

ETSI TS 143 059 V14.3.0 (2020-04)



**Digital cellular telecommunications system (Phase 2+) (GSM);
Functional stage 2 description of Location Services (LCS) in
GERAN
(3GPP TS 43.059 version 14.3.0 Release 14)**

STANDARDS PREVIEW
Full standards catalog: <https://standards.iteh.ai/catalog/standards/sic/43059-v14-3-0-2020-04>
4df6-9f52-fee17e16f42/etsi-ts-143-059-v14-3-0-2020-04



ReferenceRTS/TSGR-0643059ve30

Keywords

GSM

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2020.

All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members.

3GPP™ and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

oneM2M™ logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

GSM® and the GSM logo are trademarks registered and owned by the GSM Association.

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Legal Notice

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under <http://webapp.etsi.org/key/queryform.asp>.

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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights	2
Legal Notice	2
Modal verbs terminology.....	2
Foreword.....	7
1 Scope	8
2 References	8
3 Definitions and abbreviations.....	10
3.1 Definitions	10
3.2 Abbreviations	11
4 Main concepts	12
4.1 Assumptions	12
4.2 Standard LCS Methods	12
4.2.1 Timing Advance	12
4.2.2 Enhanced Observed Time Difference (E-OTD) positioning mechanism.....	12
4.2.3 Global Navigation Satellite System (GNSS) based positioning mechanism	12
4.2.4 Uplink Time Difference of Arrival (U-TDOA) positioning mechanism	13
4.2.5 Multilateration Positioning Methods	13
4.2.5.1 Multilateration Timing Advance	13
4.2.5.2 Multilateration OTD.....	13
5 GERAN LCS Architecture	13
5.1 LCS Operations	14
5.2 High-Level Functions.....	15
5.2.1 Co-ordination, Measurement and Calculation Functions.....	16
5.3 GERAN LCS Functional Entities	17
5.3.1 Internal Client Group	17
5.3.1.1 Internal GERAN Location Client Function (LCF).....	17
5.3.2 GERAN System Handling group.....	17
5.3.2.1 GERAN Location System Control Function (LSCF).....	17
5.3.2.2 GERAN Location System Operations Function (LSOF)	17
5.3.2.3 Location System Broadcast Function (LSBcF).....	17
5.3.3 Positioning group.....	18
5.3.3.1 GERAN Position Radio Co-ordination Function (PRCF).....	18
5.3.3.2 GERAN Position Calculation Function (PCF).....	18
5.3.3.3 GERAN Position Signal Measurement Function (PSMF)	19
5.3.3.4 GERAN Position Radio Resource Management (PRRM)	19
5.4 Assignment of LCS Functional Entities to GERAN Elements.....	19
5.5 Functional Description of GERAN LCS Network Elements	19
5.5.1 BSC.....	19
5.5.2 SMLC	19
5.5.3 CBC	20
5.5.4 LMU	20
5.5.5 MS	20
6 Signalling Protocols and Interfaces	20
6.1 Protocol layering in A/Gb mode.....	20
6.1.1 Generic Signalling Model.....	20
6.1.2 Message Segmentation in A/Gb mode.....	21
6.1.2.1 Network Level Segmentation.....	21
6.1.2.2 Intermediate Level Segmentation.....	22
6.1.2.3 RRLP Pseudo-Segmentation	22
6.1.3 Signalling between an SMLC, MSC and BSC.....	22
6.1.3a Signalling between an SMLC, SGSN and BSS	22
6.1.4 Signaling between SMLC and MS	23

