

European eCall will deploy in 2015

**Pan-European vehicle emergency call system
to affect millions of cars in Europe**

Whitepaper by:

*Carl Fenger,
Communications Manager, u-blox*

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Executive Summary



In June 2013, the European Commission adopted two proposals to insure that by October 2015 all new cars and light vehicles sold in the European Union must be equipped with an “In-Vehicle eCall System”, or IVS. The correct choice of IVS components will have a large affect on conformance to the eCall specification as well as time-to-market. Important factors to consider are the possibility to simulate and verify IVS before deployment, the ability to support design-in requirements of closely-coupled GPS and GSM subsystems, in-band modem support, comprehensive software support, component-level certification of the cellular modem, forward compatibility with future wireless technologies such as UMTS, and the availability of automotive-grade GPS and GSM components in high-volume. This paper examines these requirements.

eCall: background



Fig. 1: The European eCall system for automated accident assistance will be deployed in all new cars in the EU by October 2015

After much delay, Europe's automated emergency call system for vehicles involved in a serious accident, known as eCall, will become reality in 2015. The original idea for eCall originates from an idea submitted to a German youth science competition in 2001. Fourteen years later, eCall will finally be deployed.

In June 2013, the European Commission adopted two proposals to insure that by October 2015 all new cars and light vehicles sold in the European Union must be equipped with an eCall compliant terminal.

With over a million new cars currently sold in the EU per month, and over 250 million cars currently in use, the market for in-car eCall systems (for new vehicles) and after-market eCall terminals (for existing vehicles) is enormous.

The "eCall" system automatically dials 112 – Europe's single emergency number - in the event of a serious accident. Manual activation is also possible, for example in the event a driver wishes to report an accident that he/she has witnessed but was not involved in.

The system communicates the vehicle's location, type, color and number of passengers to emergency services, even if the driver is unconscious or unable to make a phone call. A voice channel is also established automatically. It is estimated that eCall it could save up to 2500 lives and save € 26 billion each year by reducing the severity of injuries through faster rescue and medical response.

eCall deployment has been endorsed by 19 European countries and the European Automobile Manufacturers Association which includes renowned automotive companies such as Ford, Daimler, BMW, Toyota, Renault, Fiat, Volkswagen, Hyundai and General Motors.

eCall will work all over the European Union, plus Iceland, Norway and Switzerland. The Russian Federation is developing a similar emergency call system called ERA GLONASS based on the eCall standards. Currently the EU and Russia are working together in order to make eCall and ERA GLONASS interoperable so that eCall will also work in Russia and ERA GLONASS in the EU.

eCall terminals monitor in-vehicle sensors for such events as airbag deployment and automatically transmits location and vehicle details and summons assistance via GSM cellular service. The system requires an embedded eCall subsystem in each vehicle that continuously monitors crash sensors and GPS receiver in order to initiate an automated data and full duplex voice call via a dedicated GSM modem in case of an emergency situation.

eCall: key requirements



Fig. 2: u-blox' SARA-G3: eCall enabled GSM module with in-band modem

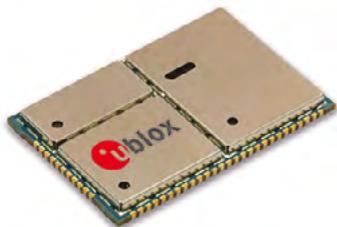


Fig. 3: u-blox' LISA-U2 series: GSM/UMTS modules with in-band modem



Fig. 4: u-blox' UBX-G8030 GPS/GNSS receiver chip for eCall and ERA-GLONASS with Automotive Dead Reckoning



Fig. 5: u-blox' MAX-7: GPS/GNSS receiver module for eCall and ERA-GLONASS

The electronic heart of an eCall terminal

A GSM modem and GPS satellite receiver are at the heart of an "In-Vehicle eCall System", often abbreviated as "IVS". These components provide two crucial functions to support eCall:

- **Constant tracking of a vehicle's location** based on triangulation of at least 4 GPS satellites located 20 thousand kilometers overhead. This function must also operate during situations when satellite view is blocked such as in tunnels, park houses, or high-rise urban locations.
- **GSM wireless network connectivity** throughout the entire EU and participating non-EU countries. Operator approval of the modem and IVS throughout all regions is required.

Vehicle emergency call: not only for Europe

In addition to eCall and ERA-GLONASS, u-blox technology also enables emergency call systems in other geographic regions such as Japan, North and South America as well as Asia-Pacific countries where GSM and UMTS cellular services are widely available. The design criteria for both modem and GNSS receiver are very similar.

