

OMTP

OMTP POSITIONING ENABLERS

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1 INTRODUCTION

1.1 DOCUMENT PURPOSE

The document defines requirements to enable location based services for GSM/WCDMA family mobile Terminals in terms of platform and interfaces. It addresses different positioning techniques (wireless network based, satellite based and hybrid), standard interfaces (such as the ones defined in OMA SUPL) and APIs to be accessed from the application level in the mobile.

1.2 DOCUMENT SCOPE

Diagram 1 below depicts a conceptual model of the different components and functionalities for Positioning Enablers.

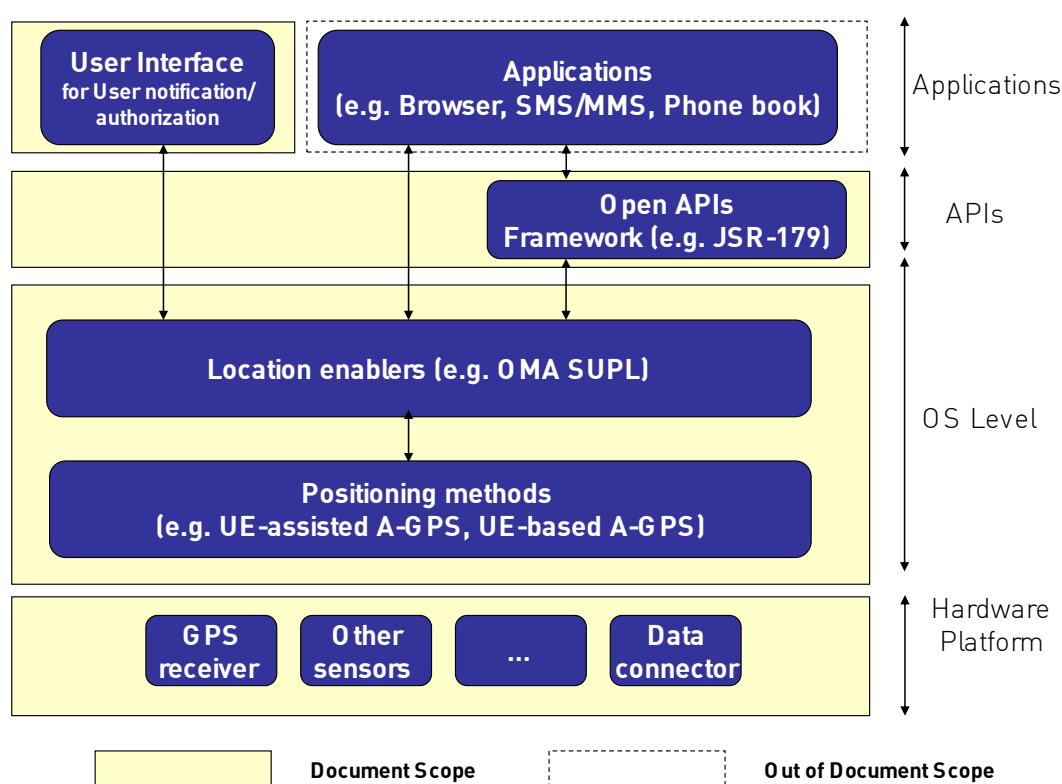


Diagram 1: Positioning Enablers Conceptual Model

This model is structured in four main layers:

- **Hardware Platform:** This layer comprises all the hardware elements (e.g. GPS receiver, electronic compass, 3D accelerometer, gyroscope, altimeter, other motion sensors) available on the device.

- OS Level: This layer includes the software modules built on top of the hardware platform, i.e. the software modules to drive the hardware elements and the Location Enablers to such as OMA SUPL.
- APIs: The API layer exposes the functionality implemented in the OS Level via a programmatic interface that makes possible application development.
- Applications: This layer comprises the applications available on the device in order to offer a service to end-user and the User Interface for enabling the User to be notified about and authorize Location requests.

1.3 BUSINESS RATIONALE

Location based services are becoming more and more important for a high number of use cases. Moreover, in the next year a high number of mobile handsets with satellite positioning capability will be available on the market.

Guidance from OMTP is needed in order to defragment the mobile handsets in terms of the positioning functionalities and the related protocols. Having a set of uniform positioning features will enable interoperability, will allow mobile operators to provide better services and users to enjoy good quality and similar user experience on different mobiles.

