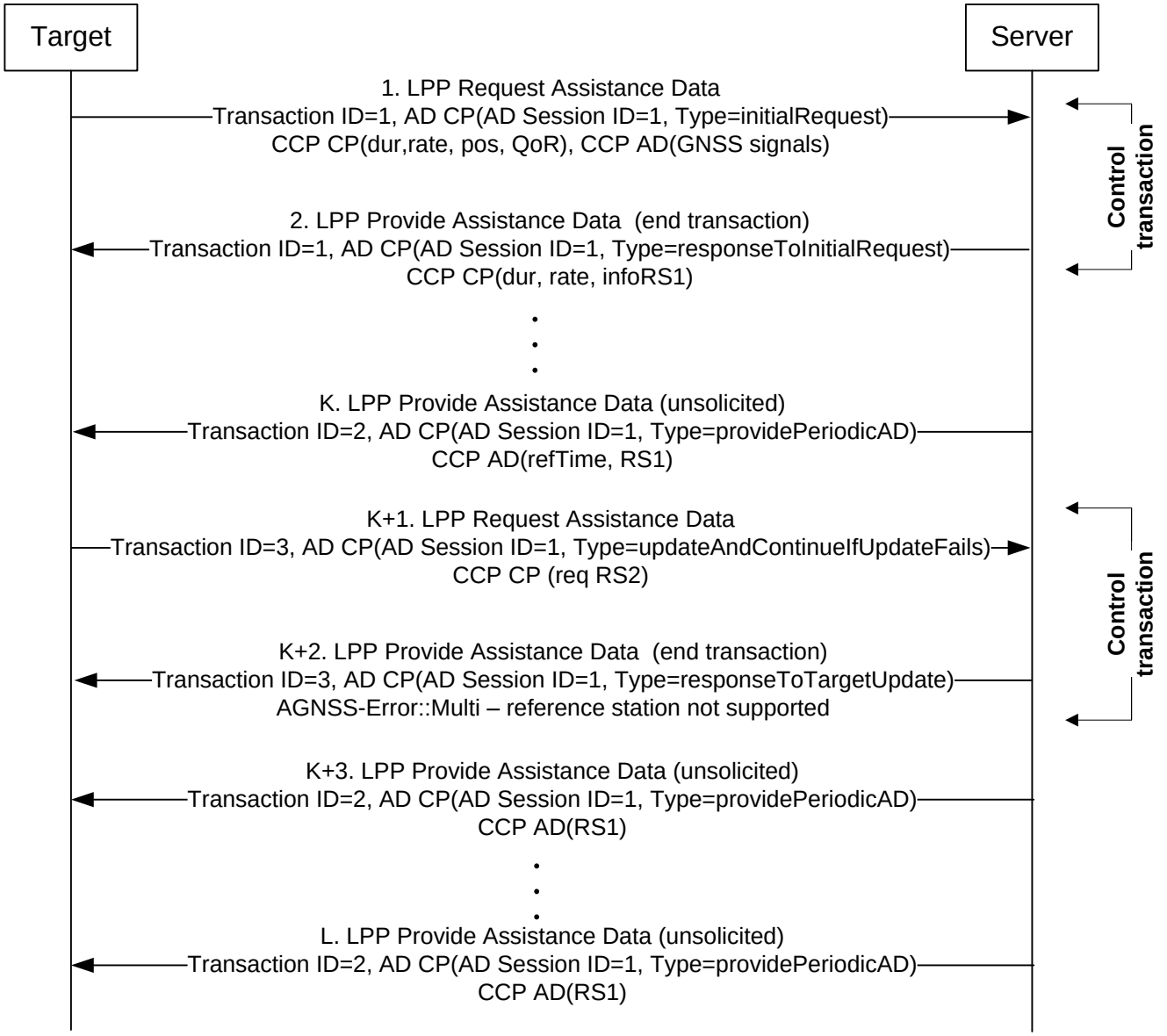


Figure 25: CCP assistance data transfer – failure in the change of reference station

1 - K. As in the previous flow

K+1. The target request for CCP AD for RS2 in the new transaction with ID=3

Note that the target might have requested for the neighbor list as in the previous case prior to this step.

In case the neighbor list is empty, the target may still request for another reference station based on position, i.e. the empty neighbor list does not indicate that the server is not capable of providing CPP AD for multiple reference stations.

K+2. The server responds with the AGNSS-Error "multi-reference station not supported" in LPP Provide AD indicating that the server cannot provide CCP AD for multiple reference stations at the same time.

Note that in case the target requested for the neighbor list and it was returned non-empty, the server may still be unable to provide CPP AD for multiple reference stations (see next step). In this case the target might decide to continue with the current reference station. Alternatively the target may abort the current session and start another CCP AD session based on the knowledge (from the neighbor list) that there are potential reference stations nearby.

Note that in case the target had indicated "updateAndAbortIfUpdateFails" the provision of AD would have been aborted by server without any further Provide AD (or Abort/Error) messages.

