Telit Location Based Services User Guide

1VV0301046 Rev.1 – 2013-04-02

Making machines talk.

APPLICABILITY TABLE

PRODUCT
GE864-QUAD Automotive V2
GE864-QUADV2
GE864-QUAD ATEX
GE864-GPS
GE865-QUAD
GL865-DUAL/QUAD
GL865-DUAL V3
GE910 Family
HE910 Family
UE910 Family
CE910 Family
DE910 Family
GC864-QUAD V2

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Contents

1. Introduction

1.1. Scope

Scope of this document is to provide an overview of the different Location Based Services (LBS) available in Telit modules.

1.2. Audience

This document is intended for customers who are developing applications aiming to provide positioning data and positioning services through Telit modules.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-EMEA@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

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To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. Document Organization

This document contains the following chapters:

“Chapter 1: “Introduction” provides a scope for this document, target audience, contact and support information.

“Chapter 2: “Overview” provides an overview of the reliable position acquisition and related problems.

“Chapter 3: “Positioning Networks and Techniques” provides an overview of different techniques and networks related to positioning applications.

“Chapter 4: “Telit Location Based Services” provides an overview of the Location Based Services offered by Telit.

“Chapter 5: “Telit Bundle\Combo Solution” details the LBS supported by Telit bundle solutions.

“Chapter 6: “Acronyms ”.

“Chapter 7: “Document History” details the history of the present document.

1.5. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.6. Related Documents

- Telit_GPS_User Guide
- Telit_SiRF_InstantFix User Guide.
- Jupiter SGEE Application Note
- Jupiter InstantFix Application Note
- Client EE Distribution Server set-up

2. Overview

The acquisition of the device position information is a key factor in most of m2m applications such as asset tracking, infotainment, theft prevention, and surveillance systems. The acquisition and updating required for a reliable position is usually performed using a GNSS receiver often mounted in tandem with a cellular module or by means of a combo Cellular+GNSS module. The cellular module is required so that position data can be sent to the remote service provider associated with the device and data received from the service provider can be made available to the device.

Beside the position fix performed using satellite navigation systems, there are also other methods for a M2M device, to compute the device position. For instance, using 2G/ 3G mobile networks' measured parameters, and methods like BTS triangulation (Cell-ID, OTDOA, AOA and so on) it is possible to retrieve an estimated position.

The quality and confidence of the Cell-ID position is not comparable with GNSS position in outdoor environments. Nevertheless, often Cell-ID performs better than GPS in the indoor due to the weakness of GPS signal strength.

Moreover, GNSS standalone modules could face serious challenges in harsh outdoor environments, such as urban canyons, mountains, etc, due to a potential limited visible sky-slice.

The limited satellite visibility can be experienced not only in the classic trade centers with high buildings, but also in other apparently less challenging roads like "Venice's calles" in which it is often difficult (or even impossible) to retrieve a position fix or it could happen that this operation is so slow that the position data in not available at the right moment.

In order to overcome these limitations of GNSS devices, several assistance techniques have been developed in order to "assist" the GNSS device in performing and speeding up the position computation. All these "assisting" techniques use some communication network (Ethernet, WiFi, Cellular and so on) in order to provide additional data to GNSS device.

These "assisting" techniques are often called Assisted-GPS because they have been developed with the aim to assist GPS receiver.

The Assisted GPS (AGPS or A-GPS) allows mitigating these limits providing the GNSS device with crucial data to speed up the position fix, likte, Time, Almanac, Ephemeris and so on. Nevertheless, some of these positioning techniques can also be used by applications without the need of a GPS device onboard. For instance, position triangulation using cellular base stations or WiFi hot-spots.

The usage of different positioning techniques and their combination in the last years have been more properly called "Location Based Service".

3. Positioning networks and techniques

There are several networks/methods available for positioning computation:

- Global Navigation Satellite Systems (so-called GNSS)
  - GPS (GPS-NavStar, U.S.A. owned)
  - GLONASS (ГЛОНАСС, Russia owned)
  - Galileo (European Community owned)
  - Compass BD2(also known as Beidou2, PRC owned)
- Cellular Network positioning techniques
  - Cell-ID
  - RTT (round trip time)
  - and more…WiFi for instance
- Combined GNSS+Wireless (A-GPS)
  - RRLP (C-plane, 3GPP)
  - SUPL (U-Plane, OMA)
  - Assisted GPS (with extended ephemeris provided by an external entity)

NOTE:

These techniques can be combined to minimize the time to first fix (TTFF) as well as the position error

Let’s have a fast look on these positioning techniques in §3.1.

3.1. Positioning using Satellite Navigation constellations

The device position is computed using one or more satellite constellations orbiting around the Earth. The basic concept is that the device position is estimated through the time of arrival (TOA) ranging.

Basically, TOA is based on the measurement of the time interval employed by a RF signal transmitted by an emitter (e.g., satellite, BTS, WiFi…and so on) at a known location to arrive at the MT (Mobile Terminal).

The TOA is defined as:

TOA = Time Instant of Arrival – Time Instant of Transmission

which is measured by the user receiver.

If the receiver knows the speed of the signal, it is able to determine the distance from the emitter by multiplying the TOA with the signal speed value.

In the case of satellite navigation, electromagnetic signals, propagating at the speed of light (approximately 3 × 108 m/s), are used; therefore, the fundamental equation of satellite navigation is:

- Speed of Light×Time of Arrival = Distance

It is clear that the computation of the true (i.e., geometric) distance between the satellite and the MT can be obtained only through the measurement of the true TOA, which implies that the receiver has a precise knowledge of the time instant of arrival and the time instant of transmission of the satellite signal.

The former can be achieved through direct reading of the local receiver clock, whereas the latter is embedded in the GNSS message, which is nominated navigation signal.

To achieve the true difference between these time instants, the satellite and receiver clocks have to be synchronized to the same time scale.

Once the user receiver has a sufficient number of distance values from multiple satellites with known locations, it can compute its position.

One important point to take into account is that, in satellite-based navigation, transmitters are not fixed points but space vehicles (SV) with certain instant speed, position, fluctuations. The receiver has, hence, to be able to determine the satellite position for each distance measurement.