1.4 INTENDED AUDIENCE

The document is intended to be used as reference within:

- Mobile Operators: As one of the main targets is reducing requirements fragmentation, Operators should adopt or reference these recommendations within their requirements specifications.
- Terminal manufacturers, i.e. the equipment and technology vendors that will be asked to satisfy OMTP recommendations

Some examples of usage follow:

“The Terminal is compliant with OMTP LOC requirements as defined in ‘OMTP Positioning Enablers’ document”

Within requirements for a Java application: “The application needs an ME compliant with OMTP LOC requirements as defined in ‘OMTP Positioning Enablers’ document”

1.5 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 [1].

- **MUST:** This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.
- **MUST NOT:** This phrase, or the phrase "SHALL NOT", mean that the definition is an absolute prohibition of the specification.
- **SHOULD:** This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- **SHOULD NOT:** This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
- **MAY:** This word, or the adjective "OPTIONAL", mean that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option **MUST** be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option **MUST** be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides.)

The requirements within this document are uniquely identified using the following format:

LOC-#### where:

- #### is a 4 digit number that identifies the requirement (e.g. 0020) and which is to be unique within the document.

2 USE CASES

Lots of location services use cases can be drawn. Some examples of use cases are as follows [2]

- Mapping, navigation, and directions applications are the obvious targets for LBS, but developers who combine this capability with directory services and other offerings will be the long-term winners.
- Workforce-tracking and management applications may end up being the most lucrative applications because they will help enterprises optimize utilization of their people, supplies, and capital equipment in the field. Industry segments include security, delivery, and service businesses.
- Entertainment and gaming applications can take the baton from the pioneering geo-cache enthusiasts and create interactive gaming experiences and services that complement sporting events, concerts, and more.
- “Finder” applications can apply users’ locations to helping them locate anything from the closest restroom to friends in a crowd.
- Location-enhanced imaging applications can label captured multimedia with information about the location where the user recorded the file.
- Weather applications can provide local forecasts and warnings about inclement weather.
- Location-based reminder applications can prompt users when they reach particular locations, displaying, for example, a shopping list when a user gets close to a certain store.

Some others can be found in [3]

3 HARDWARE REQUIREMENTS

In this chapter basic hardware requirements for localisation are listed.

3.1 POSITIONING RELATED HARDWARE

This section contains hardware requirements related to positioning functionality.

REQ. ID	REQUIREMENT
LOC-0010	The Terminal SHOULD be equipped with an internal GPS receiver.
LOC-0020	If the Terminal is equipped with a GPS receiver, the Assisted GPS functionality SHALL be supported.
LOC-0030	If the Terminal is equipped with GPS receiver, Assisted GPS SHALL be used as the default method (instead of Standalone GPS).
LOC-0040	The Terminal MAY be equipped with an electronic compass, 3D accelerometer, gyroscope, altimeter, and other motion sensors.
LOC-0050	The Terminal SHOULD be equipped with a speaker phone capability.
LOC-0060	The Terminal MAY support connection to external accessories in the car (for instance hands-free kit, speakers, screen display, .
LOC-0070	For in-car navigation the Terminal MAY support the use of an external GPS antenna connection for improving overall performance.

3.2 TESTABILITY

This section contains hardware testability requirements

REQ. ID	REQUIREMENT
LOC-0080	The Terminal MAY be equipped with the following connectors for testing purposes. These connectors SHALL be easily accessible. <ul style="list-style-type: none">• Data connector• And specifically NMEA data connector (and ability to log this data)

4 SOFTWARE AND PROTOCOLS REQUIREMENTS

Software and protocols requirements are listed in this section.

4.1 DEVICE CAPABILITIES

REQ. ID	REQUIREMENT
LOC-0090	An A-GPS enabled Terminal SHALL support the User Plane solution specified in OMA SUPL [4], [5] specifications limited to Proxy mode only and RRLP only.
LOC-0100	An A-GPS enabled Terminal SHALL implement the Control Plane CS NI-LR, MT-LR, MO-LR as specified in Release 5 of following 3GPP specifications: <ul style="list-style-type: none"> • 3GPP TS 24.030 [6], • 3GPP TS 25.331 [7], • 3GPP TS 25.305 [8], • 3GPP TS 44.031 [9], • 3GPP TS 23.171 [10], • 3GPP TS 24.080 [11]. • 3GPP TS 43.059 [12], • 3GPP TS 23.271 [13].
LOC-0110	An A-GPS enabled Terminal SHALL support the following positioning methods: <ul style="list-style-type: none"> • UE-assisted A-GPS • UE-based A-GPS • Autonomous/Standalone GPS
LOC-0120	The Terminal SHALL support the following positioning methods: <ul style="list-style-type: none"> • LocationID (SUPL only) • Enhanced Cell/sector (SUPL only)