K+3. The server continues to provide CCP AD for RS1 in the transaction with ID=1 and periodic AD session ID=1

L. The periodic AD assistance session terminates, when the duration expires.

D.1.7 CCP Assistance Data Transfer procedure – unsolicited

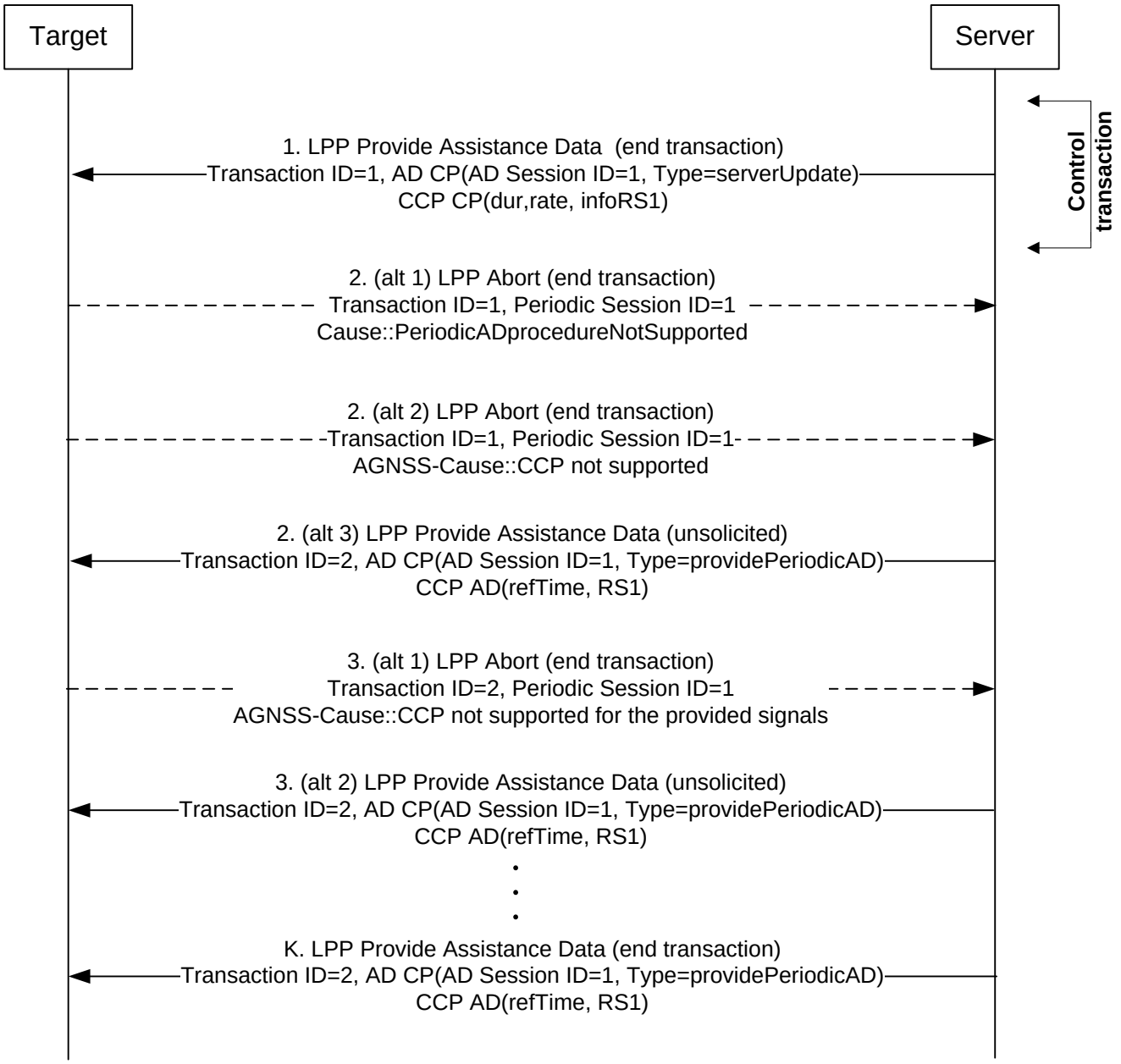


Figure 26: CCP assistance data transfer – unsolicited

1. The server sends LPP Provide AD message with the Periodic AD control parameters (AD CP) as well as the CCP-specific control parameters (CCP CP).

2. (alternative 1) The target aborts the session, because the target does not support periodic AD procedure.

2. (alternative 2) The target aborts the session, because the target does not support CCP AD.

2. (alternative 3) Server starts to provide periodic CCP AD to the target for RS1.

3. (alternative 1) The target aborts the session, because the target does not support CCP AD for the provided GNSSs/signals