6.1.5	SMLC Signalling to a Type A LMU	24
6.1.5.1	Circuit Switched Signalling using an SDCCH.....	24
6.1.5.2	Signalling using a TCH.....	24
6.1.6	SMLC signalling to a Type B LMU	25
6.1.7	SMLC Signalling to a peer SMLC.....	26
6.2	Protocol layering in Iu mode	26
6.2.1	Signalling between SMLC and MSC/SGSN	26
6.2.2	Signalling between SMLC and MS	27
6.2.3	SMLC signalling to a Type A LMU	28
6.2.4	SMLC signalling to a Type B LMU	28
6.2.5	SMLC signalling to a peer SMLC	28
7	GERAN Network Location Procedures	28
7.1	State description for SMLC.....	28
7.1.1	SMLC States	28
7.1.1.1	NULL State	28
7.1.1.2	LOCATION State	28
7.1.2	State Functionality	29
7.1.2.1	State Transitions.....	29
7.1.2.2	LOCATION Timer Function	29
7.2	State Description for the BSC	29
7.2.1	BSC States	29
7.2.1.1	IDLE State.....	29
7.2.1.2	LOCATION State	29
7.2.2	State Functionality	30
7.2.2.1	State Transitions.....	30
7.2.2.2	LOCATION Timer Function	30
7.3	Usage of SCCP Connection on the Lb interface in the CS domain in A/Gb mode	30
7.3.1	SCCP Connection for positioning of a target MS	30
7.3.2	SCCP connection to access a Type A LMU	31
7.4	Usage of SCCP Connection on the Lb interface in the PS domain in A/Gb mode.....	31
7.4.1	SCCP Connection for positioning of a target MS	31
8	Common Procedures to Support Positioning	32
8.1	Information Transfer between an SMLC and a Target MS in the CS Domain in A/Gb mode for E-OTD and A-GNSS positioning methods	32
8.1a	Information Transfer between an SMLC and a Target MS in the PS Domain in A/Gb mode	33
8.1b	Information Transfer between an SMLC and a Target MS in Iu Mode	34
8.2	Information Transfer between an SMLC and a BSC.....	35
8.3	Common Procedures to Support Access to an LMU	36
8.3.1	Location Update Procedure between an SMLC and a Type A LMU	36
8.3.2	IMSI Detach Procedure between an SMLC and a Type A LMU	36
8.3.3	LCS Information Transfer between an SMLC and a Type A LMU	38
8.3.3.1	Information Transfer using an SDCCH.....	38
8.3.3.2	Information Transfer using a TCH.....	39
8.3.4	LCS Information Transfer between an SMLC and a Type B LMU	40
8.4	Common Control Procedures for LMUs	41
8.4.1	Reset Procedure	41
8.4.2	Status Query Procedure	41
8.4.3	Status Update Procedure	42
8.5	Exception Procedures	42
8.5.1	Procedures in the SMLC.....	42
8.5.2	Procedures in an LMU	43
8.5.3	Procedures in the BSC in the CS Domain.....	43
8.5.3.1	General Procedures	43
8.5.3.2	Rejection of an SMLC Positioning Request.....	44
8.5.3.3	Interaction with Inter-BSC Handover	44
8.5.3.4	Interaction with Intra-BSC Handover and other RR Management Procedures	44
8.5.3.5	Priority of Handover and Other RR Management Procedures	44
8.5.3.6	Interaction with Segmentation support for Legacy MS.....	44
8.5.3.7	Overload.....	45
8.5.4	Procedures in the BSS in the PS Domain	45