For this purpose, each satellite modulates a signal message that includes the satellite orbital parameters (known as satellite ephemeris) and, thus, enables the receiver to propagate the satellite orbit and, then, to evaluate the transmitter position at each time instant.

The Time reference is the crucial point for GNSS systems. The GNSS reference time is available at the master station while each SV has a precise atomic clock. The time gap (due to clock drift) between GPS time and the different SV clocks as well as receiver clock introduce a degree of error in the measurement.

Besides the errors due to time offsets between GPS system time and satellite clock time and between satellite clock time and receiver clock time, the ranging measurement is corrupted by other factors, namely, incorrect values of the satellite ephemeris, ionospheric and tropospheric navigation signal delay, receiver noise, jamming and multipath.

All these reasons make the computed range measurement not coincide with the true (i.e., geometric) distance between the satellite and user receiver, hence causing one to designate such a range measurement pseudo-range. See fig-1.

This is the reason because GPS devices provide the position information with a certain degree of uncertainty called CEP (Circular Error Probability). Sometimes CEP is indicated with a value in parenthesis: CEP (50) or CEP (90).

CEP (50) is defined as the radius of a circle centered on the true value that contains 50% of the actual GPS measurements. So a receiver with 1 meter CEP accuracy will be within one meter of the true measurement 50% of the time. The other 50% of the time the measurement will be in error by more than one meter.

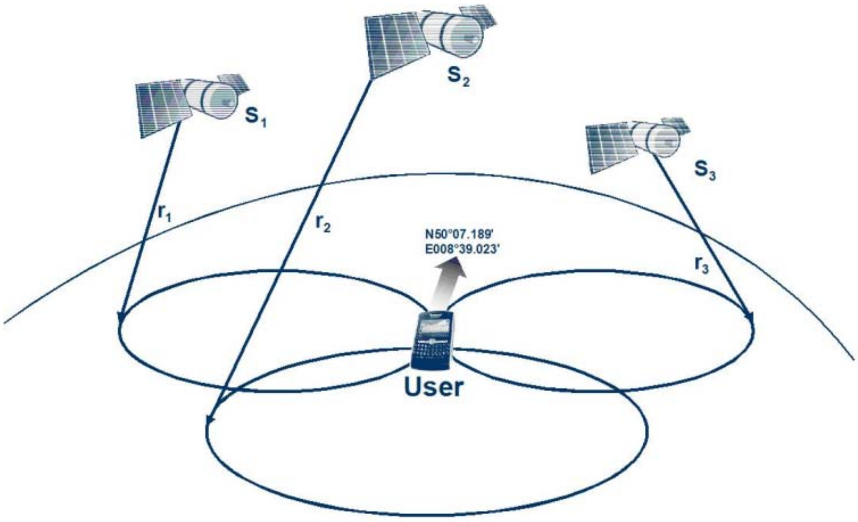
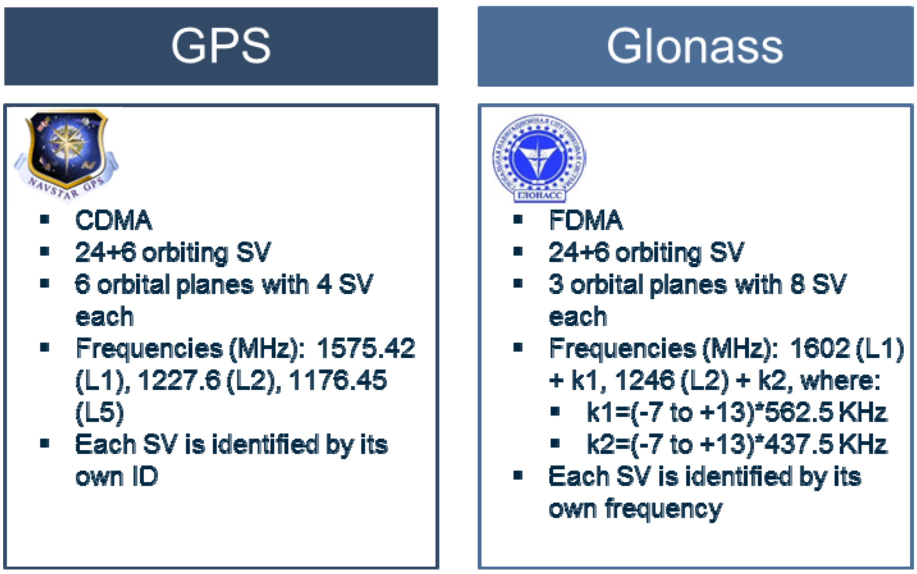


Fig-1 Pseudo-ranges

3.1.1. Navigation Constellation Overview

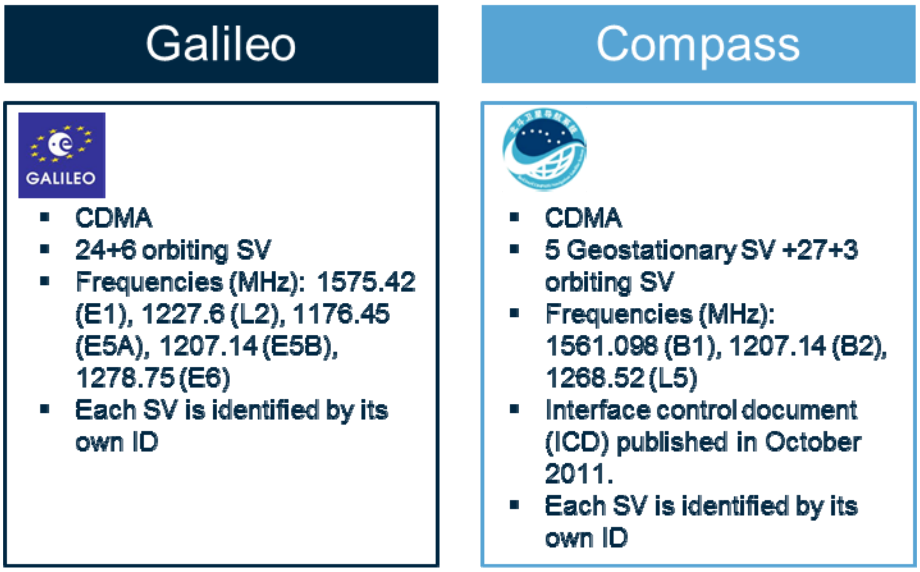
Currently (2013), there are four GNSS constellations in the world, two completed and two being delivered.
Fully working Satellite constellations are:

- GPS
- Glonass



Constellations that are under deployment:

- Galileo
- Compass BD2



3.1.2. Satellite Positioning pros and cons

Satellite positioning has some advantages and disadvantages due to the peculiarity to be based on a space segment.
The space segment consists in a number of satellites (typical 24) transmitting a navigation message a one or more digital codes (sine waves). These data (message and codes) are used to determine the distance from the user's receiver to the GNSS satellite.