REQ. ID	REQUIREMENT
LOC-0130	<p>The Terminal SHOULD support the following positioning methods:</p> <ul style="list-style-type: none"> • Cached position (SUPL only) as defined in OMA-TS-ULP: Section 7.13 QoP [5] and in OMA-AD (step E in section 6.8.1) [4]

4.2 PRIVACY/NOTIFICATION CONTROL

REQ. ID	REQUIREMENT
LOC-0140	The Terminal SHALL provide location information accordingly to OMTP ASF [14]

4.2.1 GLOBAL PRIVACY CONTROL SETTING

The global privacy setting provides primary protection on user privacy. Requirements on privacy control setting are listed below.

REQ. ID	REQUIREMENT
LOC-0150	The Terminal SHALL have the ability for the user to set privacy options.
LOC-0160	The user interface SHOULD refer to a Location On mode, an Emergency Only mode (associated with Terminal detected emergency calls)
LOC-0170	If country specific regulatory framework allows it, the user interface SHALL refer to a Location Off mode.
LOC-0180	The user interface SHALL allow the user to select the mode during a call
LOC-0190	When privacy is set to Emergency Only, the Terminal SHALL only allow emergency positioning (and not any other positioning service). Positioning includes initiation of location sessions, reporting of any location information to applications and reporting of GPS information to any network elements.
LOC-0200	The Terminal SHALL NOT initiate a location session or report any location information to applications and GPS information to any network elements if the privacy is set to Location Off.

REQ. ID	REQUIREMENT
LOC-0210	The Terminal SHOULD support a notification and verification mode whereby the user can respond to one notification event with an “always deny” or “always accept” response. This is not an explicit mode supported over the air in either SUPL [4], [5] or the Control Plane [6],[11] but the UE SHOULD be able to respond with the appropriate over the air "deny" or "accept" for all subsequent calls on a per requestor basis or for all location events.

4.2.2 CP PRIVACY CONTROL

In addition to the Global privacy setting, interactive privacy control is also specified in the Control Plane specification.

REQ. ID	REQUIREMENT
LOC-0220	With the exception of emergency services, for mobile terminated location requests (MT-LR) in Control Plane the Terminal SHALL support the notification and privacy verification procedures specified in [6], [11].

4.2.3 UP PRIVACY CONTROL

In addition to the Global privacy setting, an User Plane capable Terminal has to support interactive privacy control. A privacy control requirement is listed below.

REQ. ID	REQUIREMENT
LOC-0230	With the exception of emergency services, the application SHALL provide the user option of notification and/or verification dialog window upon the location request and SHALL only provide location information to the network if authorized by user [4], [5]

4.3 SECURITY

In Control Plane the communication between UE and SMLC is secure since SMLC is within the operator’s network. This section contains a requirement related to authentication and security in User Plane.

REQ. ID	REQUIREMENT
LOC-0240	<p>Mutual authentication SHALL be supported between Terminal and a SLP. Terminals and SLPs SHOULD perform PSK-TLS with the 3GPP GBA [15] as described in TS 33.222 [16] with relevant key management mechanisms. Where 3GPP GBA with PSK-TLS [16] is not supported either in the Terminal or in the SLP the alternative client authentication (MSISDN/IP Address Mapping based) SHALL be used by the SLPs to authenticate the Terminal.</p> <p>If SLP address is provisioned on the SET, the authentication SHALL take place via PSK-TLS and GBA.</p>

4.4 OPEN APIS FRAMEWORK

Requirements related to API for localization are listed in this section.

