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LTE Positioning Protocol (LPP)
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Contents

Intellectual Property Rights	2
Foreword.....	2
Modal verbs terminology.....	2
Foreword.....	8
1 Scope	9
2 References	9
3 Definitions and Abbreviations.....	10
3.1 Definitions	10
3.2 Abbreviations	10
4 Functionality of Protocol.....	12
4.1 General	12
4.1.1 LPP Configuration	12
4.1.2 LPP Sessions and Transactions.....	12
4.1.3 LPP Position Methods	12
4.1.4 LPP Messages	13
4.2 Common LPP Session Procedure	13
4.3 LPP Transport	14
4.3.1 Transport Layer Requirements	14
4.3.2 LPP Duplicate Detection	14
4.3.3 LPP Acknowledgement	15
4.3.3.1 General	15
4.3.3.2 Procedure related to Acknowledgement.....	15
4.3.4 LPP Retransmission.....	16
4.3.4.1 General	16
4.3.4.2 Procedure related to Retransmission.....	16
5 LPP Procedures	17
5.1 Procedures related to capability transfer	17
5.1.1 Capability Transfer procedure.....	17
5.1.2 Capability Indication procedure	17
5.1.3 Reception of LPP Request Capabilities.....	18
5.1.4 Transmission of LPP Provide Capabilities	18
5.2 Procedures related to Assistance Data Transfer.....	18
5.2.1 Assistance Data Transfer procedure	18
5.2.2 Assistance Data Delivery procedure	19
5.2.3 Transmission of LPP Request Assistance Data	19
5.2.4 Reception of LPP Provide Assistance Data	19
5.3 Procedures related to Location Information Transfer	19
5.3.1 Location Information Transfer procedure	20
5.3.2 Location Information Delivery procedure.....	20
5.3.3 Reception of Request Location Information.....	21
5.3.4 Transmission of Provide Location Information	21
5.4 Error Handling Procedures	21
5.4.1 General.....	21
5.4.2 Procedures related to Error Indication	21
5.4.3 LPP Error Detection.....	22
5.4.4 Reception of an LPP Error Message	22
5.5 Abort Procedure	22
5.5.1 General.....	22
5.5.2 Procedures related to Abort	23
5.5.3 Reception of an LPP Abort Message	23
6 Information Element Abstract Syntax Definition.....	23

6.1	General	23
6.2	LPP PDU Structure	24
-	LPP-PDU-Definitions	24
-	LPP-Message	24
-	LPP-MessageBody	25
-	LPP-TransactionID	25
6.3	Message Body IEs	26
-	RequestCapabilities	26
-	ProvideCapabilities	26
-	RequestAssistanceData	27
-	ProvideAssistanceData	27
-	RequestLocationInformation	28
-	ProvideLocationInformation	28
-	Abort	28
-	Error	29
6.4	Common IEs	29
6.4.1	Common Lower-Level IEs	29
-	AccessTypes	29
-	ARFCN-ValueEUTRA	30
-	ARFCN-ValueUTRA	30
-	CellGlobalIdEUTRA-AndUTRA	30
-	CellGlobalIdGERAN	30
-	ECGI	31
-	Ellipsoid-Point	31
-	Ellipsoid-PointWithUncertaintyCircle	31
-	EllipsoidPointWithUncertaintyEllipse	32
-	EllipsoidPointWithAltitude	32
-	EllipsoidPointWithAltitudeAndUncertaintyEllipsoid	32
-	EllipsoidArc	32
-	EPDU-Sequence	33
-	HorizontalVelocity	33
-	HorizontalWithVerticalVelocity	34
-	HorizontalVelocityWithUncertainty	34
-	HorizontalWithVerticalVelocityAndUncertainty	34
-	LocationCoordinateTypes	34
-	Polygon	35
-	PositioningModes	35
-	VelocityTypes	35
6.4.2	Common Positioning	35
-	CommonIEsRequestCapabilities	35
-	CommonIEsProvideCapabilities	36
-	CommonIEsRequestAssistanceData	36
-	CommonIEsProvideAssistanceData	36
-	CommonIEsRequestLocationInformation	36
-	CommonIEsProvideLocationInformation	39
-	CommonIEsAbort	40
-	CommonIEsError	41
6.5	Positioning Method IEs	41
6.5.1	OTDOA Positioning	41
6.5.1.1	OTDOA Assistance Data	41
-	OTDOA-ProvideAssistanceData	41
6.5.1.2	OTDOA Assistance Data Elements	42
-	OTDOA-ReferenceCellInfo	42
-	PRS-Info	43
-	OTDOA-NeighbourCellInfoList	43
6.5.1.3	OTDOA Assistance Data Request	46
-	OTDOA-RequestAssistanceData	46
6.5.1.4	OTDOA Location Information	46
-	OTDOA-ProvideLocationInformation	46
6.5.1.5	OTDOA Location Information Elements	46
-	OTDOA-SignalMeasurementInformation	46
-	OTDOA-MeasQuality	48

