

Combining the best of UMTS with GPS

Highlights of the LISA-U2 3G module series

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Executive Summary

The combination of mobile communications with global positioning, Internet and multimedia services in small, portable devices has become an accelerating industry trend, particularly for mobile resource management systems, connected automotive navigation systems and handheld consumer products. The result is attractive new location-based applications and services that were previously impossible with either technology alone: smart, self-upgrading navigators, sophisticated vehicle and personal trackers, smartphones and tablet PCs with rich multimedia and communications capabilities.

This whitepaper highlights some important considerations when combining UMTS connectivity with GPS based on the LISA-U2 module series.

Design considerations



Global UMTS frequency coverage

Capitalizing on the advantages of combined Wireless/GPS technologies requires more than simply connecting a wireless modem to a GPS receiver: many design considerations must be taken into account especially when selecting the wireless modem:

1. Coverage of global UMTS/HSPA frequency bands

UMTS is not the same everywhere: there are 6 main frequency bands utilized by UMTS/HSPA networks across the globe, making both design and logistics complicated for wireless terminals that should operate in more than one region. That is why u-blox introduced the [LISA-U2 module series](#), universal UMTS modems that support all 6 global UMTS frequency bands, allowing equipment makers to create wireless terminals that work everywhere based on a single modem and design.

2. HSPA+ data rates

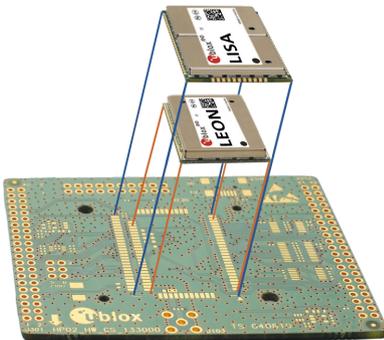
LISA-U2 modules support HSPA+ data rates, up to 21.2 Mb/s in the down-link direction. This is the highest data rate currently offered by an industrial-grade wireless module, and is important for applications requiring video, for example security systems.

3. Layout compatibility with multi-GNSS technologies

The interface between LISA-U2 modules (as well all u-blox wireless modems) and a u-blox GNSS receiver, be it for GPS, GLONASS, Galileo or QZSS, has been reduced to a simple 2-wire I2C bus. This means that end-device variants supporting different satellite positioning standards can be easily created by simply swapping the GNSS receiver without the need for layout or software changes.

4. Interchangeability of GSM, UMTS and CDMA modules

World mobile communication usage has settled primarily on these 3 network protocols. Often a geographic region will support multiple standards provided by different carriers. For equipment manufacturers it is thus advantageous to be able to introduce a single hardware design that can quickly adapt to different protocols simply by interchanging the modem module and upgrading the firmware. This is the case for u-blox' LEON 2G and LISA 3G modem series: a single PCB footprint can be designed that adapts to GSM, UMTS and CDMA networks to maintain compatibility across different regional requirements.



2G / 3G layout compatibility

u-blox maintains a consistent form factor approach to insure that successive generations of SMT components retain layout-compatibility with previous generations, allowing device manufacturers to easily upgrade their designs with minimal hardware and PCB changes. Additionally, firmware compatibility between successive generations assures that designers don't lose man-years of software development time with each successive product generation.



u-blox' LISA SMT (LCC) modem module

5. Size and package:

Pocket-sized or covertly mounted boxes have become the standard for location aware devices. They typically require a microprocessor, memory, display driver, wireless modem, GPS receiver, antenna and passives, all packed into a small, palm-sized housing. As the 3G modem is one of the largest components in the system the smallest possible SMT package with minimum height is important.