REQ. ID	REQUIREMENT
LOC-0250	If JSR-179 (location API specified in [17]) is supported, the Terminal SHALL support the security framework specified in [18]
LOC-0260	<p>If JSR-179 (location API specified in [17]) is supported, the Terminal SHOULD support</p> <ul style="list-style-type: none"> • the security and trust services API specified in [19] • Scalable vector graphics API as specified in [20]. • JSR 256 Mobile Sensor API specified in [21] • JSR 135 [22] for Voice guidance • JSR 75 [23] and JSR 248 [24] for Access to Device Address Book
LOC-0270	WAP-based positioning application SHOULD be considered as -Network Initiated. The Terminal support for WAP-based positioning application SHALL comply with WAP 2.0 as specified in [4].
LOC-0280	A WAP and User Plane capable Terminal SHALL also support WAP push trigger [25] for network initiated location request as specified in OMA SUPL ([14], [15]). WAP 2.0 SHALL be used for the WAP push.

REQ. ID	REQUIREMENT
LOC-0290	If an open application framework is provided, it SHALL expose APIs with at least same functionalities and provided return data as Java's API defined in LOC-250 using appropriate programming model.
LOC-0300	If an open application framework is provided, it SHOULD expose APIs with same functionalities and provided return data as Java's API defined in LOC-0260 using the appropriate programming model.

4.5 SERVICE INTERACTION

Requirements related to interaction and concurrency of services are listed below.

REQ. ID	REQUIREMENT
LOC-0310	In CP mode the Terminal SHALL support GPS operation concurrently with CS services; If Terminal supports 3G or DTM the Terminal SHALL support GPS operation concurrently with other data services
LOC-0320	In UP mode, the Terminal SHALL support GPS operation concurrently with other data services; If the Terminal supports 3G or DTM, the Terminal SHALL support GPS operation concurrently with CS services
LOC-0330	The Terminal SHALL allow concurrent requests but the Terminal SHALL NOT enter error state or violate CP or UP protocol
LOC-0340	Interactions MAY also be defined for location requests and other phone activities such as voice/data calls, music playing, camera, etc. For instance the Terminal MAY provide voice navigation prompt for an incoming location request during music playing or voice call; the Terminal MAY also support simultaneous location request and camera usage

4.6 OTHER POSITIONING RELATED SUBJECTS

Other positioning related requirements are listed in this section

REQ. ID	REQUIREMENT
LOC-0350	Preloaded applications Applications MAY be preloaded at the operator's discretion to make location services available by default. Additionally an over-the-air download process MAY be used for upgrading preloaded applications as well as installing new applications.

5 USER INTERFACE

Requirements related to User Interface and integration with other applications on the mobile are listed below.

REQ. ID	REQUIREMENT
LOC-0360	The location selected mode (as defined in LOC-0160 and LOC-0170) SHALL be always clearly visible to the user through an icon on primary (and secondary if present) display (e.g. as for battery and signal strength ones).
LOC-0370	If a location session is running or has happened, the user SHALL be notified on primary (and secondary if present) display through an icon or a modification of the mode icon defined in LOC-0320
LOC-0380	The Terminal SHOULD communicate to the user the status of a positioning request such as positioning in progress, subscription failure, data communication failure, positioning failure, server not found.
LOC-0390	<p>Location Access Points</p> <p>The Terminal SHOULD provide options for the user to activate positioning application from the following standard applications.</p> <ul style="list-style-type: none"> • Browser • Mail • SMS/MMS • Phone book • PoC • Buddy Lists • My position • Cellular calls • Calendar • Photo • Favorite locations • Positioning record • Simple geo-fences and positional alerts

REQ. ID	REQUIREMENT
LOC-0400	<p>Browser</p> <p>The Terminal SHOULD support activation of positioning and sending of location information with a browser. The browser SHOULD also support:</p> <ul style="list-style-type: none"> • direct linkage to navigation (drive to/walk to) where you can set this point as the destination (default) or start point • direct linkage to map the location from browser • adding the location information to favourite location • store the location information in phone book
LOC-0410	<p>Email</p> <p>The Terminal SHOULD support sending of location information via mail. Mail SHOULD also support:</p> <ul style="list-style-type: none"> • direct linkage to navigation (drive to/walk to) where you can set this point as the destination (default) or start point • direct linkage to map the received location from mail • adding the location information to favourite location • store the location information in phone book
LOC-0420	<p>SMS/MMS</p> <p>The Terminal SHOULD support sending of location information via SMS/MMS. SMS/MMS SHOULD also support:</p> <ul style="list-style-type: none"> • direct linkage to navigation (drive to/walk to) where you can set this point as the destination (default) or start point • direct linkage to map the received location from SMS/MMS • adding the location information to favourite location • store the location information in phone book • in MMS send ability to attach a map showing your location to the MMS