6.5.1.6	OTDOA Location Information Request	48
-	OTDOA-RequestLocationInformation	48
6.5.1.7	OTDOA Capability Information	49
-	OTDOA-ProvideCapabilities	49
6.5.1.8	OTDOA Capability Information Request	49
-	OTDOA-RequestCapabilities	49
6.5.1.9	OTDOA Error Elements	50
-	OTDOA-Error	50
-	OTDOA-LocationServerErrorCauses	50
-	OTDOA-TargetDeviceErrorCauses	50
6.5.2	A-GNSS Positioning	51
6.5.2.1	GNSS Assistance Data	51
-	A-GNSS-ProvideAssistanceData	51
-	GNSS-CommonAssistData	51
-	GNSS-GenericAssistData	51
6.5.2.2	GNSS Assistance Data Elements	52
-	GNSS-ReferenceTime	52
-	GNSS-SystemTime	53
-	GPS-TOW-Assist	54
-	NetworkTime	54
-	GNSS-ReferenceLocation	56
-	GNSS-IonosphericModel	56
-	KlobucharModelParameter	56
-	NeQuickModelParameter	57
-	GNSS-EarthOrientationParameters	57
-	GNSS-TimeModelList	58
-	GNSS-DifferentialCorrections	59
-	GNSS-NavigationModel	61
-	StandardClockModelList	63
-	NAV-ClockModel	64
-	CNAV-ClockModel	65
-	GLONASS-ClockModel	66
-	SBAS-ClockModel	66
-	BDS-ClockModel	67
-	NavModelKeplerianSet	67
-	NavModelNAV-KeplerianSet	68
-	NavModelCNAV-KeplerianSet	70
-	NavModel-GLONASS-ECEF	71
-	NavModel-SBAS-ECEF	72
-	NavModel-BDS-KeplerianSet	73
-	GNSS-RealTimeIntegrity	74
-	GNSS-DataBitAssistance	75
-	GNSS-AcquisitionAssistance	76
-	GNSS-Almanac	79
-	AlmanacKeplerianSet	80
-	AlmanacNAV-KeplerianSet	81
-	AlmanacReducedKeplerianSet	82
-	AlmanacMidiAlmanacSet	83
-	AlmanacGLONASS-AlmanacSet	84
-	AlmanacECEF-SBAS-AlmanacSet	85
-	AlmanacBDS-AlmanacSet	86
-	GNSS-UTC-Model	87
-	UTC-ModelSet1	87
-	UTC-ModelSet2	88
-	UTC-ModelSet3	89
-	UTC-ModelSet4	89
-	UTC-ModelSet5	90
-	GNSS-AuxiliaryInformation	91
-	BDS-DifferentialCorrections	92
-	BDS-GridModelParameter	93
6.5.2.3	GNSS Assistance Data Request	93
-	A-GNSS-RequestAssistanceData	93