Some advantages of using a satellite based positioning system are:

- Signals are always available (24H, 7/7)
- GNSS constellations cover almost the whole globe (except poles).
- Each enabled device can receive and use GNSS data for free.

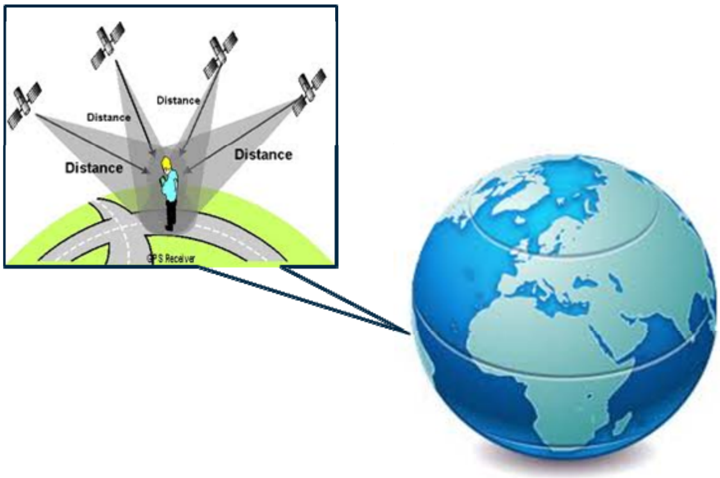


Fig-2 *Advantage: GNSS constellations cover almost the whole globe (except poles). Each enabled device can receive and use GNSS data for free.*

Beside the advantages cited above, there are also some disadvantages:

- Difficult indoor fix due to the weakness of satellite signals (several thousands of kilometers above the Earth).
- Position fix and navigation could be affected by the environmental conditions. For instance, in urban canyons like Venice's "calles" or Chicago's center the limited sky visibility could obstacle the acquisition of enough number of satellites (at least four are required) to compute the position fix.

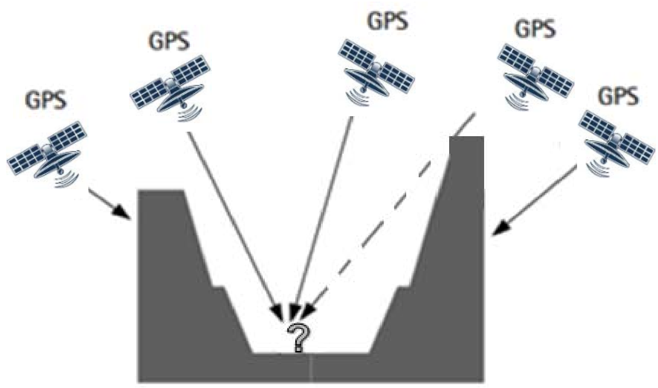


Fig-3. *Disadvantage: Satellite signals may be masked in harsh environments*

3.2. Device Positioning using Cellular Network

This technique, generally called Cell-ID to highlight the fact that is based on cellular towers position, uses the mobile network operator (MNO) base stations as reference stations to compute the mobile terminal (MT) position.

This technique is mainly used when GNSS signals are not available (indoor for instance) or a GNSS device is not available in the application.

The position is computed as relative position compared to those of MNO base stations.

This is possible thanks to support of some databases which have been populated with BTS position data.

The BTS position is known with very high accuracy, the mobile terminal’s position is estimated starting from BTS position and the estimated distance between MT and BTS.

The distance BTS←→MT is estimated using different techniques; depending on the cellular technology (GSM has different approach than CDMA, and UMTS differs from the previous two).

The distance estimation from each base station provides a radius of a circle, the intersection of different radius provides the MT estimated position.

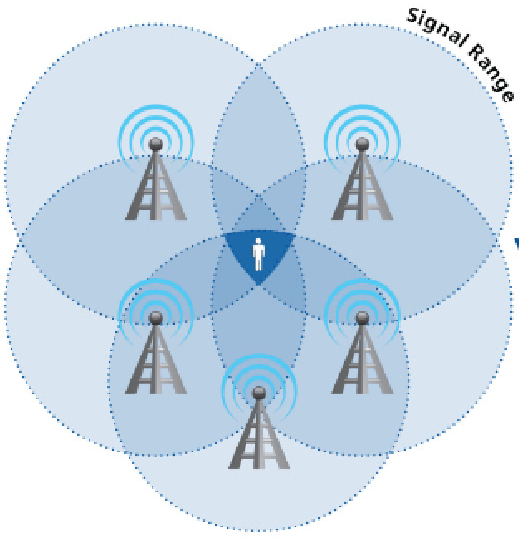


Fig-4. Example of Cell-ID method: Device position is estimated basing on BTS covered area.

The distance MT--BTS can be estimated for example with the measure of the Round-Trip Time (RTT). See fig-5.

RTT distance tis estimated taking into account that the electromagnetic waves propagate at the speed of light (approximately 3×10^8 m/s); therefore, the fundamental equation is:

- Speed of Light×Time of Arrival = Distance

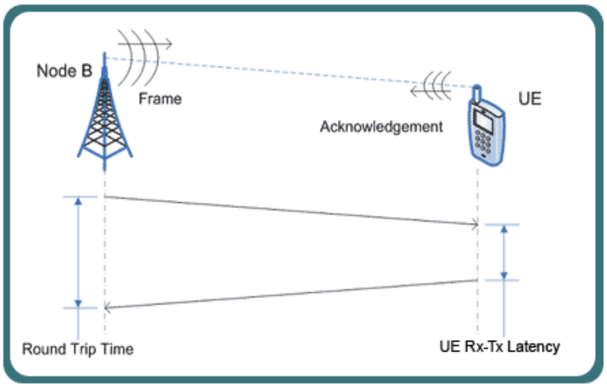


Fig-5. Example of RTT (Round Trip Time) method: it measures the distance between the BTS and the device.