8.5.4.1	General Procedures	45
8.5.4.2	Rejection of an SMLC Positioning Request.....	45
8.5.4.3	Overload.....	45
8.5.4.4	Inter BSS Cell Change	46
8.5.5	Void	46
8.6	Procedures in the Target MS	46
8.7	Further Procedures for Handover	46
9	Positioning procedures	46
9.1	Positioning Procedure Initiation	46
9.1.1	Core Network Position Procedure Initiation over the A interface	46
9.1.2	Positioning Procedure Initiation from an Internal LCS Client for the CS Domain (A/Gb mode)	47
9.1.3	Core Network Position Procedure Initiation over the Gb interface	47
9.1.3a	Core Network Position Procedure Initiation over the Gb interface for Multilateration Positioning methods.....	48
9.1.4	Positioning Procedure Initiation from Core Network (Iu mode)	49
9.1.5	Positioning Procedure Initiation from Internal LCS Client (Iu mode).....	49
9.2	Common Positioning Procedure for CS Domain in A/Gb mode.....	49
9.2a	Common Positioning Procedure for PS Domain in A/Gb mode	50
9.2b	Common Positioning Procedure for Iu mode	51
9.2c	GPRS Cell Change for the PS Domain in A/Gb mode.....	52
9.2c.1	Intra-BSS Cell Change.....	52
9.2c.2	Inter-BSS Cell Change.....	52
9.3	TA Based Positioning in CS Domain for A/Gb-mode	53
9.3.1	Definition of TA states	53
9.3.1.1	MS in IDLE State.....	53
9.3.1.2	MS in DEDICATED State	53
9.3.2	TA Positioning Procedure.....	54
9.3.3	Unsuccessful TA positioning procedure in BSC	54
9.3a	TA Based Positioning in PS Domain for A/Gb-mode	54
9.3a.1	Definition of PS Domain TA Modes	55
9.3a.1.1	MS in Packet Idle Mode.....	55
9.3a.1.2	MS in Packet Transfer Mode	55
9.3a.2	TA Positioning Procedure.....	55
9.3a.2a	TA Positioning Procedure for an MS in EC operation.....	56
9.3a.3	Unsuccessful TA positioning procedure in BSS	57
9.4	E-OTD and A-GNSS Positioning Procedures	57
9.4.1	General procedures	57
9.4.2	Positioning Request	57
9.4.3	Assistance Data Delivery.....	58
9.4.3a	Positioning Capability Transfer	59
9.4.4	Error Handling for E-OTD and A-GNSS in CS Domain.....	60
9.4.5	Error Handling for the SMLC in CS Domain	61
9.4.5a	Error Handling for E-OTD and A-GNSS in PS Domain	61
9.4.6	Broadcast of Assistance Data.....	62
9.4.6.1	Point-To-Multipoint Assistance Data Broadcast Flow.....	62
9.4.6.2	Ciphering.....	63
9.4.6.2.1	Algorithm	63
9.4.6.3	Deciphering key control and delivery to MS	64
9.5	U-TDOA Positioning Procedures.....	66
9.5.0	General.....	66
9.5.1	U-TDOA Positioning in CS Domain for A/Gb-mode.....	66
9.5.1.1	General Procedures	66
9.5.1.2	CS U-TDOA Messages and Procedures on the Lb Interface	66
9.5.1.3	RR Procedure effecting the CS U-TDOA channel description	67
9.5.1.4	BSC Error Handling during CS U-TDOA Positioning Procedure	68
9.5.2	U-TDOA Positioning in PS Domain for A/Gb-mode	68
9.5.2.1	Introduction	68
9.5.2.2	General Procedures	68
9.5.2.2.1	MS in packet idle mode	69
9.5.2.2.2	MS in packet transfer mode.....	69
9.5.2.3	PS U-TDOA Messages and Procedures on the Lb Interface	69

9.5.2.4	RLC/MAC Procedure affecting the PS U-TDOA TBF description	70
9.5.2.5	Error Handling during PS U-TDOA Positioning Procedure	70
9.6	Multilateration Positioning Methods	71
9.6.1	General.....	71
9.6.2	Multilateration Timing Advance.....	71
9.6.2.1	General procedure	71
9.6.2.2	Multilateration Timing Advance Request	72
9.6.2.3	Error Handling for MTA	75
9.6.2.4	Assistance Information.....	75
9.6.2.4.1	Assistance Information Transfer	75
9.6.2.4.2	Provisioning of Assistance Information to the MS.....	76
9.6.3	Multilateration OTD	76
9.6.3.1	General Procedure.....	76
9.6.3.2	Multilateration Observed Time Difference Measurements	77
9.6.3.3	Error Handling for MOTD	80
9.6.3.4	Network Assistance Information for Multilateration OTD	80
10	Information storage	80
10.1	SMLC	80
10.2	Recovery and Restoration Procedures	81
Annex A (informative):	Change history	82
History		84

iTeh STANDARD PREVIEW
 (standards.iteh.ai)
 Full standard:
<https://standards.iteh.ai/catalog/standards/sist/ea9d96b4-5290-4df6-9f52-fee17e16f42/etsi-ts-143-059-v14.3.0-2020-04>

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

PREVIEW
iTech STANDARD
(standards.iteh.ai)
Full standard:
<https://standards.iteh.ai/catalog/standards/sist/ea9d96b4-529b-4df6-9f52-f1e16f42/etsi-ts-143-059-v14.3.0-2020-04>

1 Scope

The present document specifies the stage 2 of the LoCation Services (LCS) feature in GERAN, which provides the mechanisms to support mobile location services for operators, subscribers and third party service providers.