REQ. ID	REQUIREMENT
LOC-0430	<p>Phonebook</p> <p>The Terminal SHOULD support</p> <ul style="list-style-type: none">• direct linkage to navigation (drive to/walk to) where you can set this location as the destination (default) or start point• direct linkage to map the location from phone book• adding the location information to favourite location• editing the location information in the phone book• importing/exporting the location information from/to the address book• sending the location information by mail from the phone book• ordering the phone book by location
LOC-0440	<p>PoC (Push to Talk)</p> <p>The Terminal MAY support the following PoC features:</p> <ul style="list-style-type: none">• Proximity indicator of other phone• when PoC call originated your location is pushed out with it (assuming privacy conditions are met)• when PoC call originated the called phone responds with its location (assuming privacy conditions are met)

REQ. ID	REQUIREMENT
LOC-0450	<p>Buddy Lists (integration with IM)</p> <p>The Terminal SHOULD support creation of buddy lists. Buddy list/IM features include:</p> <ul style="list-style-type: none"> • direct linkage to navigation (drive to/walk to) where you can set a member of the buddy list as the destination (default) or start point • ability to order buddy list by proximity • direct linkage to map buddies who are near current location • direct linkage to PoC to a buddy group, or individual which is near current location (e.g. PoC to all buddies in your “clubbing” list who are within 1-2 km) • direct linkage to SMS/MMS to a buddy group, or individual which is near current location (e.g. SMS/MMS to all buddies in your “clubbing” list who are within 1-2 km)
LOC-0460	<p>My Position (launching the application the user is localized on his current position)</p> <p>The Terminal SHOULD support</p> <ul style="list-style-type: none"> • direct linkage to map the location from my position • editing the location information in my position • importing/exporting the location information from/to my position • sending the location information by mail from my position • adding the location information to favourite location • a setting to “refresh my position when: manually, idle, making a call, taking a picture, sending an mms, etc?”

REQ. ID	REQUIREMENT
LOC-0470	<p>Cellular calls</p> <p>The Terminal MAY support</p> <ul style="list-style-type: none">• proximity indicator of other phone• when PoC call originated your location is pushed out with it (assuming privacy conditions are met)• when PoC call originated the called phone responds with its location (assuming privacy conditions are met)
LOC-0480	<p>Calendar</p> <p>The Terminal SHOULD support</p> <ul style="list-style-type: none">• direct linkage to navigation (drive to/walk to) where you can set the meeting location as the destination (default) or start point• direct linkage to map the location from calendar• intelligent alerts which alert you to meeting based on your location and the time it will take to get to the meeting location (can be enhanced based on knowledge of transportation type and traffic)• sending current position/directions to other meeting attendees• adding meeting location to favourite locations

REQ. ID	REQUIREMENT
LOC-0490	<p>Photo/Camera integration</p> <p>The Terminal SHOULD support</p> <ul style="list-style-type: none"> • acquiring the location information when built-in camera is being used • storing location information with pictures • adding the location information to favourite location • when viewing a picture/mms/email (with stored location info) it SHOULD be possible to: <ul style="list-style-type: none"> ○ direct linkage to navigation (drive to/walk to) where you can set the photo location as the destination (default) or start point ○ add the location information to favourite location ○ display the map for the location information in the photo ○ send the photo and map/direction/location information by SMS/MMS or mail
LOC-0500	<p>Favourite location</p> <p>The Terminal SHOULD support</p> <ul style="list-style-type: none"> • direct linkage to navigation (drive to/walk to) where you can set the location as the destination (default) or start point • direct linkage to map the location from favourite location • storing of the favourite locations to navigate to • acquiring/editing the location information in the favourite locations • sending the map/direction/location information by SMS/MMS or mail from the favourite locations

REQ. ID	REQUIREMENT
LOC-0510	<p>Position Record (Launching the application user can record his current and browse his past positions)</p> <p>The Terminal SHOULD support</p> <ul style="list-style-type: none">• direct linkage to navigation (drive to/walk to) where you can set the location as the destination (default) or start point• saving of location information together with date and accuracy to the position record• sending the map/direction/location information by SMS/MMS or mail from the position record• storing the location information in position record to the phone book• adding the location information to favourite location

6 PROVISIONING AND CONFIGURATION

Requirements related to provisioning and configuration of positioning enablers are listed below.