A crucial actor in Cell-ID positioning is the availability of database populated with the position of the cellular towers and the statistics of the computed device positions and the related measured parameters.

A typical way to collect this data is to map the cellular signals received from all the visible BTS and send this data collection together with the real device position retrieved using a GPS receiver.

For these reason, some of the Cell-ID service providers ask customers (and sometimes pay for it) to agree to send BTS visible statistics and related GPS position time-by-time using specific apps.

In theory, bigger the amount of statistic stored in the database more accurate the Cell-ID estimated position.

Telit offers a Cell-ID positioning service called m2mLOCATE. .

All Telit modules are able to retrieve their position using cellular network information through m2mLOCATE. service.

See m2mLOCATE. Application Note for more details about service and related AT commands.

Ask to your Telit Sales Representative or contact TTSC in order to have AGPS server access grants.

See §1.6 for reference documents and §4 and §5 for more details

3.2.1. Cellular Network positioning pros and cons

The so-called Cell-ID positioning has several points of strength but also some weaknesses due to the fact that cellular networks have not been designed to be used for positioning purpose.

Generally speaking, the signal strength of cellular BTS is much higher than GNSS signal due to the facts that satellites are at 20,000 Km far from MT while a BTS typically is few km far from the MT.

The strength points are:

- Cell-ID works fine outdoor as well as indoor.
- Cellular signals are available in locations that cannot be reached by GNSS signals.
- Do not require GNSS receiver.
- At least, it is always able to provide a rough position (those of tower cells)

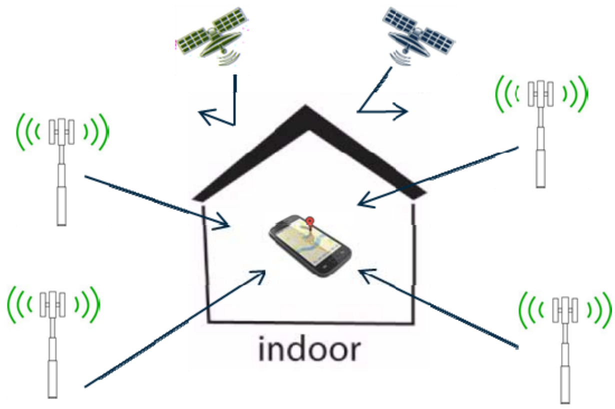


Fig-6. *Advantage: cellular signal strength is often much more strong than GNSS'. So, for indoor fix, cellular network has a better availability than GNSS.*

Weakness points are:

- Due to the fact that cellular technology has not been designed for positioning, its accuracy is lower than GNSS
- Position error could be as bigger as several kilometers (see fig-7)
- Position accuracy depends on BTS density and the quality of the database
- Internet connection is required (potential extra-cost)

Fig-7. *Disadvantage: position error can be several km, especially going out of urban centres where the BTS density in lower*

3.3. Combining Cellular and GNSS

As stated above, either GNSS than cellular positioning techniques have some advantages and disadvantages.

An integrated approach combining these two networks (cellular and satellite) can be pursued in order to compensate the respective weaknesses, taking advantage from the integration of the respective points of strength.

The integration of GNSS and cellular network is generally called Assisted GPS (A-GPS or AGPS). At the present, as also Glonass constellation has been completed, so, the A-GNSS acronym should be the more correct, but we've to notice that "AGPS" is generally used to indicate assistance technology also for GPS+Glonass devices.

Why assisted GNSS?

In order to be able to compute a reliable position (3D fix) with a GNSS device, at least 4 satellites must be tracked.

A GNSS device needs to know the position of each satellite with a very high degree of accuracy. Each Satellite broadcast position data (once every 30s for GPS constellation) and these data must be collected by GNSS receiver from each satellite. Position data download need good signal strength as well as the reception of the complete message without any interruption. The collection of all these data could require several minutes (cold start).

In some conditions, and/or adverse weather conditions, the download of satellite data can be very challenging or even impossible.

Assisted GNSS technique uses cellular network resources to help the GNSS device.

What assistance data can be exchanged with a GNSS device?

- Time mark
- Rough position (trough Cell-ID for instance)
- Ephemeris
- Almanac
- Pseudo-ranges

In combining cellular and GNSS technologies, the cellular network role can be:

1. Active,
   When cellular network structure, sends, receives, computes GPS data in order to speed up the fix of GNSS device. These data are exchanged using dedicated protocols (e.g. SUPL). A network positioning server is required in the cellular network structure.

2. Passive,

When cellular network is used as pure bearer to send and receive data stored in a server (not MNO server but 3rd party server, e.g. InstantFix™ service) containing ephemeris data that will be downloaded and injected in the GNSS device in order to speed up the position fix.

Let's have a look to GNSS+Cellular approaches in the following paragraphs.

3.3.1. Assisted GNSS, server based and network passive role

The goal is to provide the GNSS device with the Ephemeris data required to perform a hot start. The ephemeris data (often called extended Ephemeris or EE) are stored in a server and are downloaded using a cellular internet connection. In this way, the GNSS device is able to provide a fix in few seconds compared to cold start condition that could require from 30 seconds to several minutes.

The EE file stored in the server contains the ephemeris data for a certain amount of days: 1-day EE, 7-day EE and even 31-day EE.

Obviously, longer the validity period bigger the computation error closing to expiration dates.