–	GNSS-CommonAssistDataReq.....	94
–	GNSS-GenericAssistDataReq.....	94
6.5.2.4	GNSS Assistance Data Request Elements	95
–	GNSS-ReferenceTimeReq.....	95
–	GNSS-ReferenceLocationReq.....	95
–	GNSS-IonosphericModelReq.....	96
–	GNSS-EarthOrientationParametersReq.....	96
–	GNSS-TimeModelListReq.....	96
–	GNSS-DifferentialCorrectionsReq.....	97
–	GNSS-NavigationModelReq.....	97
–	GNSS-RealTimeIntegrityReq.....	99
–	GNSS-DataBitAssistanceReq.....	99
–	GNSS-AcquisitionAssistanceReq.....	100
–	GNSS-AlmanacReq.....	100
–	GNSS-UTC-ModelReq.....	100
–	GNSS-AuxiliaryInformationReq.....	101
–	BDS-DifferentialCorrectionsReq.....	101
–	BDS-GridModelReq.....	101
6.5.2.5	GNSS Location Information	102
–	A-GNSS-ProvideLocationInformation.....	102
6.5.2.6	GNSS Location Information Elements.....	102
–	GNSS-SignalMeasurementInformation.....	102
–	MeasurementReferenceTime.....	102
–	GNSS-MeasurementList.....	104
–	GNSS-LocationInformation.....	107
6.5.2.7	GNSS Location Information Request.....	108
–	A-GNSS-RequestLocationInformation.....	108
6.5.2.8	GNSS Location Information Request Elements.....	108
–	GNSS-PositioningInstructions.....	108
6.5.2.9	GNSS Capability Information.....	109
–	A-GNSS-ProvideCapabilities.....	109
6.5.2.10	GNSS Capability Information Elements.....	110
–	GNSS-CommonAssistanceDataSupport.....	110
–	GNSS-ReferenceTimeSupport.....	111
–	GNSS-ReferenceLocationSupport.....	111
–	GNSS-IonosphericModelSupport.....	111
–	GNSS-EarthOrientationParametersSupport.....	111
–	GNSS-GenericAssistanceDataSupport.....	112
–	GNSS-TimeModelListSupport.....	113
–	GNSS-DifferentialCorrectionSupport.....	113
–	GNSS-NavigationModelSupport.....	113
–	GNSS-RealTimeIntegritySupport.....	114
–	GNSS-DataBitAssistanceSupport.....	114
–	GNSS-AcquisitionAssistanceSupport.....	114
–	GNSS-AlmanacSupport.....	115
–	GNSS-UTC-ModelSupport.....	115
–	GNSS-AuxiliaryInformationSupport.....	115
–	BDS-DifferentialCorrectionsSupport.....	116
–	BDS-GridModelSupport.....	116
6.5.2.11	GNSS Capability Information Request.....	116
–	A-GNSS-RequestCapabilities.....	116
6.5.2.12	GNSS Error Elements.....	117
–	A-GNSS-Error.....	117
–	GNSS-LocationServerErrorCauses.....	117
–	GNSS-TargetDeviceErrorCauses.....	117
6.5.2.13	Common GNSS Information Elements.....	118
–	GNSS-ID.....	118
–	GNSS-ID-Bitmap.....	118
–	GNSS-SignalID.....	118
–	GNSS-SignalIDs.....	119
–	SBAS-ID.....	120
–	SBAS-IDs.....	120

- SV-ID 120
- 6.5.3 Enhanced Cell ID Positioning 121
- 6.5.3.1 E-CID Location Information 121
- ECID-ProvideLocationInformation 121
- 6.5.3.2 E-CID Location Information Elements 121
- ECID-SignalMeasurementInformation 121
- 6.5.3.3 E-CID Location Information Request 122
- ECID-RequestLocationInformation 122
- 6.5.3.4 E-CID Capability Information 123
- ECID-ProvideCapabilities 123
- 6.5.3.5 E-CID Capability Information Request 123
- ECID-RequestCapabilities 123
- 6.5.3.6 E-CID Error Elements 123
- ECID-Error 123
- ECID-LocationServerErrorCauses 124
- ECID-TargetDeviceErrorCauses 124
- End of LPP-PDU-Definitions 124
- Annex A (informative): Change History 125**
- History 127

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1 Scope

The present document contains the definition of the LTE Positioning Protocol (LPP).