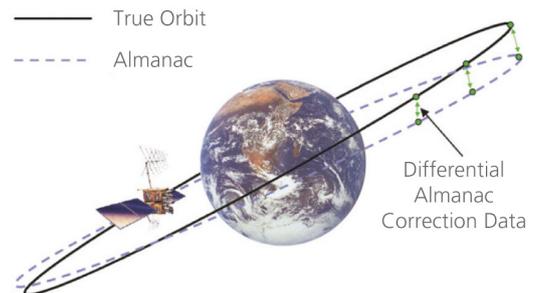
LISA is the industry's smallest 3G modem SMD module and is suitable for automatic pick-and-place assembly, easy soldering, repair and visual quality control as well as single-layer interconnect. Its Lead Chip Carrier (LCC) allows for highly reliable automated pick-and-place soldering and simple visual inspection (i.e. no x-ray inspection) as well as excellent heat dissipation.

6. Layout and component optimization:

High-frequency designs are extremely sensitive to layout as well as passive component selection. Sourcing of multiple passives can also introduce logistic and supply chain problems: the sudden delay of component availability can shut a production line down, and switching to a second source can introduce unanticipated RF performance problems. This is where a module rather than chip approach can be a wise decision: all passives and layout are pre-optimized and tested for the best RF performance. Simply add a crystal and antennae and it's ready to perform.

7. Accelerating GPS positioning:

One of the primary benefits of combining mobile communications with GPS is the availability of a communication back-channel to accelerate positioning. In areas of poor GPS reception, satellite orbital data (ephemeris) can be called-up via a mobile network connection to an [Assisted-GPS](#) server, effectively reducing GPS positioning to a few seconds. A-GPS client firmware embedded in the LEON 2G and LISA 3G modem families is thus an important element to support this feature. Refer to u-blox' AssistNow A-GPS service.



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Indoor positioning made possible with CellLocate™

8. Capitalizing on mobile cell attributes for indoor positioning

GPS satellite reception does not work everywhere. Especially when indoors, tunnels or in metallic containers, global positioning can simply stop working. To address this problem, a parallel positioning technology can be embedded in the 3G modem and utilized to calculate an approximate position based on visible mobile cell attributes. u-blox' proprietary [CellLocate™](#) technology, embedded into both LEON and LISA modem families, capitalizes on the ability of 3G signals to penetrate buildings and shielded containers, as well as the unique combination of wireless cell coverage associated with any given location.

9. Detection of GPS jamming signals

Using GPS systems to track stolen goods is easily thwarted via inexpensive GPS jammers. Integrated jamming detection intelligence can therefore help prevent theft before it begins: the detection of a GPS jamming signal by the GPS receiver can put a system into an alarm condition, while sending out an alert signal via 3G modem. This is especially attractive for vehicle-theft and asset management systems. Jamming detection is a feature of both LEON and LISA modem families.



*Easily obtainable
GPS jammer*

10. Operator certification



In today's global marketplace, manufacturers of devices with embedded wireless connectivity also target multiple markets, making certification a complicated time-consuming process. It is for this reason that a pre-certified wireless module is the most attractive solution. With certifications already granted at the module level, certification of the end-device is vastly simplified: many steps may be skipped. The risk of failing to pass final certification is also minimized as any chance of a potential design flaw in the module has been eliminated.

For the LISA-U2 series, an extensive set of national regulatory and operator certificates is available including PTCRB and AT&T. Check [the u-blox website](#) for the latest operator and standards bodies certifications.

11. Radio Interface Layer (RIL) software

LISA-U2 series comes with a set of tools allowing easy operation under Android and Windows Embedded operating systems. u-blox provides designers with [RIL software](#) for Android 2.3, Android 4.0 Embedded Windows 6.0 & 7.0. The software is provided free of charge and a set of documents instructing how to integrate the RIL software is available.

12. In-band modem capability

The latest generation of automatic emergency call systems that are activated by vehicle collision require that (GPS) data be transmitted over the mobile voice channel, and not GPRS/HSPA or SMS due to their lower prioritization by most 2G and 3G mobile networks. This introduces the



requirement for data transmission over the voice channel which always has the highest service priority. This is similar to how a fax machine transmits image data over the telephone voice channel. This capability is referred to as "in-band modem" and needs to be physically supported by the wireless modem to support emergency call devices such as those need for [Europe's eCall](#) and [Russia's ERA-GLONASS](#) systems. Both LEON and LISA module series support e-Call verified in-band modem capability.