The purpose of this stage 2 specification is to define the GERAN LCS architecture, functional entities and operations to support location methods. This description is confined to the aspects of LCS within the GERAN and does not define nor describe the LCS entities or operations within the Core Network.

Location Services may be considered as a network provided enabling technology consisting of standardised service capabilities, which enable the provision of location applications. The application(s) may be service provider specific. The description of the numerous and varied possible location applications which are enabled by this technology are outside the scope of the present document. However, clarifying examples of how the functionality being described may be used to provide specific location services may be included.

This stage 2 specification covers the GERAN LCS functional model and entities, the location methods, state descriptions, and message flows.

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 22.071: "Location Services (LCS); Service description - Stage 1".
- [3] 3GPP TS 22.101: "Service aspects; Service principles".
- [4] 3GPP TS 23.007: "Restoration procedures".
- [5] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".
- [6] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".
- [7] 3GPP TS 23.271: "Functional stage 2 description of location services".
- [8] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".
- [9] 3GPP TS 24.030: "Location Services (LCS); Supplementary service operations; Stage 3".
- [10] 3GPP TS 24.080: "Mobile radio Layer 3 Supplementary Services specification; Formats and coding".
- [11] 3GPP TS 43.051: "GSM/EDGE Radio Access Network (GERAN) overall description; Stage 2".
- [12] 3GPP TS 44.006: "Mobile Station - Base Station System (MS - BSS) interface; Data Link (DL) layer specification".
- [13] 3GPP TS 44.012: "Short Message Service Cell Broadcast (SMSCB) Support on the Mobile Radio Interface".
- [14] 3GPP TS 44.018: "Mobile radio interface layer 3 specification; Radio Resource Control Protocol".

- [15] 3GPP TS 44.031: "Location Services (LCS); Mobile Station (MS) - Serving Mobile Location Centre (SMLC) Radio Resource LCS Protocol (RRLP)".
- [16] 3GPP TS 44.035: "Location Services (LCS); Broadcast Network Assistance for Enhanced Observed Time Difference (E-OTD) and Global Positioning System (GPS) Positioning Methods".
- [17] 3GPP TS 44.071: "Location Services (LCS); Mobile Radio Interface Layer 3 Location Services (LCS) specification".
- [18] 3GPP TS 48.008: "Mobile-services Switching Centre - Base Station System (MSC - BSS) interface; Layer 3 specification".
- [19] 3GPP TS 48.031: "Location Services (LCS); Serving Mobile Location Centre - Serving Mobile Location Centre (SMLC - SMLC); SMLCPP specification".
- [20] 3GPP TS 48.058: "Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification".
- [21] 3GPP TS 48.071: "Serving Mobile Location Center – Base Station System (SMLC-BSS) interface; Layer 3 specification".
- [22] 3GPP TS 49.031: "Location Services (LCS); Base Station System Application Part LCS Extension (BSSAP-LE)".
- [23] TIA/EIA/IS-J-STD-036 (2000): "Emergency Services Data Communications".
- [24] 3GPP TS 48.016: "General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Network Service".
- [25] 3GPP TS 48.018: "General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".
- [26] 3GPP TS 44.064: "Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification".
- [27] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".
- [28] 3GPP TS 44.060: "General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol".
- [29] 3GPP TS 25.410: "UTRAN Iu Interface: General Aspects and Principles".
- [30] 3GPP TS 25.411: "UTRAN Iu Interface Layer 1".
- [32] 3GPP TS 25.412: "UTRAN Iu Interface signalling transport".
- [33] 3GPP TS 25.413: "UTRAN Iu Interface RANAP signalling".
- [34] Void.
- [35] IETF STD 51, RFC 1661(07/1994): "The Point-To-Point Protocol (PPP)".
- [36] IETF STD 51, RFC 1662(07/1994): "PPP in HDLC-like Framing".
- [37] IETF RFC 2507(02/1999): "IP header compression".
- [38] IETF RFC 1990(07/1994): "The PPP Multilink Protocol (MP)".
- [39] IETF RFC 2686(09/1999): "The Multi-Class Extension to Multi-Link PPP".
- [40] IETF RFC 2509(02/1999): "IP Header Compression over PPP".
- [41] 3GPP TS 43.064: "General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2".
- [42] 3GPP TS 45.010: "Radio subsystem synchronization".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document the following terms and definitions apply and the terms and definitions given in 3GPP TS 22.101.