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 36.305: "Stage 2 functional specification of User Equipment (UE) positioning in E-UTRAN".
- [3] 3GPP TS 23.271: "Functional stage 2 description of Location Services (LCS)".
- [4] IS-GPS-200, Revision D, Navstar GPS Space Segment/Navigation User Interfaces, March 7th, 2006.
- [5] IS-GPS-705, Navstar GPS Space Segment/User Segment L5 Interfaces, September 22, 2005.
- [6] IS-GPS-800, Navstar GPS Space Segment/User Segment L1C Interfaces, September 4, 2008.
- [7] IS-QZSS, Quasi Zenith Satellite System Navigation Service Interface Specifications for QZSS, Ver.1.1, July 31, 2009.
- [8] Galileo OS Signal in Space ICD (OS SIS ICD), Issue 1.2, February 2014, European Union.
- [9] Global Navigation Satellite System GLONASS Interface Control Document, Version 5.1, 2008.
- [10] Specification for the Wide Area Augmentation System (WAAS), US Department of Transportation, Federal Aviation Administration, DTFA01-96-C-00025, 2001.
- [11] RTCM-SC104, RTCM Recommended Standards for Differential GNSS Service (v.2.3), August 20, 2001.
- [12] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); "Radio Resource Control (RRC); Protocol specification".
- [13] 3GPP TS 25.331: "Radio Resource Control (RRC); Protocol Specification".
- [14] 3GPP TS 44.031: "Location Services (LCS); Mobile Station (MS) - Serving Mobile Location Centre (SMLC) Radio Resource LCS Protocol (RRLP)".
- [15] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".
- [16] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation".
- [17] 3GPP TS 36.214: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer – Measurements".

- [18] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".
- [19] 3GPP TS 23.003: "Numbering, addressing and identification".
- [20] OMA-TS-LPPe-V1_0, LPP Extensions Specification, Open Mobile Alliance.
- [21] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".
- [22] ITU-T Recommendation X.691 (07/2002) "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)" (Same as the ISO/IEC International Standard 8825-2).
- [23] BDS-SIS-ICD-2.0: "BeiDou Navigation Satellite System Signal In Space Interface Control Document Open Service Signal (Version 2.0)", December 2013.

3 Definitions and Abbreviations

3.1 Definitions

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

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

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

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

Observed Time Difference Of Arrival (OTDOA): The time interval that is observed by a target device between the reception of downlink signals from two different cells. If a signal from cell 1 is received at the moment t_1 , and a signal from cell 2 is received at the moment t_2 , the OTDOA is $t_2 - t_1$.

3.2 Abbreviations

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

ADR	Accumulated Delta-Range
A-GNSS	Assisted-GNSS
ARFCN	Absolute Radio Frequency Channel Number
BDS	BeiDou Navigation Satellite System
BTS	Base Transceiver Station (GERAN)
CID	Cell-ID (positioning method)
CNAV	Civil Navigation
CRS	Cell-specific Reference Signals
ECEF	Earth-Centered, Earth-Fixed
E-CGI	Evolved Cell Global Identifier
ECI	Earth-Centered-Inertial
E-CID	Enhanced Cell-ID (positioning method)
EGNOS	European Geostationary Navigation Overlay Service
E-SMLC	Enhanced Serving Mobile Location Centre
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
EOP	Earth Orientation Parameters
EPDU	External Protocol Data Unit
FDMA	Frequency Division Multiple Access