REQ. ID	REQUIREMENT
LOC-0520	If the Terminal supports OMA SUPL, it SHALL support provisioning and auto-configuration of the SLP address in the SIM/USIM or UICC card as specified in [4].
LOC-0530	If the Terminal supports storage of H-SLP address on the SET, the H-SLP address SHALL only be changeable through OTA. As defined in SUPL [4] the OTA mechanism SHALL be OMA DM

7 PERFORMANCES

Requirements related to positioning performance are listed.

REQ. ID	REQUIREMENT
LOC-0540	The Terminal supporting CP positioning SHALL comply with the CP protocol conformance requirements specified in [26], [27], [28].
LOC-0550	The Terminal supporting OMA SUPL SHALL comply with the SUPL protocol conformance requirements specified in [29] ¹ .
LOC-0560	For A-GPS UE-assisted and A-GPS UE-based positioning methods the Terminal SHALL comply with the minimum performance specified in [30], [31].

NOTE: This version of the document does not suggest any specific test requirements for standalone GPS because there is no standard specification that addresses standalone GPS performance yet.

¹GCF is currently working to define a conformance subset in GCF-WI-058. The work item could be considered in future version of the document

8 LOOKING FORWARD

The following requirements are expected to be formalized in future versions of this document, when the mentioned standard specifications and systems are available.

8.1 OMA SUPL 2.0

Trigger location procedures SHOULD be provided. Both periodic and area event flows SHOULD be provided.

8.2 SECURITY

Terminals supporting OMA SUPL SHALL support 3GPP GBA with PSK-TLS [4], [5]

8.3 CONTROL PLANE

An A-GPS enabled Terminal SHALL implement the Control Plane PS NI-LR, MT-LR, MO-LR as specified in Release 5 of following 3GPP specifications: [6], [7], [8], [9], [10], [11].

An A-GPS enabled Terminal SHALL implement the Control Plane as specified in Release 6 of following 3GPP specifications: [[6], [7], [8], [9], [10], [11].

An A-GPS enabled Terminal SHALL implement the Control Plane as specified in Release 7 of following 3GPP specifications: [6], [7], [8], [9], [10], [11].

8.4 GALILEO AND OTHER POSITIONING SYSTEMS

OMTP intends to work on specific requirements for Galileo system in future versions of the document.

9 DEFINITION OF TERMS

TERM	DESCRIPTION
AUTONOMOUS/ STANDALONE GPS MODE	When operating in Autonomous/Standalone mode, the UE computes its own position without assistance from the wireless network; the UE uses GPS assistance data that is or has been obtained from the satellites. Connectivity with the network is not required in this mode.
A-GPS UE- BASED MODE	When operating in UE-based mode, the UE computes its own position with the assistance of the wireless network, which provides the appropriate GPS assistance data. Connectivity with the network is required in this mode.
A-GPS UE- ASSISTED MODE	When operating in UE-assisted mode, the wireless network computes the UE position. The wireless network provides GPS assistance data to the UE. Connectivity with the network is required in this mode.
EMERGENCY ONLY MODE	In this operational mode positioning is only enabled in the context of an emergency services call.
LOCATION ON MODE	In this operational mode positioning is enabled for all services and applications.
LOCATION OFF MODE	In this operational mode positioning is disabled in all contexts including emergency services call.
TERMINAL	Used as an alternative term for a cellular/mobile telephone or handset.

10 ABBREVIATIONS

ABBREVIATION	DESCRIPTION
3GPP	3 rd Generation Partnership Project
A-GPS	Assisted GPS
API	Application program interface
CP	Control Plane
CS	Circuit Switched
DTM	Digital Terrain Mapping
GCF	Global Certification Forum
GPS	Global positioning system
GSM	Global system for mobile communications
IM	Instant messaging
IP	Internet Protocol
JCP	Java Community Process
JSR	Java Specification Request
LCS	LoCation services
MMS	Multimedia messaging service
MO-LR	Mobile Originated Location Request
MSISDN	Mobile Systems International Subscriber Identity Number
MT-LR	Mobile Terminated Location Request
NMEA	National Marine Electronics Association
OMA	Open Mobile Alliance
OS	Operating System
OTMP	Open Mobile Terminal Platform