3. (alternative 2) Server provides periodic CCP AD to the target for RS1

K. Periodic session terminates, when the duration of the session expires.

D.2 Periodic High Accuracy GNSS examples

D.2.1 Nominal case

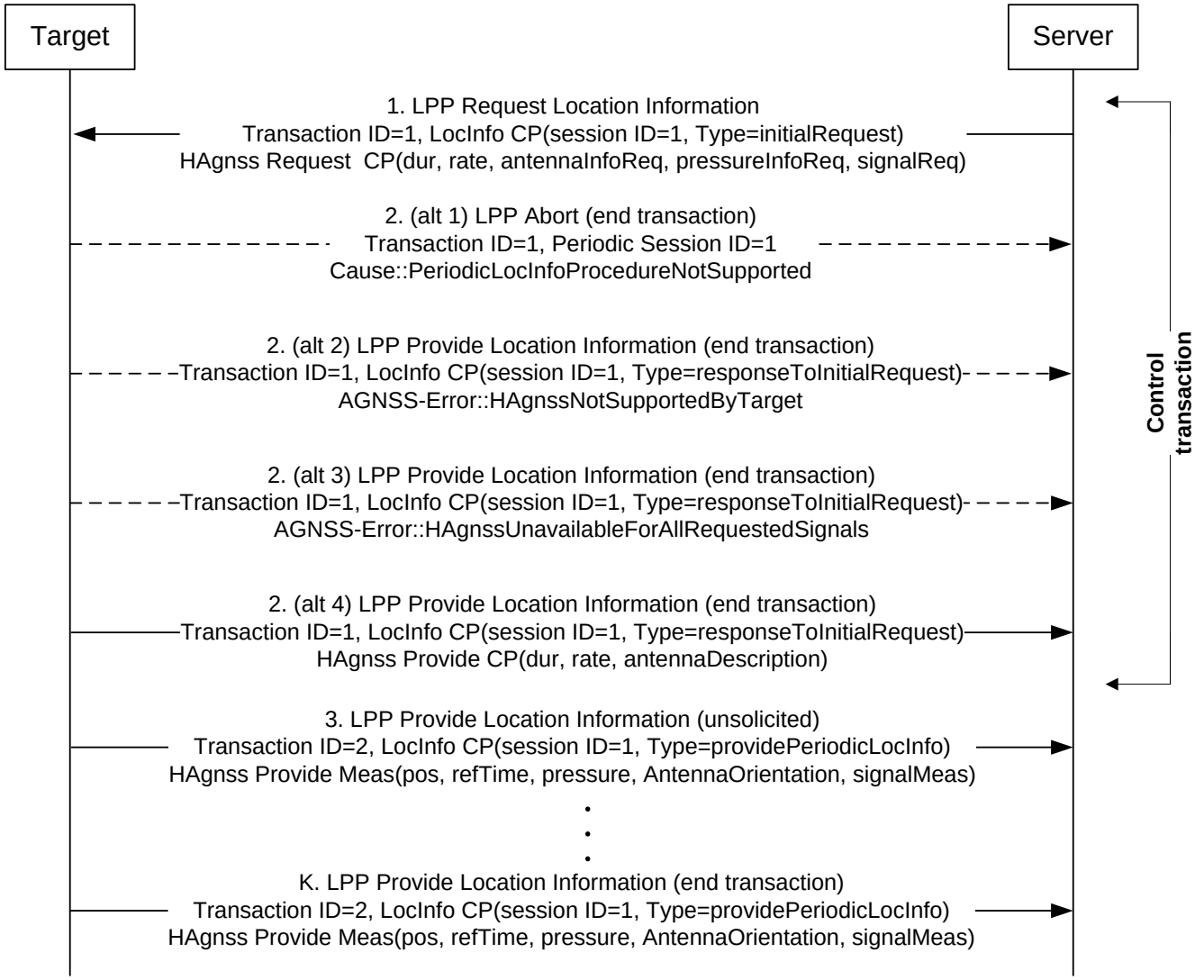


Figure 27: Periodic HA GNSS – nominal case

1. The server requests the periodic HA GNSS measurements from the target. The common part of the Location Information request carries the periodic session ID, which stays the same throughout the HA GNSS session.

   The HA GNSS CP (Control Parameter) request carries the requested duration of the session, rate of the measurement deliveries, information if pressure information is to be provided and GNSS signals requested. Moreover, the request also defines if the antenna information is to be provided.

2. (alternative 1) In case the target does not support periodic Location Information delivery, the target shall abort the session by the cause "Periodic Location Information Procedure Not Supported".

2. (alternative 2) In case the target does not support HA GNSS, the target shall reply with the AGNSS Error "HA

GNSS Not Supported By Target". The session gets terminated without further message exchange.

2. (alternative 3) In case the target does not support HA GNSS for any requested GNSS signal, the target shall reply with AGNSS Error "HA GNSS not unavailable for all requested signals". The session gets terminated without further message exchange.

2. (alternative 4) In case the target can support the request the HA GNSS CP provide IE carries the confirmation for the duration of the session and the rate of the message deliveries. The duration and rate may or may not be the same as requested. In case antenna description was requested and supported, it shall be provided in the provide CP.

3. The target starts to provide Periodic Location Information messages from the server to the target in a new (unsolicited) transaction with ID=2. The provide message carry at least the signal measurements. The pressure information is carried, if requested and supported. The position and reference time information is carried unless forbidden by the LPP proper AGNSS measurement control. The antenna orientation information is provided, if requested and supported.