FEC	Forward Error Correction
FTA	Fine Time Assistance
GAGAN	GPS Aided Geo Augmented Navigation
GLONASS	GLObal'naya NAVigatsionnaya Sputnikovaya Sistema (Engl.: Global Navigation Satellite System)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICD	Interface Control Document
IOD	Issue of Data
IS	Interface Specification
LPP	LTE Positioning Protocol
LPPa	LTE Positioning Protocol Annex
LSB	Least Significant Bit
MO-LR	Mobile Originated Location Request
MSAS	Multi-functional Satellite Augmentation System
MSB	Most Significant Bit
msd	mean solar day
MT-LR	Mobile Terminated Location Request
NAV	Navigation
NICT	National Institute of Information and Communications Technology
NI-LR	Network Induced Location Request
NTSC	National Time Service Center of Chinese Academy of Sciences
OTDOA	Observed Time Difference Of Arrival
PRC	Pseudo-Range Correction
PRS	Positioning Reference Signals
PDU	Protocol Data Unit
PZ-90	Parametry Zemli 1990 Goda – Parameters of the Earth Year 1990
QZS	Quasi Zenith Satellite
QZSS	Quasi-Zenith Satellite System
QZST	Quasi-Zenith System Time
RF	Radio Frequency
RRC	Range-Rate Correction Radio Resource Control
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSTD	Reference Signal Time Difference
RU	Russia
SBAS	Space Based Augmentation System
SET	SUPL Enabled Terminal
SFN	System Frame Number
SLP	SUPL Location Platform
SUPL	Secure User Plane Location
SV	Space Vehicle
TLM	Telemetry
TOD	Time Of Day
TOW	Time Of Week
UDRE	User Differential Range Error
ULP	User Plane Location Protocol
USNO	US Naval Observatory
UT1	Universal Time No.1
UTC	Coordinated Universal Time
WAAS	Wide Area Augmentation System
WGS-84	World Geodetic System 1984

4 Functionality of Protocol

4.1 General

4.1.1 LPP Configuration

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

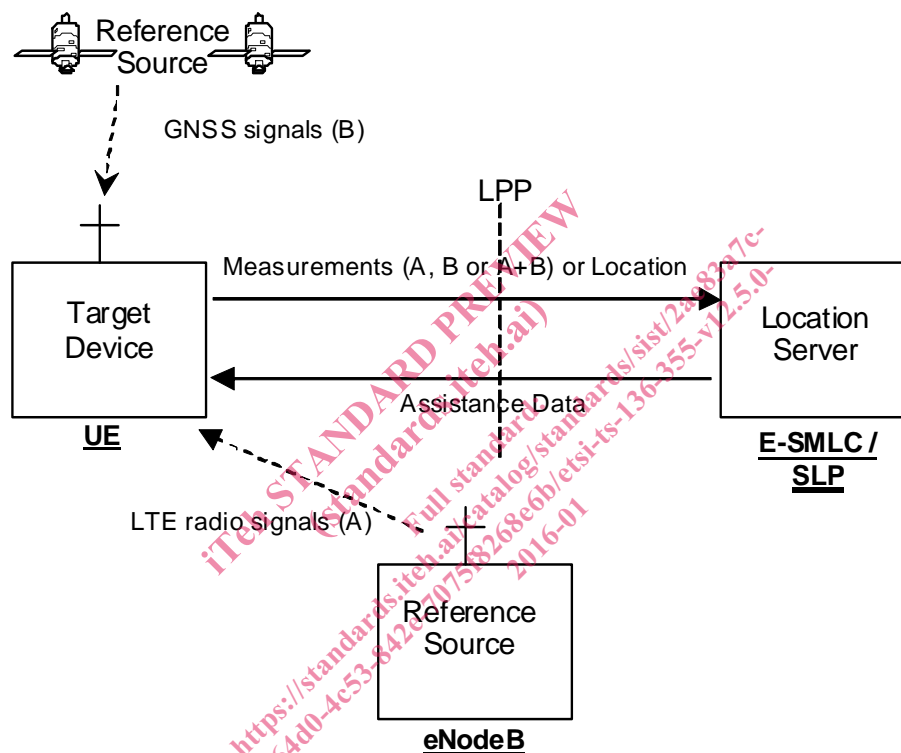


Figure 4.1.1-1: LPP Configuration for Control- and User-Plane Positioning in E-UTRAN

4.1.2 LPP Sessions and Transactions

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

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

4.1.3 LPP Position Methods

Internal LPP positioning methods and associated signalling content are defined in this specification.