A/Gb mode: see 3GPP TS 43.051 [11].

Coverage Class: see 3GPP TS 43.064 [41].

EC-GSM-IoT: see 3GPP TS 43.064 [41].

EC operation: see 3GPP TS 43.064 [41].

Iu mode: see 3GPP TS 43.051 [11].

LCS (LoCation Services): LCS is a service concept in system standardisation. LCS specifies all the necessary network elements and entities, their functionality, interfaces, as well as communication messages, necessary to implement the positioning functionality in a cellular network.

NOTE 1: LCS does not specify any location based (value added) services except locating of emergency calls.

LCS Client: software and/or hardware entity that interacts with a LCS Server for the purpose of obtaining location information for one or more Mobile Stations. LCS Clients subscribe to LCS in order to obtain location information. LCS Clients may or may not interact with human users. The LCS Client is responsible for formatting and presenting data and managing the user interface (dialogue). The LCS Client may reside in the Mobile Station (MS).

LCS Server: software and/or hardware entity offering LCS capabilities. The LCS Server accepts requests, services requests, and sends back responses to the received requests. The LCS server consists of LCS components, which are distributed to one or more PLMN and/or service provider.

Location Estimate: geographic location of an MS and/or valid Mobile Equipment (ME), expressed in latitude and longitude data. The Location Estimate shall be represented in a well-defined universal format. Translation from this universal format to another geographic location system may be supported, although the details are considered outside the scope of the primitive services.

Location Request: request for a Location Estimate and optionally a Velocity Estimate.

Mobile Assisted positioning: any mobile centric positioning method (e.g. E-OTD, A-GNSS) in which the MS provides position measurements to the network for computation of a location estimate by the network. The network may provide assistance data to the MS to enable position measurements and/or improve measurement performance.

Mobile Based positioning: any mobile centric positioning method (e.g. E-OTD, A-GNSS) in which the MS performs both position measurements and computation of a location estimate and where assistance data useful or essential to one or both of these functions is provided to the MS by the network. Position methods where an MS performs measurements and location computation without network assistance data are not considered within this category.

Mobile Station: consists of Mobile or User Equipment (ME or MS) with a valid SIM or USIM attached.

Positioning (/location detecting): positioning is a functionality, which detects a geographical location (of e.g. a mobile terminal).

Positioning technology (/locating technology): technology or system concept including the specifications of RF interfaces, data types, etc. to process the estimation of a geographical location, e.g. A-GNSS and E-OTD.

Radio Interface Timing: Comprise Absolute Time Differences (ATDs) or Real Time Differences (RTDs) of the signals transmitted by Base Stations, where timing differences are measured relative to either some absolute time difference (ATD) or the signals of another Base Station (RTD).

RRLP maximum PDU size: maximum PDU size for the RRLP protocol, which is 242 octets.

RRLP pseudo-segmentation: use of several RRLP data messages to deliver a large amount of information.

Target MS: Mobile Station being positioned.

Type A LMU: accessed exclusively over the air interface (Um interface): there is no wired connection to any other network element.

Type B LMU: is accessed over the Abis interface from a BSC. The LMU may be either a standalone network element addressed using some pseudo-cell ID or connected to or integrated in a BTS.

Velocity Estimate: speed and bearing of an MS and/or valid Mobile Equipment (ME), expressed as speed in kilometres per hour and bearing in degrees measured clockwise from North.

NOTE 2: Abis interface is beyond the scope of the present document.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations and the abbreviations given in 3GPP TS 21.905 apply.

