



TECHNICAL SPECIFICATION

**Satellite Earth Stations and Systems (SES);
GNSS based location systems;
Part 4: Requirements for location data exchange protocols**

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Foreword

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

The present document is part 4 of a multi-part deliverable covering GNSS-based Location Systems (GBLS), as identified below:

- Part 1: Functional requirements;
 - Part 2: Reference Architecture;
 - Part 3: Performance requirements;
 - Part 4: Requirements for location data exchange protocols;**
 - Part 5: Performance Test Specification.
-

Modal verbs terminology

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

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Introduction

The increasing proliferation of location-based services is based on several trends in user applications and devices; these include notably the widespread adoption of multi-functional smart-phones, etc., and the wider adoption of tracking devices (e.g. in transport). This need for new and innovative location-based services is generating a need for increasingly complex location systems. These systems are designed to deliver location-related information for one or more targets to user applications.

The wide spectrum of technical features identified in ETSI TR 103 183 [i.1] calls for a new and broader concept for location systems, taking into account hybrid solutions in which GNSS technologies are complemented with other technology sensors to improve robustness and the performance.

1 Scope

The present document defines the requirements for data elements that may need to be exchanged within the GBLS and externally to applications using the GBLS.

The present document also specifies data exchange models for these data elements which may form the basis of protocols (or for modification of protocols) and which may be used for the exchange of location-related data within the GNSS-based Location System (GBLS), as well as between the GBLS and external applications.

In particular, the present document defines the procedures and messages associated with these data exchange models

The GBLS data exchange models are defined to be independent of their underlying transport mechanisms. Nevertheless, on certain GBLS interfaces, transport protocols are recommended.

2 References

2.1 Normative references

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

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

- [1] ETSI TS 103 246-1: "Satellite Earth Stations and Systems (SES); GNSS based location systems; Part 1: Functional requirements".
- [2] ETSI TS 103 246-2: "Satellite Earth Stations and Systems (SES); GNSS based location systems; Part 2: Reference Architecture".
- [3] ETSI TS 103 246-3: "Satellite Earth Stations and Systems (SES); GNSS based location systems; Part 3: Performance requirements".
- [4] OMA-TS-MLP-V3.5: "Mobile Location Protocol".
- [5] OMA-TS-LPpe-V2.0: "LPP Extensions Specification".
- [6] ETSI TS 136 355: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP) (3GPP TS 36.355)".

2.2 Informative references

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

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

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

- [i.1] ETSI TR 103 183: "Satellite Earth Stations and Systems (SES); Global Navigation Satellite Systems (GNSS) based applications and standardisation needs".
- [i.2] OMA-TS-ULP-V3: "User Plane Location Protocol".

- [i.3] OMA-AD-LOCSIP-V1: "Location in SIP/IP core Architecture".
- [i.4] ETSI ES 201 915: "Open Service Access (OSA); Application Programming Interface (API)".
- [i.5] 3GPP2 C.S0022-B: "Position Determination Service for cdma2000 Spread Spectrum Systems".
- [i.6] ETSI TS 125 331: "Universal Mobile Telecommunications System (UMTS); Radio Resource Control (RRC); Protocol specification (3GPP TS 25.331)".
- [i.7] ETSI TS 144 031: "Digital cellular telecommunications system (Phase 2+); Location Services (LCS); Mobile Station (MS) - Serving Mobile Location Centre (SMLC) Radio Resource LCS Protocol (RRLP) (3GPP TS 44.031)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI TS 103 246-1 [1] apply.

3.2 Abbreviations

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

3GPP	3 rd Generation Partnership Project
API	Application Programming Interface
ASN	Abstract Syntax Notation
BFN	Beam Forming Network
CL	Confidence Level
DoA	Direction of Arrival
DTD	Document Type Definition
ECID	Enhanced Cell ID
EMI	ElectroMagnetic Interference
EOTD	Enhanced Observed Time Difference
EPDU	Extension Protocol Data Unit
EPDU	External Protocol Data Unit
E-SMLC	Enhanced Mobile Location Centre
FFS	For Further Study
GBLS	GNSS Based Location System
GGTO	GPS-Galileo Time Offset
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HTTP	HyperText Transfer Protocol
HTTPS	HTTP Secure
IE	Information Element
IMSI	International Mobile Station Identifier
INS	Inertial Navigation Sensor
LCS	Location Services
LOCSIP	LOCation in SIP
LPP	LTE Positioning Protocol
LPPe	LTE Positioning Protocol Extensions
LSEP	Location System External Protocol
LSIP	Location System Internal Protocol
LTE	Long-Term Evolution
MLP	Mobile Location Protocol
MLS	Mobile Location System
MS	Mobile Station
MSID	Mobile Station Identifier
OMA	Open Mobile Alliance
OTDOA	Observed Time Difference of Arrival
PVT	Position Velocity Time