K. The session terminates, when the duration expires.

D.2.2 Server-side session modification

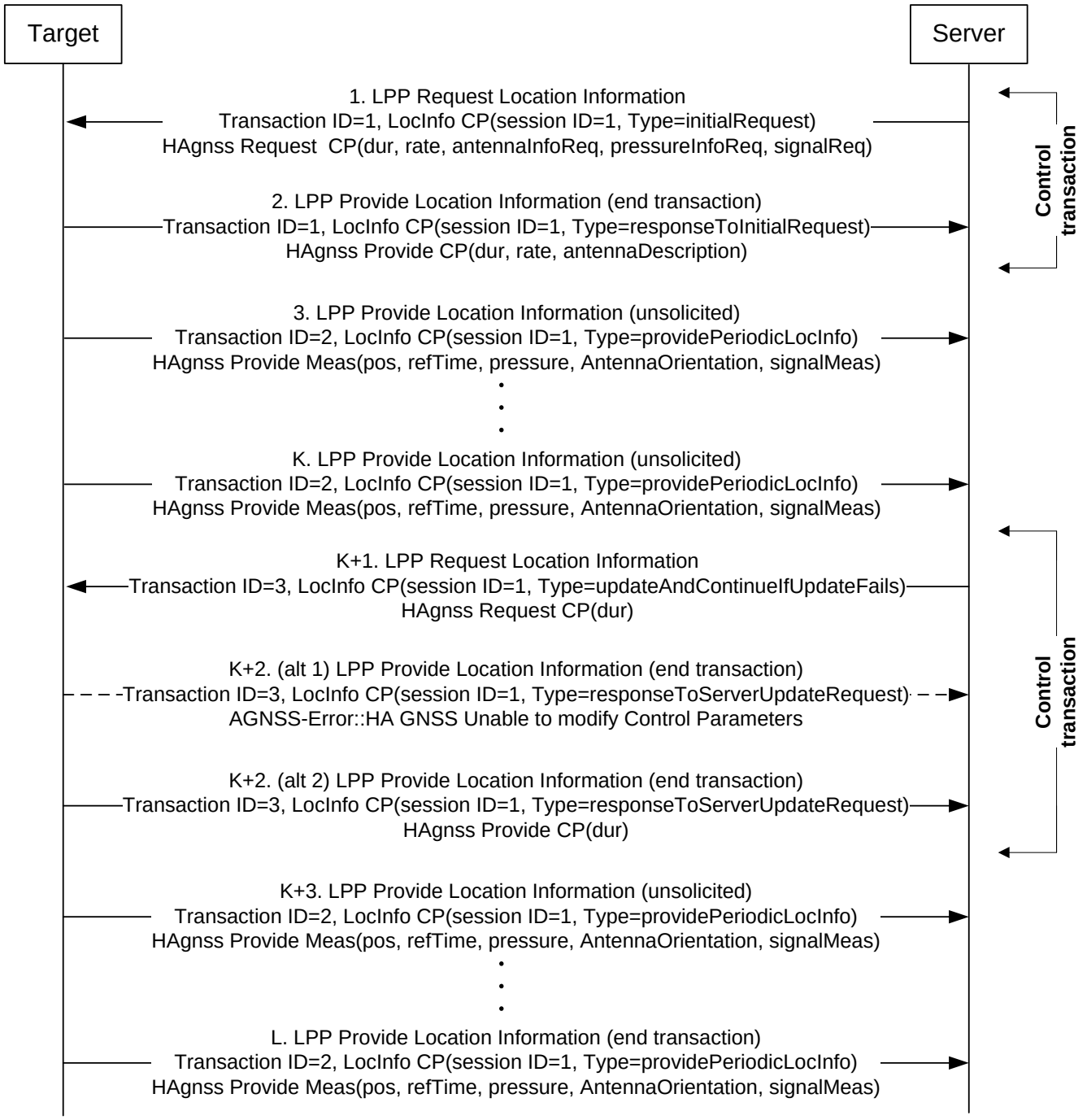


Figure 28: Periodic HA GNSS – nominal case

1 - 3. As in the previous flow.

K. The target continues to provide periodic HA GNSS measurements to the server according to the control parameters.

K+1. The server requests for a new duration for the periodic HA GNSS in HA GNSS CP Request. The request launches a new transaction with ID=3.

K+2. (alternative 1) In case the target cannot update the HA GNSS CP, the target shall reply with the error code

"Unable to Modify Control Parameters". The session continues without abruption, because the server indicated in the request "Continue If Update Fails". In case, however, the server indicated "Abort If Update Fails" then the target would have aborted the session without further messages to the server.

K+2. (alternative 2) The target confirms the new duration in the HA GNSS CP Provide. The duration may or may not be the same as requested by the server.

K+3. The target continues to provide HA GNSS measurements to the server in the transaction with ID=2 according to the updated control parameters.