13. Host interfacing

PCB area is precious real-estate for small consumer devices. To minimize layout, a serial port reduces interface requirements with the host controller, reducing PCB area. Additionally, relaying of all commands from the 3G modem to the GPS receiver can effectively eliminate the requirement for a second interface.



14. TCP/IP and UDP/IP support

3G modems should include embedded support for both TCP/IP and HTTP for high-speed web browsing and FTP for reliable transfer of large data files, as well as UDP/IP for VoIP and streaming media applications required by entertainment as well as security applications. This is especially attractive for in-vehicle infotainment systems (automotive quality grade is also important), or for security and surveillance applications. Multiple sockets and IP addresses is also attractive in order to support simultaneous high-speed applications and multiple users. SSL software-client is embedded in the module allowing for secure data transmission.

About u-blox' LISA UMTS and CDMA module series

The LISA-U2 series provides dual-band UMTS/HSPA high-speed data and voice communication. Each modem supports all 6 globally implemented UMTS frequency bands, as well as quad-band GSM/GPRS/EDGE, in the industry's smallest SMT (LCC) form factor. Featuring up to 21.1 Mb/s HSDPA download and 5.76 Mb/s HSUPA upload speeds, a rich set of Internet protocols (TCP/IP, UDP/IP, HTTP, FTP) including SSL functionality, and very low power consumption, LISA-U2 series is ideal for compact applications requiring voice and/or very high data transmission rates such as mobile Internet terminals, hand-held industrial terminals, in-car infotainment, connected navigation systems, eCall, Security and surveillance (video and images), anti-theft systems, and Internet Gateways.

LISA also includes embedded CellLocate™ technology enabling approximate positioning in areas where GPS signals are blocked such as indoors, and also supports in-band modem data transmission supporting emergency call standards.

LISA offers fully integrated access to u-blox GPS receivers. Wireless and GPS are controlled through a single serial port from any host processor, and A-GPS (AssistNow Online and Offline) functionality is integrated.

The LISA-U2 series is also layout compatible with the LISA-C200 CDMA2000 module designed for the North American market, and also enables easy migration from u-blox' LEON GSM/GPRS modules.

Evaluation

Evaluating LISA

Both hardware design, software development and debugging of complex telematics systems can involve significant time and R&D investment. When choosing a 3G modem, it is therefore advisable to take advantage of vendor-provided development environments that can immediately save man-years of engineering costs as well as shave many months off development time.

To make embedded UMTS/HSPA designs run smoothly, u-blox provides LISA-U2 series samples and evaluation kits EVK-U23. The kit provides simple, flexible and ready-to-use environments for evaluating the LISA-U2 module series, as well as for designing and testing of wireless/GPS telematics applications. The kits are very user-friendly, and have both USB and RS232 interfaces for development, testing and tracing.

The kit comes with a built-in u-blox GPS receiver module, giving designers the flexibility to either test GSM/GPRS functionality alone or to integrate it together with u-blox GPS technology. For evaluating Assisted-GPS (A-GPS) a u-blox AssistNow A-GPS client is embedded in the firmware stack, providing users with the option of integrating and testing our license-free A-GPS solutions.

The EVK-U23 evaluation kit includes [m-center](#) and [u-center](#): u-blox' interactive evaluation tools for configuration, testing, visualization and data analysis of wireless and GPS receivers. These powerful and easy to use tools provide useful assistance during all phases of a system integration project.



EVK-U23 evaluation kit for the LISA-U2 universal UMTS module series

About u-blox

u-blox is a leading fabless semiconductor provider of embedded positioning and wireless communication solutions for the consumer, industrial and automotive markets. Our solutions enable people, devices, vehicles and machines to locate their exact position and wirelessly communicate via voice, text or video.

With a broad portfolio of GPS modules, cards, chips, and software solutions together with wireless modules and solutions, u-blox is uniquely positioned to enable OEMs to develop innovative solutions quickly and cost-effectively. Headquartered in Switzerland and with global presence in Europe, Asia and the Americas, u-blox employs 200 people. Founded in 1997, u-blox is listed on the SIX Swiss Exchange.

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