QoS	Quality of Service
RF	Radio Frequency
RRC	Radio Resource Control
RRLP	Radio Resource Location services (LCS) Protocol
RT	Real-Time
SET	SUPL Enabled Terminal
SIP	Session Initiation Protocol
SLP	Server Location Provider
SMLC	Serving Mobile Location Centre
SOAP	Simple Object Access Protocol
SRN	Short Range Node
SSL	Secure Socket Layer
TCP/IP	Transmission Control Protocol over Internet Protocol
TLS	Transport Layer Security
UE	User Equipment
ULP	User-plane Location Protocol
UMTS	Universal Mobile Telecommunications System
UTC	Coordinated Universal Time
UTRA	UMTS Terrestrial Radio Access
WLAN	Wireless Local Area Network
XML	Extensible Markup Language

4 Data Exchange Requirements

4.1 Context

The GBLS data that shall or may be exchanged is defined in ETSI TS 103 246-2 [2] in general terms for two main cases:

- 1) externally to applications using the GBLS; and
- 2) internally between modules of the GBLS.

The specific requirements for this data are defined further in clauses 5 and 6.

In addition, data exchange models are defined herein as a basis for protocols that may be used to transfer the GBLS data.

Figure 4.1 shows these defined protocol models and their relevant interfaces applied to the GNSS-based Location System (GBLS) and its functional entities as defined in ETSI TS 103 246-2 [2], within an end-to-end system.

NOTE: Throughout the present document, the word "protocol" is used for brevity, when defining a GBLS "data exchange model". The specifications herein are of data exchange models that may form the basis of protocols.

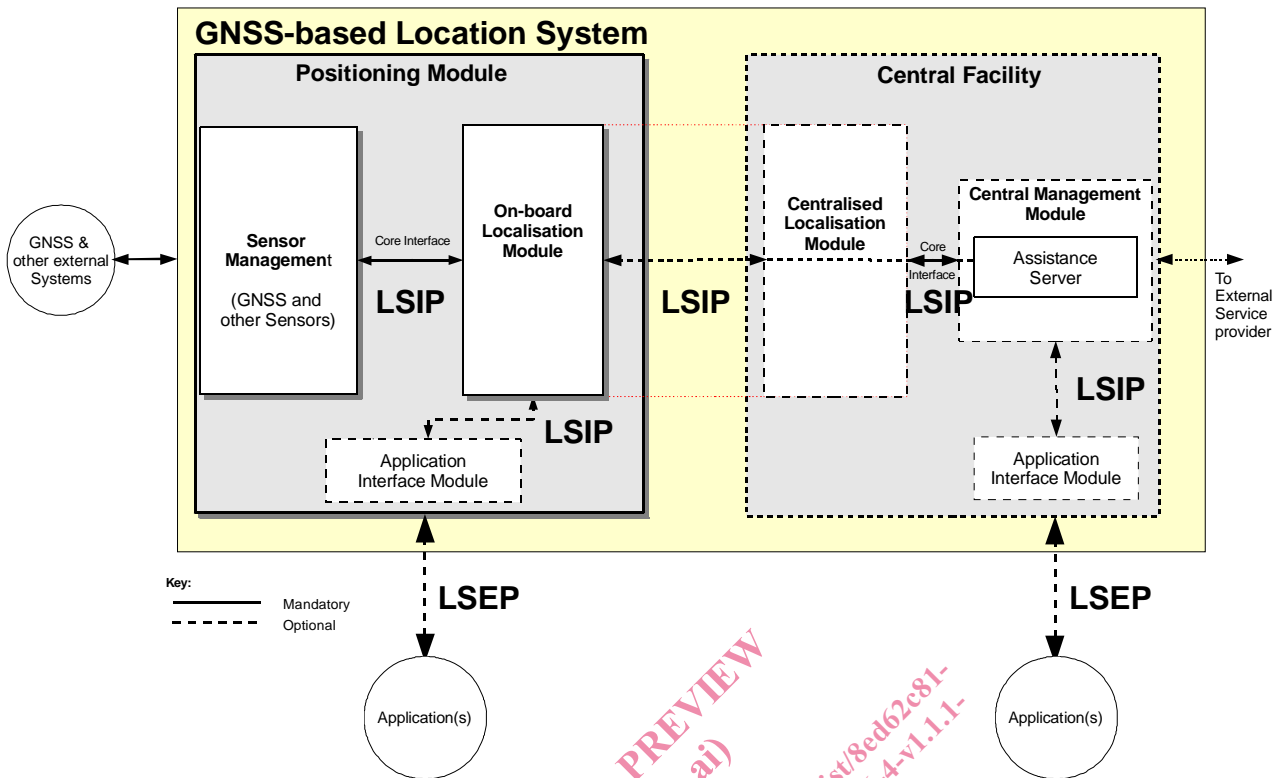


Figure 4.1: Use of LSEP and LSIP in the GBLs architecture

The protocols defined are:

- **LSEP** (Location System External Protocol): between the GBLs and an external application (requesting entity).
- **LSIP** (Location System Internal Protocol): between internal components of the GBLs.