L. The session terminates, when the duration expires.

D.2.3 Target/server-side abort

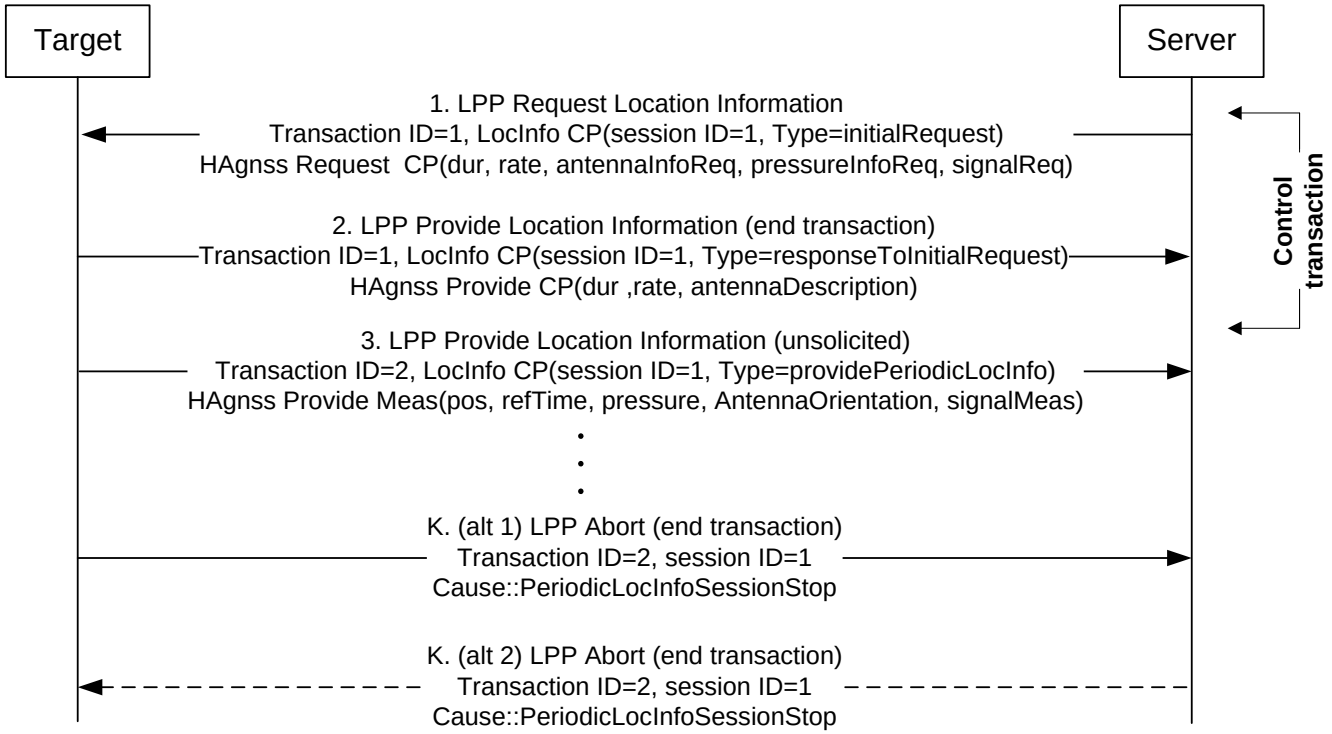


Figure 29: Periodic HA GNSS – abort

1 - 3. As in the previous flow.

K. (alternative 1) The target aborts the session with the cause Periodic Location Information Session Stop

K. (alternative 2) The server aborts the session with the cause Periodic Location Information Session Stop

D.3 Periodic wide area ionosphere corrections procedure

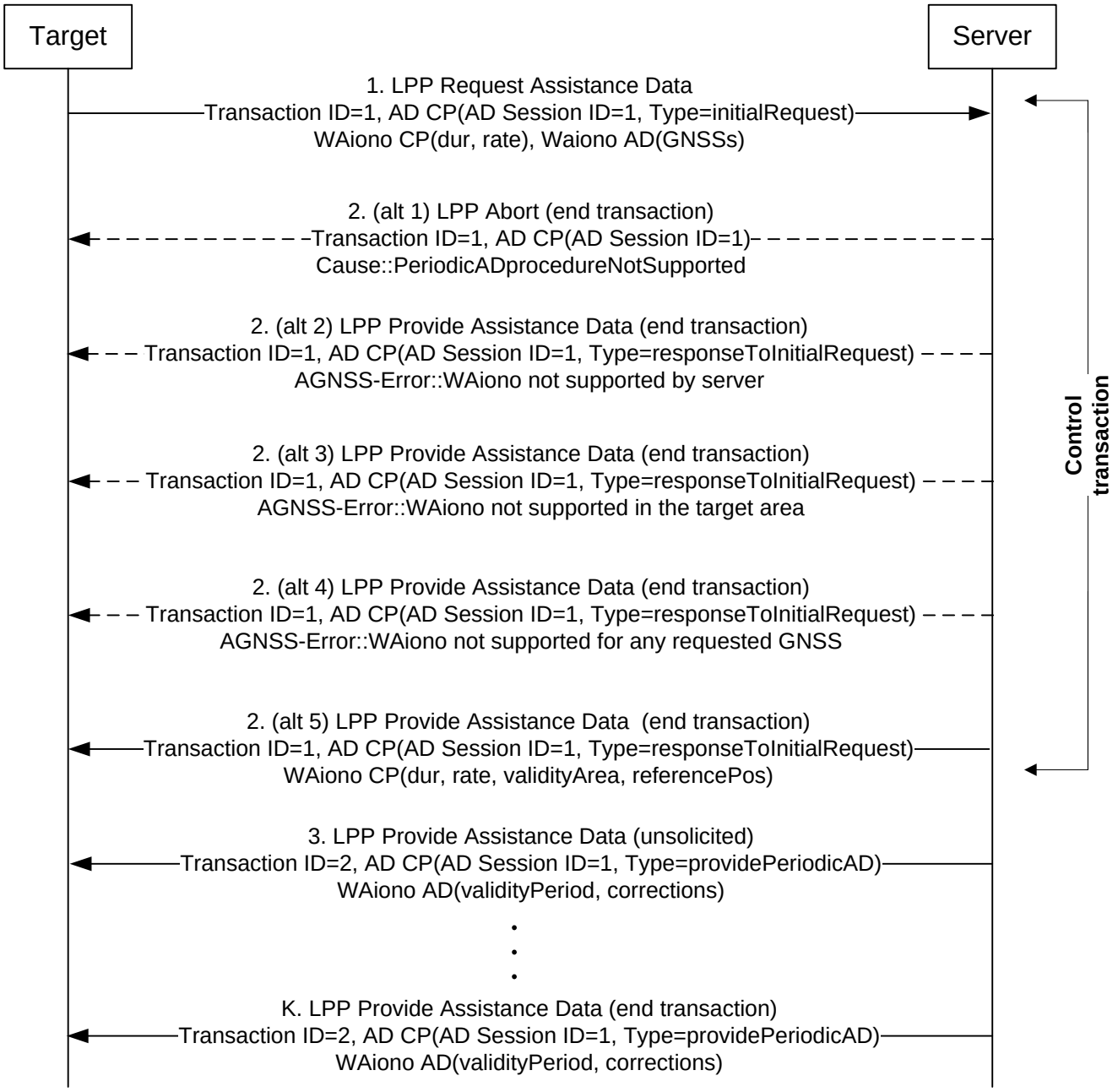


Figure 30: Periodic procedure in the context of wide area ionosphere surface corrections

1. The target requests for the periodic AD for WA Ionosphere Surface AD. The request contains the requested WA Iono Control Parameters (duration, rate) and the list of GNSSs for which the corrections are being requested for.