Using server based extended ephemeris have the following advantages:

- It is mobile network operator (MNO) independent
- No dedicated protocols (e.g. SUPL or RRLP) are needed
- Simple internet connection (HTTP or FTP) is used to download the ephemeris file from a server

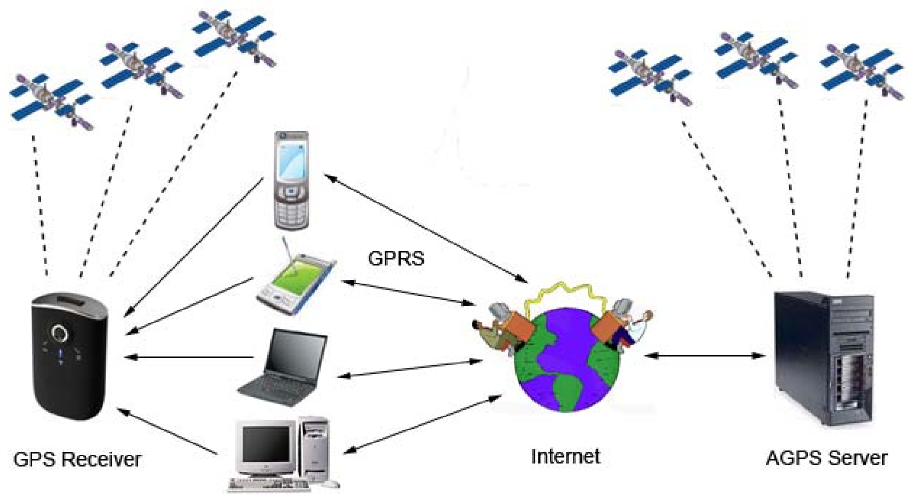


Fig-8. Assisted ephemeris file generation and transmission.

As stated above, the cellular network is used as a pure bearer, without any additional role than providing the internet access to download the EE files from 3rd party server.

Telit offers the AGPS service for free to customers using GNSS devices (see table in §5 for enabled devices list).

Several Extended Ephemeris files are available: 1-day, 3-day, 7-day and 14-day EE file.

Ask to your Telit Sales Representative or contact TTSC in order to have AGPS server access grants.

See §1.6 for reference documents and §4 and §5 for more details.

3.3.2. Assisted GNSS, server based and network active role

Active Cellular assisted positioning techniques are those where the GPS is aided by the MNO network making them MNO-dependent.

In general, it is possible to divide network-assisted positioning into two groups:

1. Mobile Station (MS) Assisted

   MS Assisted is that where the network transmits an assistance message to the MT, consisting of a time mark, visible satellite list, ephemeris, and other parameters. These aiding parameters help the GPS receiver reduce acquisition time considerably. The embedded GPS receiver acquires satellite pseudo-ranges and then sends them to network base station where the position fix is calculated and then sent back to the device. This method requires most of the hardware elements of a stand-alone GPS receiver (i.e. antenna, RF front-end, and digital processor), but can generally get by with less RAM and ROM as the firmware required to compute the position solution exists elsewhere in the network.

2. Mobile Station (MS) Based.

   MS Based is that where the onboard GPS is used to collect satellite data and the cellular network is used to obtain rough position, time mark and other data allowing fast TTFF. Position is calculated onboard. The MS-based device can also work in an autonomous mode providing position solutions to the user or embedded application without the cellular network provided aiding data.

In both these cases the MNO is an active part of the process. The MNO Location Server either performs the position estimation or sends aiding parameters for a reliable and quick fix.

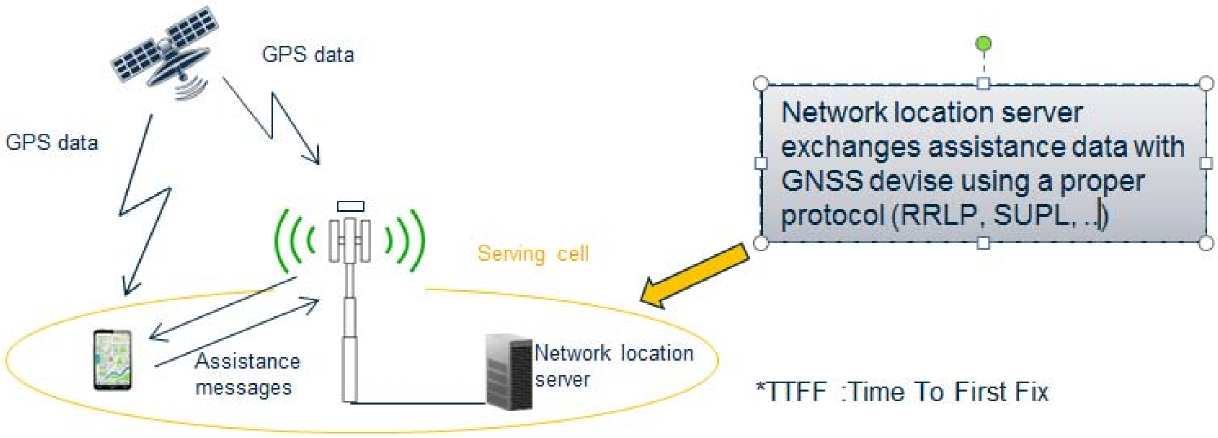


Fig-9. Assisted GPS positioning using cellular network

Position or aiding data can be sent using different dedicated channels and protocols like SUPL (over User plane, defined by OMA) or RRLP (Over Control Plane, defined by 3GPP) see fig-9.

3.4. Assisted GNSS server based: conclusion

As stated in the previous paragraphs, network role could be active or passive, depending on how the network interacts with the GNSS device, but it must be noted that there are more and more cases in which the LBS server is not managed directly by the MNO but form a 3rd party (related of not with MNO) and a User Plane protocol is used to send AGPS data (using SUPL, but also proprietary protocols).

In this case, the classification of this service should fall into the “network passive role” group, in fact, the network acts only as bearer, but this could not be always true. In fact, this kind of implementation uses the position of the BTS in view (or WiFi hot Spot or MCC country code) to select and send only a reduced set of almanac and ephemeris as well as the time stamp data for that specific zone rather than the classic extended ephemeris file that includes the ephemeris for the complete constellation with a certain expiration date.

Whatever implementation is used, the combination of wireless and GNSS technologies allows overcoming the limitations of both technologies positioning technologies in most of the applications, providing customers with a fast and reliable position data at the right moment.

3.5. Self-Assisted GPS

The growth in computing power and memory of latest GNSS chipsets, allows chip manufacturers to embed in the Navigation firmware a SW engine able to compute the EE data starting from the ephemeris data broadcasted by satellites.

This approach does not require any external assistance. Accuracy of the EE file generated onboard is lower than EE files calculated and stored in the AGPS server, especially when data is calculated for long periods (i.e. with validity of 3, 7, 14 days).

From GPS device point of view, EE file generated onboard or the file downloaded from the AGPS server acts in the same way and are managed with the same procedure at the boot.