2G-	Second Generation
3G-	Third Generation
A	Interface between GERAN BSS and MSC
A-GNSS	Assisted GNSS
A-GPS	Assisted GPS
ATD	Absolute Time Difference
BDS	BeiDou Navigation Satellite System
BSSLAP	Base Station System Application Part
BSSAP-LE	Base Station System Application Part LCS Extension
CBC-BSC	Interface between CBC and BSC
CBC-SMLC	Interface between CBC and SMLC
D-GPS	Differential GPS
E-OTD	Enhanced Observed Time Difference
GNSS	Global Navigation Satellite System (e.g. GPS, Galileo)
Iu	Interface between GERAN BSS and 3G Core Network
Iu-cs	Interface between GERAN BSS and 3G MSC
Iu-ps	Interface between GERAN BSS and 3G SGSN
Gb	Interface between GERAN BSS and SGSN
Lb	Interface between SMLC and BSC
LCCF	Location Client Control Function
LCF	Location Client Function
LSBcF	Location System Broadcast Function
LSCF	Location System Control Function
LSOF	Location System Operation Function
MTA	Multilateration Timing Advance
PCF	Position Calculation Function
PRCF	Positioning Radio Co-ordination Function
PRRM	Positioning Radio Resource Management
PSMF	Positioning Signal Measurement Function
RIT	Radio Interface Timing
RRLP	Radio Resource Link Protocol
RTD	Real Time Difference
SMSCB	Short Message Service Cell Broadcast
SMLCPP	Serving Mobile Location Center Peer Protocol
TA	Timing Advance
UDT	SCCP Unitdata message
Um	GERAN Air Interface
UTC	Universal Coordinated Time
U-TDOA	Uplink Time Difference of Arrival

4 Main concepts

A general description of location services and the service requirements is given in the specification 3GPP TS 22.071. By measuring radio signals the capability to determine the geographic location of the mobile station (MS) shall be provided. The location information may be requested by and reported to a client (application) associated with the MS, or by a client within or attached to the Core Network. The location information may also be utilised internally by GERAN, for example to support features such as home location billing. The location information shall be reported in standard formats, such as those for cell based or geographical coordinates of the location of the MS.

It shall be possible for the majority of the MS (active or idle) within a network to use the feature without compromising the radio transmission or signalling capabilities of the GERAN.

Five positioning mechanisms are supported for LCS: Timing Advance (TA), Enhanced Observed Time Difference (E-OTD), Global Navigation Satellite System (GNSS) based positioning (A-GNSS), Uplink Time Difference Of Arrival (U-TDOA), and Multilateration based positioning.

4.1 Assumptions

- SMLC is either an integrated functionality in BSS or a standalone network element within GERAN.
- LMU is either an integrated functionality in BTS (Type B LMU) or a standalone network element (Type A LMU) where communication is over the Um interface.

4.2 Standard LCS Methods

4.2.1 Timing Advance

The TA is based on the existing Timing Advance (TA) parameter. The TA value is known for the serving BTS. To obtain TA values in case the MS is in idle mode a special procedure, not noticed by the GSM subscriber (no ringing tone), is set up. The cell-ID of the serving cell and the TA is returned as the result of the TA.

TA may be used to assist all positioning mechanisms.

4.2.2 Enhanced Observed Time Difference (E-OTD) positioning mechanism

The E-OTD method is based on measurements in the MS of the Enhanced Observed Time Difference of arrival of bursts of nearby pairs of BTSs. For E-OTD measurement synchronization, normal and dummy bursts are used. When the transmission frames of BTSs are not synchronized, the network needs to measure the Real or Absolute Time Differences (RTDs or ATDs) between them. To obtain accurate trilateration, E-OTD measurements and, for non-synchronized BTSs, RTD or ATD measurements are needed for at least three distinct pairs of geographically dispersed BTSs. Based on the measured E-OTD values the location of MS can be calculated either in the network or in the MS itself, if all the needed information is available in MS.

4.2.3 Global Navigation Satellite System (GNSS) based positioning mechanism

Global Navigation Satellite System (GNSS) refers to satellite systems that are set up for positioning purposes. Systems belonging to this category, that are operational today or will be in the near future are e.g., GPS, Galileo, Satellite Based Augmentation Systems (SBAS), Modernized GPS, Quasi Zenith Satellite System (QZSS), GLONASS and BDS.

A mobile station with GNSS measurement capability may operate in an autonomous mode or in an assisted mode for example MS-assisted or MS-based mode. In autonomous mode MS determines its position based on signals received from GNSS without assistance from network. In assisted mode, MS receives assistance data from network. MS may support one or several GNSSs and the assistance data content may vary depending on this capability.

A-GNSS refers to a concept which supports several global navigation satellite systems and their different navigation signals, including e.g. GPS, Galileo, Satellite Based Augmentation Systems (SBAS), Modernized GPS, Quasi Zenith