These protocols shall transfer the location-related data defined in ETSI TS 103 246-2 [2].

The Protocol definitions in the following clauses address the following aspects:

- 1) protocol procedures;
- 3) message definitions from a semantic point of view i.e. the information they shall contain, and how this information is structured;
- 4) information elements within messages and a set of relationships between them.

The definitions do not cover:

- Message syntax. Thus no encoding scheme or data representation is given.
- Underlying transport mechanisms for the messages.

4.2 Protocol Choice and Compatibility

4.2.1 LSEP (MLP)

LSEP is based on the procedures, messages and elements of OMA MLP [4]. Annex A provides a rationale for this choice.

MLP is intended for a Mobile Location Service (MLS) Client (e.g. a GBLs external application) to obtain the related data of a location target (e.g. mobile terminal, GBLs Positioning Module, etc.) from a Location Server (e.g. the GBLs).

MLP is defined at the application layer of the protocol stack. Its messages are defined in XML and it is intended to be transported over HTTP or other protocols (e.g. SOAP). For security reasons Secure Socket Layer (SSL) or Transport Layer Security (TLS) cryptographic protocols can be used to carry HTTP (or HTTPS).

4.2.2 LSIP (LPPe)

4.2.2.1 General

LSIP is defined as an extension to LPP and relies also on the procedures, messages and elements of LPPe [5]. Annex A provides a rationale for this choice.

As LPPe is also defined as an extension to, and relies on the main elements of, LPP [6] then LSIP is in effect based on both of these protocols.

LPPe is intended to provide transactions for location-related data in a client-server model, and specifically between a SET and SLP ("target" and "server" in LPPe). However LPPe allows many of its messages to be transacted in reversed mode also.

In the GBLs, LSIP is defined for interfaces between all internal functional blocks. Annex A3 describes implementation options.

LSIP as defined herein defines the global set of necessary location-related data required for the overall functioning of the GBLs as defined in ETSI TS 103 246-2 [2].

4.2.2.2 LSIP Data Exchange Requirements

A summary of additional data for LSIP (i.e. not included in LPPe) requiring to be transferred over the GBLs interfaces defined in ETSI TS 103 246-2 [2] is shown in table 4.1 (defined for each type of LSIP procedure: Location information exchange and Assistance data exchange).

Table 4.1: Extension data for LSIP procedures

Interface	Location information exchange	Assistance data exchange
	LSIP-Specific data	LSIP-Specific data
1 (GNSS)	observables (Pseudo-range, Accumulated Doppler Range), RF samples, + error on PVT and observables.	A-GNSS assistance data (models (nav, GGTO, UTC), RT integ, diff corr, data bit assist, acq assist, almanac, aux. info).
2 (Telco)	N/A.	N/A.
3 (INS)	Gyro/accelerometer measurements + error estimates.	N/A.
4 (Magnetometer)	Magnetic field + error estimates.	Temperature (for calibration).
5 (odometer)	speed, distance, + error estimates.	Wheel diameter.
6 (BFN)	Body orientation, jammer characteristics: number, power, direction of arrival (DoA).	N/A.
7 (map)	FFS.	N/A.
8	location information consistent with "location-related data" defined in LSEP: <ul style="list-style-type: none"> Position (horizontal, vertical), velocity (linear/angular) acceleration (linear/angular), heading. QoS estimation (estimated accuracy of the above params). Integrity and Authentication parameters. 	N/A.
9	All location data identified on I/F 10.	All assistance data identified on the sensors I/F (1 to 7).
10	All location-related data above from sensor interfaces (1 to 6), and dedicated to central processing (in centralized localization module). Additionally, any "processed" location information from the On-Board Localization Module, and needing to be forwarded to the Central Facility.	All location data present on interfaces 1 to 8.

Table 4.2 shows the data to be made available for GBLS external interface (i.e. for an application) and which should therefore be consistent with LSEP data elements. The relevant source protocols and the LSIP extension IEs are also shown.