2. (alternative 1) In case the server does not support periodic AD, the server shall abort the ongoing procedure.

2. (alternative 2) In case the server does not support WA Ionosphere Surface assistance, the server shall send back LPPe Provide Assistance Data with AGNSS error code "WA iono not supported by server". The transaction gets terminated.

2. (alternative 3) In case the server does not support WA Ionosphere Surface assistance for the target area, the server

shall send back LPPe Provide Assistance Data with AGNSS error code “WA iono not supported in the target area”. The transaction gets terminated.

2. (alternative 4) In case the server cannot provide the target with WA Ionosphere Surface assistance for any requested GNSS, the server shall send back LPP Provide Assistance Data with AGNSS error code “WA iono not supported for any requested GNSS”. The transaction gets terminated.

2. (alternative 5) The server sends LPP Provide AD message with the WA Iono Control. The first message carries the duration, rate, validity area and the model reference position. Note that the duration and/or rate may or may not be the same as requested by the target.

   All the control parameters may be updated in a later phase either unsolicited by server or based on the target request using the periodic AD update procedure.

3. Server starts to provide periodic WA Ionosphere Surface AD to the target. The actual WA Ionosphere Surface AD is provided to the target in a new transaction (ID=2). The AD session ID stays at ID=1.

K. Periodic session terminates, when the duration of the session expires.

Appendix E. Broadcast Restrictions and Labelling (Normative) – version 1.1

This appendix defines restrictions applicable to the content of broadcast assistance data and limitations on the areas within which certain types of assistance data may be broadcast. This appendix also provides a means of labelling different types of assistance data. The labels may be used both within LPPe and by a broadcast system to advertise support for particular types of assistance data and/or to provide broadcast scheduling information. The precise use of the labels by particular broadcast systems is outside the scope of this specification.

E.1 LPP Restrictions and Labels

Table 6 shows the different types of assistance data for LPP that may be broadcast where each assistance data type is referred to using its ASN.1 parameter name. For each assistance data type, an area limitation is shown if the assistance data is only valid within a restricted area. A server may broadcast assistance data outside the area limitation if it is preferred to provide target devices with assistance data for a wider geographic area although there is no guarantee that the data will always be usable in that case. Other restrictions for assistance data are also shown where these exist – e.g. any restrictions on content. It is assumed that assistance data that is time sensitive (e.g. GNSS time, GNSS real time integrity, GNSS acquisition assistance) will be updated as needed by the server and that stale data will be removed. For assistance data that includes an explicit validity area, broadcast outside the validity area is allowed and a target is assumed to verify presence within the validity area before using the data.

The table also shows labels that may be used within LPPe and by a broadcast system to refer to particular types of assistance data – e.g. when indicating broadcast support for different types of assistance data within LPPe or when indicating which assistance data types are being broadcast by a broadcast system. A label is specified as a sequence of n (n = 1 to 4) numerical elements separated by periods – e.g. 2, 2.1, 2.1.3, 2.1.3.5 – where n is the nesting level of the labelled data item.

In the table, the nesting level of any assistance data type is indicated using a “>” symbol where the number of concatened “>” symbols m shown for any data item and its associated label indicates that its nesting level is m+1 where m is in the range 0 to 3. The order of data items in the table follows the ASN.1 definition which means that the parent data item for any nested data item at level n is the closest preceding data item in the table at level n-1. Labels are shown in column 1 and show only the final elements, since preceding elements can be inferred from the final elements for the parent data items. As an example, the assistance data type otdoa-ProvideAssistanceData has a nesting level of 1 and label of 2; the data type otdoa-NeighbourCellInfo (which is nested within and one level deeper than otdoa-ProvideAssistanceData) has a nesting level of 2 and a label of 2.2; and the assistance data type gnss-DataBitAssistance has a nesting level of 4 and a label of 3.2.N.5 where N (N = 1 to 9) indicates the particular GNSS or SBAS system to which it applies.

Label	ASN.1 Assistance Data Type	Area Limitation	Other Restrictions
1	commonIEsProvideAssistanceData	None	None (Note 1)
2	otdoa-ProvideAssistanceData		
> 1	> otdoa-ReferenceCellInfo	Limited to the area served by the provided neighbor cells and reference cell	
> 2	> otdoa-NeighbourCellInfo	Limited to the area served by the provided neighbor cells and reference cell	expectedRSTD shall refer to a target at the midpoint between the reference cell and neighbor cell eNodeB antenna locations. expectedRSTD-Uncertainty shall allow for a target at any location where the neighbor and reference cells can both be measured.
3	a-gnss-ProvideAssistanceData		