Basic Self-Assisted concept is:

- GNSS Satellites broadcast ephemeris
- Onboard SW engine for extended ephemeris prediction (starting from broadcasted data)
- No internet/external connection required

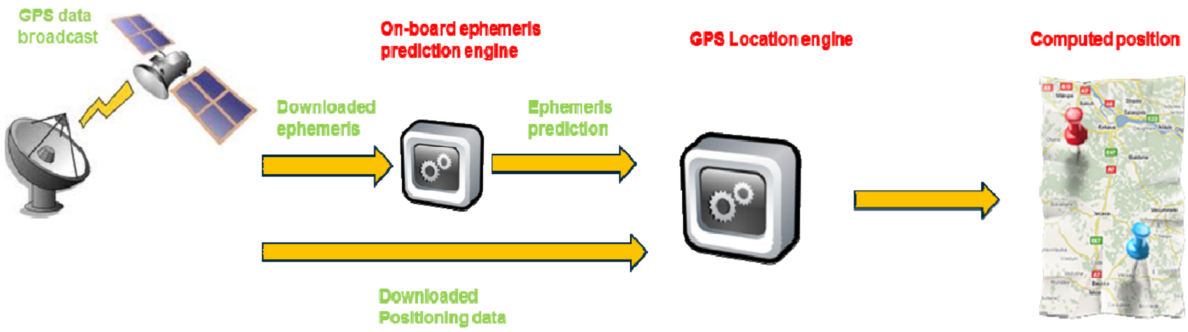


Fig-10: Extended ephemeris generated onboard

3.6. Positioning techniques: conclusion

Positioning services can be characterized by different attributes, among these; availability, accuracy, and computation time are ones of the most important.

- Availability refers to the amount of time when positioning is possible.
- Accuracy refers to the precision that a positioning technology can reach.
- Computation time, obviously, refers to how many time positioning process takes.

For instance, GNSS technology, typically, has very high accuracy. Its availability is excellent in outdoor conditions (especially in rural environment) but could degrade rapidly in indoor or urban conditions.

On the other hand, Cellular positioning has a significantly lower accuracy compared to GNSS but its availability in excellent in indoor and outdoor.

Concerning the computation time, it could be from 1 sec to several minutes for a GNSS (cold start and harsh environment), while takes from 30s to a couple of minutes for cell-ID method even though that returned position could be either “void” or the Cell tower position due to lack of statistical data for that specific geographic zone.

4. Telit Location Based Services

Telit well understands the requirement, constraint and added value related to indoor and outdoor reliable positioning and provides its modules with different positioning capabilities, with an AGPS server service for extended ephemeris download beside an advanced location service based on cellular network positioning techniques provided in partnership with RXNetworks and called m2mLOCATE. .

Moreover, Telit cellular and GNSS modules have been conceived for a seamless integration in bundle Cellular+GNSS solutions, providing customers with a complete and integrated set of positioning solution offering and the related AT commands as well as development tools.

4.1. Telit AGPS server

Telit AGPS service is based on two servers (main server and backup server) providing Telit customers with extended ephemeris files for free.

Extended Ephemeris files are available in the following formats:

- 1-day EE
- 3-day EE
- 7-day EE
- 14-day EE

Beside the AGPS server, Telit provides customer with User Guides, Application Notes and SW tools to test and integrate AGPS feature in the final application.

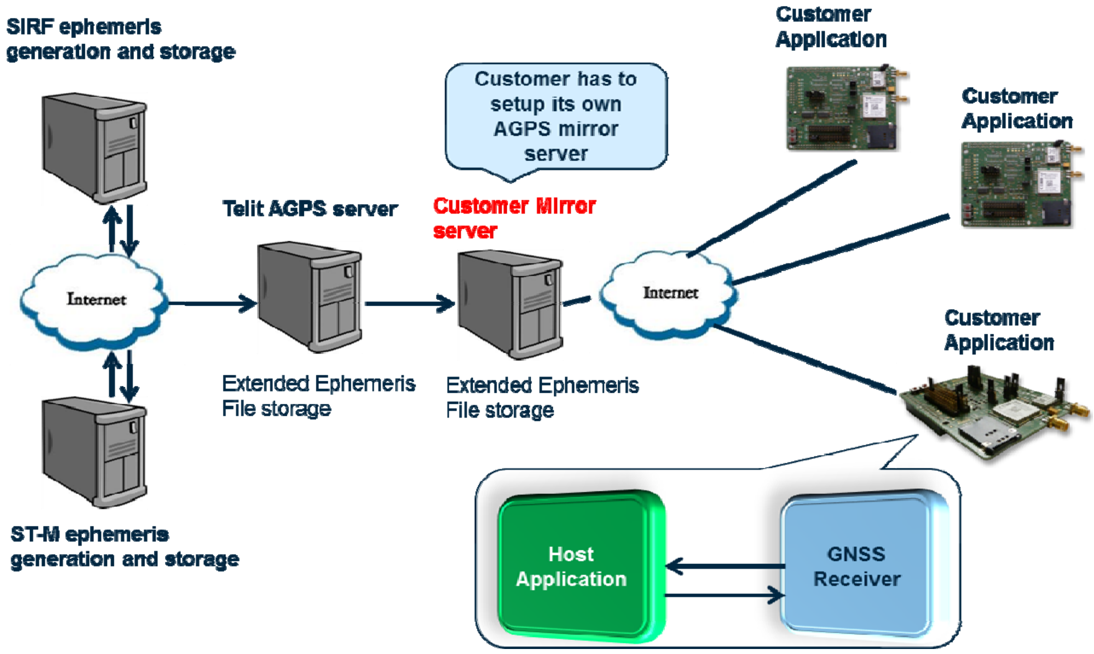


Fig-11: Extended ephemeris generated onboard

The different variants of Telit modules support different EE files size because memory limits.

Telit AGPS server is used by all Telit GNSS modules as well as Telit combo Cellular+GNSS modules with some exception (like HE\UE910 family). See table in §4.3 for details.

Telit AGPS service is available for free after signing the Telit AGPS Agreement.

An AGPS Application Note is available for each platform with related AT commands.

Contact your Telit Sales Representative or Telit Support Center for further details.

4.2. Telit m2mLOCATE Location Service

Telit offers a Cell-ID positioning service called m2mLOCATE.