**Table 4.2: LSIP/LPP IEs for GBLS external interfaces (Application)
with applicable protocol extensions**

Elementary information	LSIP/LPP Data type	Request	Provide	Protocol
Hybridised Location-related data (i.e. as final products)				
Time	LocInfo	x	x	LPP
HorPos	LocInfo	x	x	LPP
VertPos	LocInfo	x	x	LPP
Velocity	LocInfo	x	x	LPP
Acceleration	LocInfo	x	x	LPPe
Heading	LocInfo	x	x	LPPe
Detected no. of jammers	LocInfo	x	x	LSIP
Jammer ID	LocInfo		x	LSIP
Jammer Power	LocInfo	x	x	LSIP
Jammer DoA	LocInfo	x	x	LSIP
Hybrid type/Location source	LocInfo	x	x	LPPe
Hybridised QoS indicators (i.e. as final products)				
Time unc	LocInfo	x	x	LPP
HorPos ConfLev	LocInfo	x	x	LPP
HorPos unc	LocInfo	x	x	LPP
HorPos qos class	LocInfo	x		LSIP
HorPos unc not met	LocInfo		x	LSIP
int. alert (HorPos)	LocInfo		x	LSIP
Vertpos ConfLev	LocInfo	x	x	LPP
Vertpos unc	LocInfo	x	x	LPP
Vertpos qos class	LocInfo	x		LPP
Vertpos unc not met	LocInfo		x	LSIP
int. alert (Vertpos)	LocInfo		x	LSIP
Authentication	LocInfo	x	x	LSIP
Velocity ConfLev	LocInfo	x	x	LSIP
Velocity unc	LocInfo	x	x	LPP
Velocity qos class	LocInfo	x		LPP
Velocity unc not met	LocInfo		x	LSIP
int. alert (Velocity)	LocInfo		x	LSIP
Accel ConfLev	LocInfo	x	x	LSIP
Accel unc	LocInfo	x	x	LSIP
Accel unc not met	LocInfo		x	LSIP
Heading ConfLev	LocInfo	x	x	LSIP
Heading ConfClass	LocInfo	x	x	LSIP
Heading unc	LocInfo	x		LSIP
Heading qos class	LocInfo	x		LSIP
Heading unc not met	LocInfo		x	LSIP
int. alert (Heading)	LocInfo		x	LSIP

Table 4.3 summarizes the LSIP/LPPe IEs for GBLS internal sensor interfaces, and identifies particularly the new IEs needed in LSIP.

Table 4.3: LSIP/LPP IEs for GBLS internal sensor interfaces (with applicable protocol extensions)

Elementary information	LSIP/LPP Data type	Request	Provide	Protocol
Control parameters; needed to implement the internal GBLS reporting scheme				
Event trigger req	LocInfo	x		LSIP
GNSS				
GNSS RF samples	LocInfo	x	x	LSIP
Telco				
OTDOA, EOTD, OTDOA-UTRA, LTE, LTE ECID, GSM ECID, UTRA ECID, WLAN, WiMax, SRN				
Existing				LPPe
Internal INS data				
Existing				LPPe
Magnetometer				
Existing				LPPe
Odometer				
Wheel size	LocInfo	x	x	LSIP
Travelled distance	LocInfo	x	x	LSIP
Speed	LocInfo	x	x	LSIP
BFN				
maxNbrofjammers	LocInfo	x		LSIP
detected no. of jammers	LocInfo		x	LSIP
jammer ID	LocInfo		x	LSIP
jammer Power	LocInfo	x	x	LSIP
jammer DoA	LocInfo	x	x	LSIP
Map				
FFS		x	x	LSIP

4.2.3 LSEP/MLP and LSIP/LPPe Terminology

Table 4.4 defines the correspondence between GBLS and 3GPP/OMA MLP/LPPe terminology.

Table 4.4: MLP/LPPe and LSEP/LSIP terminology relationships

MLP/LPPe		LSEP/LSIP	
Term	Definition	Term	Definition
MS	Mobile Station	Location Target Positioning Module	See definition in ETSI TS 103 246-2 [2]
MSID	MS identifier	MSID	Identifier for location targets
Mobile subscriber	Owner of the MS who has subscribed to a communication service. Target of the Location service	Location Target user	Optional and minor role in GBLS context. Target of the location service is the Location Target, rather than its user
MLS Client	The application, seen as a client of the Mobile Location Service	Application	See definition in ETSI TS 103 246-2 [2]
LCS Client	The application, seen as a client of the Location Service	Application	See definition in ETSI TS 103 246-2 [2]
Location Server	The server which provides location data of the MS to the Client (normal mode) or LPPe client (reversed mode)	GBLS Location Server	The Server which provides location data of the Location Target to the Application, and the assistance data to the Location target or Positioning Module or LPPe client (reversed mode)
Target (LPPe)	LPPe client (normal mode) or LPPe server (reversed mode)	Location Target Positioning Module	See definition in ETSI TS 103 246-2 [2] or LPPe server (reversed mode)