> 1	> gnss-CommonAssistData		
>> 1	>> gnss-ReferenceTime	Limited to the area served by the provided cells (up to 16) if GNSS-cell time is included. No restriction otherwise.	GNSS-cell time association, if provided for any cell, applies to the antenna location for the cell
>> 2	>> gnss-ReferenceLocation	None	The location uncertainty ellipsoid should encompass the area within which this assistance data is broadcast
>> 3	>> gnss-IonosphericModel	None	None
>> 4	>> gnss-EarthOrientationParameters	None	None
> 2	> gnss-GenericAssistData		
>> N	>> gnss-ID / sbas-ID		The label N indicates the GNSS or SBAS system as follow: N=1: GPS N=2: QZSS N=3: Galileo N=4: Glonass N=5: WAAS N=6: EGNOS N=7: MSAS N=8: GAGAN
>>> 1	>>> gnss-TimeModels	None	None
>>> 2	>>> gnss-DifferentialCorrections	None	None
>>> 3	>>> gnss-NavigationModel	None	None
>>> 4	>>> gnss-RealTimeIntegrity	None	None
>>> 5	>>> gnss-DataBitAssistance	None	None
>>> 6	>>> gnss-AcquisitionAssistance	It is recommended to limit this data type to an area of 100 miles across or less	The server should ensure that the data is valid for all locations at which it may be received (e.g. by providing suitable values for Doppler uncertainty and Code Phase search window).
>>> 7	>>> gnss-Almanac	None	None
>>> 8	>>> gnss-UTC-Model	None	None
>>> 9	>>> gnss-AuxiliaryInformation	None	None

Table 6: LPP Assistance Data Restrictions and Labels

Note 1: this AD parameter is empty in LPP Rel-9 through Rel-11 but is included as a placeholder for possible use in a later release of LPP.

E.2 LPPe Restrictions and Labels

Table 7 shows the different types of assistance data for LPPe 1.1 that may be broadcast, with associated area limitations and other restrictions, where each data type is referred to using using its ASN.1 parameter name. The conventions used to define nesting levels and labels are as described for LPP in section E.1.

Label	ASN.1 Assistance Data Type	Area Limitation	Other Restrictions
1	commonIEsProvideAssistanceData	None	None
> 1	> assistanceContainerList	Any area limitation is specific to the type of proprietary assistance data	checkOrUpdateOrError shall not be included dataResult shall contain OMA-LPPe-AssistanceContainerData
> 2	> providePeriodicADwithUpdate	Any area limitation is specific to the type of assistance data	A server shall follow the procedure defined in section 5.2.1.4 when including this parameter.
> 3	> segmentedADTransfer		Not used in this version of LPPe. A target shall ignore this parameter if included by a server.
> 4	> default-reference-point	None	None
> 5	> localCellInformation	Limited to the area served by the provided cells.	GNSS-cell time association, if provided for any cell, applies to the antenna location for the cell
2	agnss-ProvideAssistanceData		
> 1	> commonAssistData		
>> 1	>> ionosphericModel	None	None
>> 2	>> troposphereModel	None	None
>> 3	>> altitudeAssistance	None	None
>> 4	>> solarRadiation	None	None
>> 5	>> ccpAssistCommonProvide	Limited to a geographic area supported by the provided reference stations.	ccpProvideControlParameters shall be included in ccpAssistCommonProvide only in the messages corresponding to steps 1 and 4 of the procedure in section 5.2.1.4.
> 2	> genericAssistData		
>> N	>> gnss-ID		The label N indicates the GNSS or SBAS system as follow:

			N=1: GPS N=2: QZSS N=3: Galileo N=4: Glonass
>>> 1	>>> wideAreaIonoSurfacePerSVlist	None	None
>>> 2	>>> mechanicsForAllSVs	None	None
>>> 3	>>> dcbsForAllSVs	None	None
>>> 4	>>> navModelDegradationModel	None	None
>>> 5	>>> ccpAssistProvide	Limited to a geographic area supported by the provided reference stations.	This paramater shall be included only in messages corresponding to steps 2 and 3 in the procedure in section 5.2.1.4.
>>> 6	>>> navModelList	None	None
3	otdoa-ProvideAssistanceData		
> 1	> otdoa-ReferenceCellInfo	Limited to the area served by the neighbor cells and reference cell	None
> 2	> otdoa-NeighbourCellInfo	Limited to the area served by the neighbor cells and reference cell	expectedRSTD shall refer to a target at the midpoint between the reference cell and neighbor cell eNodeB antenna locations. expectedRSTD-Uncertainty shall allow for a target at any location where the neighbor and reference cells can both be measured.
4	eotd-ProvideAssistanceData		
> 1	> referenceBTS	Limited to the area served by the provided neighbor cells and reference cell	None
> 2	> msrAssistDataList	Limited to the area served by the provided neighbor cells and reference cell	expectedOTD shall refer to a target at the midpoint between the reference BTS and neighbor BTS antenna locations. expOTDUncertainty shall allow for a target at any location where the neighbor and reference BTSs can both be measured.
> 3	> systemInfoAssistDataList	Limited to the area served by the provided neighbor cells and reference cell	expectedOTD shall refer to a target at the midpoint between the reference BTS and neighbor BTS antenna locations.

			expOTDUncertainty shall allow for a target at any location where the neighbor and reference BTSs can both be measured.
5	otdoa-utra-ProvideAssistanceData		
> 1	> referenceCellInfo	Limited to the area served by the provided neighbor cells and reference cell	roundTripTime and roundTripTimeExtension shall not be included and shall be ignored by a target if included.
> 2	> neigborCellList	Limited to the area served by the provided neighbor cells and reference cell	searchWindowSize shall allow for a target at any location where the reference and neighbor cells can both be measured. roundTripTime and roundTripTimeExtension shall not be included and shall be ignored by a target if included.
6	ecid-lte-ProvideAssistanceData		
> 1	> ecid-LTE-NetworkData	Limited to the area served by the provided eNBs and HeNBs	None
7	ecid-gsm-ProvideAssistanceData		
> 1	> ecid-gsm-NetworkData	Limited to the area served by the provided BTSs	
8	ecid-utra-ProvideAssistanceData		
> 1	> ecid-UTRA-NetworkData	Limited to the area served by the provided Node Bs and HNBs	None
9	wlan-ap-ProvideAssistanceData		
> 1	> wlan-DataSet	Limited to the area served by the provided WLAN APs	None
10	sensor-ProvideAssistanceData	None	None (Note 2)
11	srn-ProvideAssistanceData		
> 1	> srnGroup	Limited to the area served by the provided SRNs	Shall provide srnGroupList and shall not provide srnGroupUpdateResponse
> 2	> antennaPattern	Limited to the area served by the referenced SRNs	None