ABBREVIATION	DESCRIPTION
PoC	Push to talk over cellular
RRC	Radio resource control
RRLP	Radio resource LCS protocol
SET	SUPL Enabled Terminal
SLP	SUPL location platform
SMLC	Serving mobile location center
SMS	Short message service
SUPL	Secure User Plane Location
TLS-PSK	Transport layer security – pre-shared key
UE	User equipment
UMTS	Universal Mobile Telecommunications System
UP	User Plane
WAP	Wireless Application Protocol
WCDMA	Wideband Code Division Multiple Access

11 REFERENCED DOCUMENTS

No.	DOCUMENT	AUTHOR	DATE
1	RFC 2119 “Key words for use in RFCs to Indicate Requirement Levels”. http://www.ietf.org/rfc/rfc2119.txt	S Bradner	March 1997
2	Capitalizing On The Location-Based Services Opportunity – Nokia white paper (http://forum.nokia.com/info/sw.nokia.com/id/90db45d4-5f59-44a0-8cd1-cebd62f4967e/Capitalizing_On_v1_1.pdf.html)	Nokia	March 2005
3	3GPP, TSG Services and Systems Aspects; LCS; Service Description; Stage 1 (TS 22.071)	3GPP	
4	OMA Secure User Plane Location Architecture, version 1.0 www.openmobilealliance.org	OMA	June 2007
5	OMA UserPlane Location Protocol, version 1.0 www.openmobilealliance.org	OMA	June 2007
6	Location Services (LCS); Supplementary service operations – stage 3 (TS 24.030)	3GPP	
7	Radio Resource Control (RRC) protocol specification (TS 25.331)	3GPP	
8	Stage 2 functional specification of User Equipment (UE) positioning in UTRAN (TS 25.305)	3GPP	
9	Location Services (LCS); Mobile Station (MS) - Serving Mobile Location Centre (SMLC) Radio Resource LCS Protocol (RRLP) (TS 44.031)	3GPP	
10	Location Services (LCS); Functional description; Stage 2 (UMTS) (TS 23.171)	3GPP	
11	Mobile radio interface layer 3; supplementary services specification; Format and coding (TS 24.080)	3GPP	
12	3GPP, Functional stage 2 description of Location Services (LCS) in GERAN (TS 43.059)	3GPP	

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13	3GPP, Functional stage 2 description of Location Services (LCS) (TS 23.271)	3GPP	
14	OMTP Application Security Framework v2.1	OMTP	September 2007
15	3GPP - Generic Authentication Architecture (GAA); Generic bootstrapping architecture (TS 33.220)	3GPP	
16	3GPP - Generic Authentication Architecture (GAA); Access to network application functions using Hypertext Transfer Protocol over Transport Layer Security (HTTPS) (TS 33.222)	3GPP	
17	Location API for Java™ 2 Micro Edition (JSR-179)	JCP	March 2006
18	Mobile information device profile for Java™ 2, micro edition (JSR-118)	JCP	June 2006
19	Security and trust services API (SATSA) for Java™ 2 platform, micro edition (JSR-177)	JCP	August 2007
20	Scalable 2D vector graphics for Java™ 2 Micro Edition (JSR-226)	JCP	June 2006
21	Mobile Sensor API (JSR-256)	JCP	July 2007
22	Mobile Media API (JSR-135)	JCP	June 2006
23	PDA Optional Packages for the J2ME Platform (JSR-75)	JCP	June 2004
24	Mobile Service Architecture (JSR-248)	JCP	November 2007
25	“WAP Push Message”, Open Mobile Alliance™, Mar 2001, URL: http://www.openmobilealliance.org/tech/affiliates/wap/wap-251-pushmessage-20010322-a.pdf	OMA	March 2001
26	User Equipment (UE) conformance specification; Part 1: Protocol conformance specification (TS 34.123-1)	3GPP	
27	Terminal conformance specification; Radio transmission and reception (FDD) (TS 34.121)	3GPP	

No.	DOCUMENT	AUTHOR	DATE
28	Mobile Station (MS) conformance specification; Part 1: conformance specification (TS 51.010-1)	3GPP	
29	OMA Enabler Test Specification for SUPL www.openmobilealliance.org	OMA	October 2007
30	Requirements for support of Assisted Global Positioning System (A-GPS) (FDD) (TS 25.171)	3GPP	
31	Terminal conformance specification; Assisted Global Positioning System (A-GPS); Frequency Division Duplex (FDD) (TS 34.171)	3GPP	

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