The m2mLCOATE is based on a partnership between Telit and RX Network, a leading company in Location Based Services offering Cell-ID and WiFi hot-spot database for positioning, as well as GNSS ephemeris download.

All Telit new generation modules are able to retrieve their position using cellular network through m2mLOCATE service.

The m2mLOCATE is based on different Cellular Network positioning techniques (Cell-Id and similar like OTDOA), depending on the cellular technology used by the module, and a database of mapped cellular network containing GSM, WCDMA and CDMA2000 base station positions.

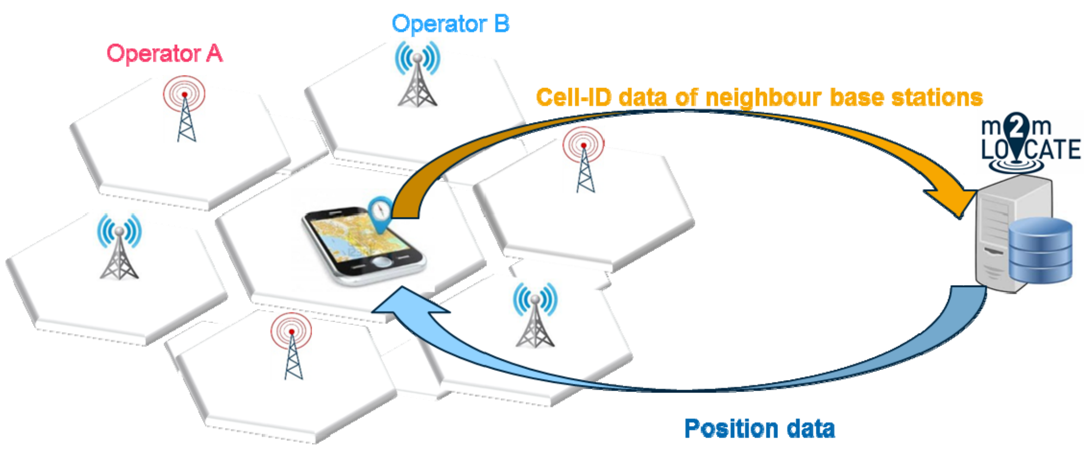


Fig-12. m2mLOCATE concept

The basic steps to retrieve the estimated position are showed in the figure below:

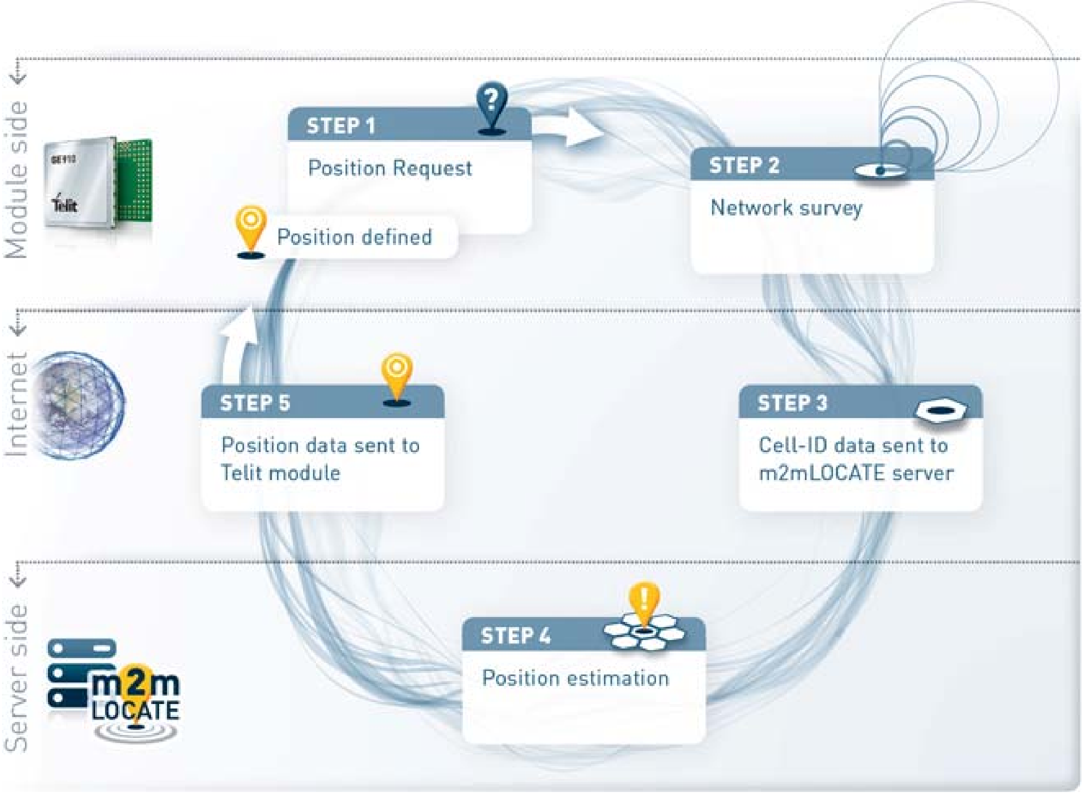


Fig-13. m2mLOCATE position's retrieve operational steps

The implementation of m2mLOCATE does not require any special protocol or any SW development on customer side. The m2mLOCATE is managed using Telit AT commands.

The advantages of m2mLOCATE are listed in the picture below:

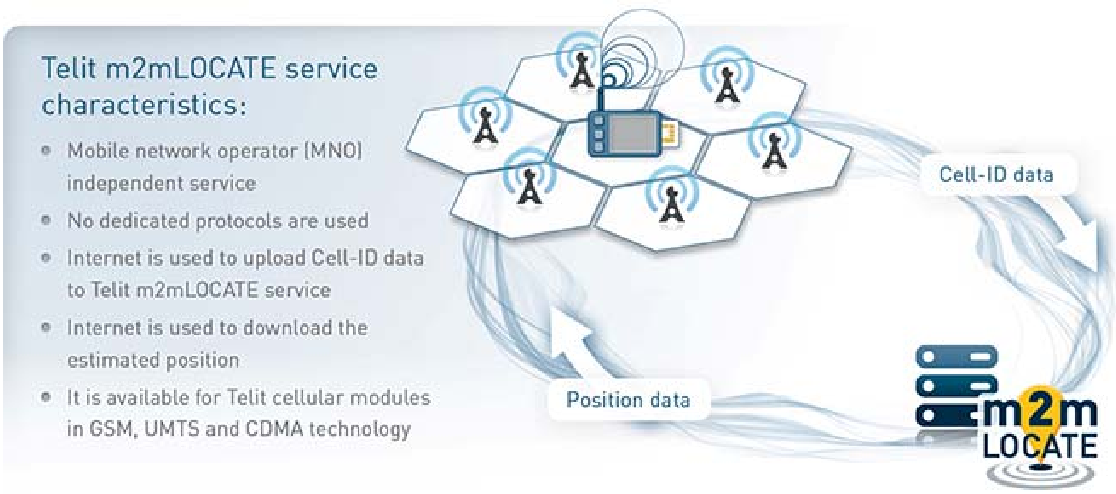


Fig-14. m2mLOCATE main characteristics

Accuracy of computed position is related either to the cell density than to the quality of the statistics available in that specific zone. Generally speaking, the accuracy is in the range of 200-2000m.

Telit m2mLOCATE covers most of the world countries.

Basic m2mLOCATE service is available for free after signing the m2mLOCATE Service Agreement.

Basic m2mLOCATE service provides customer the possibility to query up to ten (10) position information per day.

Those customers requiring higher data rate position (more than 10 query per day) have to subscribe the Premium m2mLOCATE Service Agreement.

See m2mLOCATE Application Note for more details about m2m Locate service and the related AT commands.

Ask to your Telit Sales Representative for more detailed coverage information.

4.3. Telit modules table with supported LBS

Below is detailed the Telit portfolio with the respective positioning capabilities:

Cellular modules and positioning services services							
	Module	**GNSS**	**AGPS server based**	**AGPS self-assisted**	**m2mLOCATE**	**AGPS Network based**	**Product docs**
2G	GE864-QUAD V2 GE864-QUAD Automotive V2 GE865 GL865 GC864-QUAD V2	-	-	-	Yes (from 10.00.xx7)	-	-
2G	GE864-GPS	GPS	Yes	Yes	Yes (from 10.00.xx7)	-	SiRF InstantFix App Note
2G	GE910	-	-	-	Yes (13.00.003)	-	-
2G	GE910-GNSS	GPS, Glonass, Galileo	Yes	Yes	Yes (from 13.00.004)	-	-
2G	GL865-DUAL V3	-	-	-	Yes (from 16.00.xx2)	-	-
3G	UC864-G	GPS	-	-	-	-	-
3G	HE863-xxG	GPS	-	-	-	-	-
3G	HE910-G / DG / -xxG	GPS	-	-	Yes (from 12.00.04)	SUPL1.0	HE910 SUPL App Note
3G	H24	GPS	-	-	-	gpsOne™	-
EVDO	DE910-DUAL	GPS, Glonass	-	-	-	gpsOne™	-
CDMA	CE910-DUAL	-	-	-	-	-	

	C24	GPS	-	-	-	gpsOne™	
	CC864-DUAL	GPS	-	-	-	gpsOne™	

Positioning Modules and services							
	Module	**GNSS**	**AGPS server based**	**AGPS self-assisted**	**m2mLOCATE**	**AGPS Network based**	**Product Docs**
GPS	JF2	GPS	Yes	Yes	(*)	-	▪ Jupiter SGEE Evaluation Manual ▪ Jupiter InstantFix App. Note ▪ Client EE Distribution Server set-up ▪ Telit_Jupiter_Host_NMV_Storag
	JN3	GPS	Yes	Yes	(*)	-	
	Jupiter SE880	GPS	Yes	Yes	(*)	-	
GPS Glonass Galileo	Jupiter SL869	GPS, Glonass, Galileo	Yes	Yes	(*)	-	▪ Telit_SL869_Autonomous_AGPS_App_Note_r0. ▪ Telit_SL869_Server_AGPS_Application_Note_r0

(*) in bundle cellular + GNSS applications or in Telit combo modules, m2mLOCATE. service is able to provide a rough position to GNSS module/section speading up the TTFF as well.

5. Telit Bundle/Combo solutions

Most of Telit cellular modules are ready to be integrated in Bundle cellular + GNSS solutions.

Telit cellular modules are able to handle the AGPS files, used by Telit GNSS modules, by means simple AT commands. In this way, the final integrator does not need to manage specific GPS binary protocols/files and/or integrate an AGPS library in its own SW.

See below bundle matrix for details about the bundling options and the cellular SW variant from which the AGPS AT commands are available.

Positioning Modules		Cellular Modules					
		GSM				HSPA+	
	Module	GE865	GL865	GC864	GE910	HE910	Notes
GPS	Jupiter F2	10.00.xx6	10.00.xx6	10.00.xx7	13.00.xx4	12.00.xx5	
	Jupiter N3	10.00.xx6	10.00.xx6	10.00.xx7	13.00.xx4	12.00.xx5	
	Jupiter SE880	10.00.xx6	10.00.xx6	10.00.xx7	13.00.xx4	12.00.xx5	
GPS GLO GAL	Jupiter SL869	10.00.xx7	10.00.xx7	10.00.xx7	13.00.xx4	12.00.xx5	

Telit Bundle Matrix

6. Acronyms

AOA	Angle Of Arrival
CDMA	Code Division Multiple Access
FDMA	Frequency Division Multiple Access
CDMA	Code Division Multiple Access
EE	Extended Ephemeris
Glonass	GLObalnaya NAvigatsionnaya Sputnikovaya Sistema (Global Navigation Satellite System) - (Russia)
GPS	Global Positoning System
GSM	Global System for Mobile Communication
LBS	Location Based Service
MT	Mobile Terminal
OTDOA	Observed Difference Time Of Arrival
QZSS	Quasi Zeta Satellite System
RTT	Round Trip Time
UART	Universal Asynchronous Receiver Transmitter
UMTS	Universal Mobile Telecommunication System

7. Document History

Revision	Date	Changes
0	2013-01-07	First issue
1	2013-04-02	Updated §4.1 Telit AGPS service Updated §4.2 m2mLOCATE service Updated product list in §4.3, added GL865-DUAL V3. Updated AGPS available documentation