Table 7: LPPe Assistance Data Restrictions and Labels

Note 2: this assistance data parameter is empty in LPPe 1.1 but is included as a placeholder for possible use in a later version of LPPe.

Appendix F. Broadcast Ciphering (Informative) – version 1.1

This appendix provides an informative level description of the algorithm use to cipher and decipher LPPe 1.1 broadcast assistance data messages. For a normative definition, refer to to [AES] and [NIST-800-38A].

The algorithm uses AES ciphering with counter mode. AES is a block mode cipher algorithm that ciphers blocks of 128 bits at a time. However, Counter mode enables usage for a bit string that is not an exact multiple of 128 bits. Further, Counter mode enables a target (or a server) to perform most of the deciphering (or ciphering) processing independently of receipt of the data to be deciphered (or ciphered) which may enable more efficient processing. Provided counters are chosen in a non-repeating manner by the server (which is a requirement for Counter mode), every block of data will be ciphered in a unique manner.

The algorithm makes user of a sequence of counters <C1, C2, C3, …> each containing 128 bits, where C1 is specified by the server and each subsequent counter (C2, C3 etc.) is obtained from the previous counter by adding one modulo 2**128. Each counter Ci is ciphered using the AES algorithm with a common 128 bit key to produce an output block Oi of 128 bits. To perform ciphering of a broadcast message, the LPP/LPPe message is divided into blocks B1, B2, … Bn of 128 bits each, except for the last block Bn which may contain fewer than 128 bits. The ciphered message is obtained as a sequence of n blocks containing 128 bits each (except possibly for the last block) given by (O1 XOR B1), (O2 XOR B2), … (On XOR Bn), where XOR denotes bitwise exclusive OR. In the case of the last block, if Bn contains m bits (m<128), then the m most significant bits of On would be used for the exclusive OR. Deciphering is performed in the same way except that the blocks B1, B2, … Bn are now obtained from the ciphered message and the result of the exclusive OR operations yields the original unciphered message. Figure 31 provides an illustration of Counter mode for the generic case of an arbitrary block cipher algorithm $CIPH_k$.

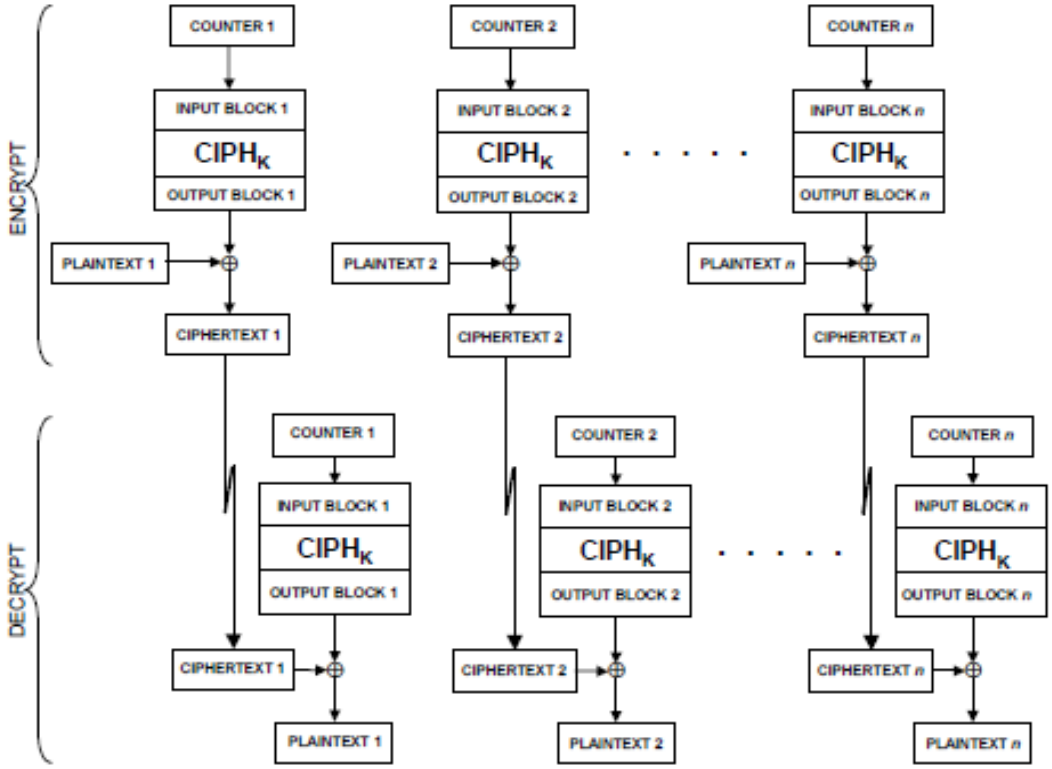


Figure 31: Illustration of Block Ciphering with Counter Mode