For designers of IVS terminals, both first-mount and after-market, selection of these two components requires some serious considerations:

• In-band modem support

For eCall, both data and voice call are required to use the same physical voice channel. SMS and GPRS are not suitable for eCall due to delay, unavailability and lower prioritization as compared to voice. These requirements dictate that the GSM/UMTS transceiver implements an "in-band modem" that allows data transmission over the voice channel, similar to how a fax machine operates. The GSM/UMTS modem must support in-band modem functionality compliant with the 3GPP specification TS 26.267: "eCall Data Transfer; In-band modem solution; General Description."

• Automotive qualified components

For the IVS device, a stand-alone GPS receiver and GSM/UMTS modem module in automotive quality grade:

- o AEC-Q100 qualification for integrated circuits
- o Manufactured at ISO/TS 16949 certified production sites
- o For modules, compliance with ISO 16750 – "Environmental conditions and electrical testing for electrical and electronic equipment for road vehicles".
- o Automotive temperature range, typically –40 to +85 deg. C for cabin or trunk mounted systems
- o High level of component integration: qualifying components is a complex and expensive process. Ideally, both GPS receiver and GSM/UMTS modem modules should thus provide high integration of passives resulting in a single qualification process for the entire subsystem. This also results in a minimum external BOM plus simplified logistics and manufacturing.

eCall: key requirements

- o Previous experience as a qualified vendor to automotive electronics manufacturers also plays a big role here: qualifying products from new vendors is a risky and time consuming process. Electronic OEMs/ODMs usually like to “play it safe” when it comes to designing automotive subsystems.
- o Additional requirements may include: component delivery in moisture-free packaging (“Dry Pack”), regular auditing of manufacturing sites, resistance to mechanical shock, special marking and reporting, guaranteed safety stocks of both chips and modules as well as just-in-time delivery.

- **Operator-approval of the GSM/UMTS modem**

GSM/UMTS modems are subject to country-specific government approvals. In addition, operator-specific certifications within each country may also be required. Without these approvals, an IVS device based on the module will not be allowed to operate over that country's or operator's mobile network. 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.

- **Availability of eCall test environment**

To facilitate the design and evaluation of IVS designs before the eCall infrastructure is actually deployed, a comprehensive testing environment enabling the verification of the overall in-band communication and the development of customer eCall devices is an important requirement for IVS OEMs. The test environment must allow the IVS to use its in-band modem functionality to establish a voice call over an actual GSM/UMTS network. u-blox provides a complete, tested eCall simulation environment based on the ROHDE & SCHWARZ CMW500 Wideband Radio Communication Tester that simulates both the IVS as well as well as Public Safety Answering Point (PSAP) via emulator.

- **System application know-how**

Has the vendor demonstrated system design know-how for eCall application of its components? This should be evident through the availability of a thoroughly tested and documented application note covering hardware, software, simulation and timing aspects of an eCall IVS terminal based on the manufacturer's components. It should include all aspects of communication between the IVS and a simulated Public Safety Answering Point (PSAP) over a live GSM/UMTS network.

- **High sensitivity of the GPS receiver:** because an external antenna could be easily damaged during an accident, the GPS antenna must be integrated in the IVS subsystem. This means mounting either in-dash or under a seat with no open-air line-of-sight to satellites. GPS receiver sensitivity is thus an extremely important aspect of an AVS terminal, for example able to track GPS signals down to -160 dBm during satellite tracking.

eCall: key requirements

- **Assisted-GPS support**

An important consideration for optimal GPS performance is the presence of an Assisted GPS client embedded in the GSM/UMTS modem. This allows for more reliable positioning performance, especially in areas where GPS satellite signals are blocked or attenuated: satellite ephemeris can instead be called up via wireless connection to an A-GPS server. For eCall systems, A-GPS is a crucial feature as accidents often occur in tunnels where GPS signals are unavailable. Does the GPS receiver vendor include an A-GPS firmware client, and does the vendor support this client with an online A-GPS service? Do they provide a quality of service guarantee concerning service availability?

- **Firmware update over-the-air**

Modification as well as introduction of new features and services will be inevitable after a vehicle has left the assembly line. This will be an iterative process lasting over the life of the vehicle. For this reason, the ability to wirelessly upgrade the modem as well as IVS firmware can be expected. Does the modem component support firmware update over the air (FOTA)?

u-blox' eCall solution

u-blox has developed both GPS and GSM/UMTS components supporting all aspects of eCall. Based on the company's "SARA-G3" and "LISA-U2" GSM/UMTS modules, UBX-G8020 GPS/GNSS chip and "MAX-7" GPS/GNSS module series, the company supports all above mentioned design considerations:

eCall system know-how	✓
Automotive qualified components	✓
In-band modem support	✓
eCall simulation and test environment	✓
eCall application note	✓
High component integration	✓
High GPS receiver sensitivity	✓
A-GPS support	✓
FOTA	✓
Track record as automotive vendor	✓
Support for special automotive requirements	✓

eCall: IVS diagram

The figure below shows the 3 main blocks of u-blox' IVS solution:

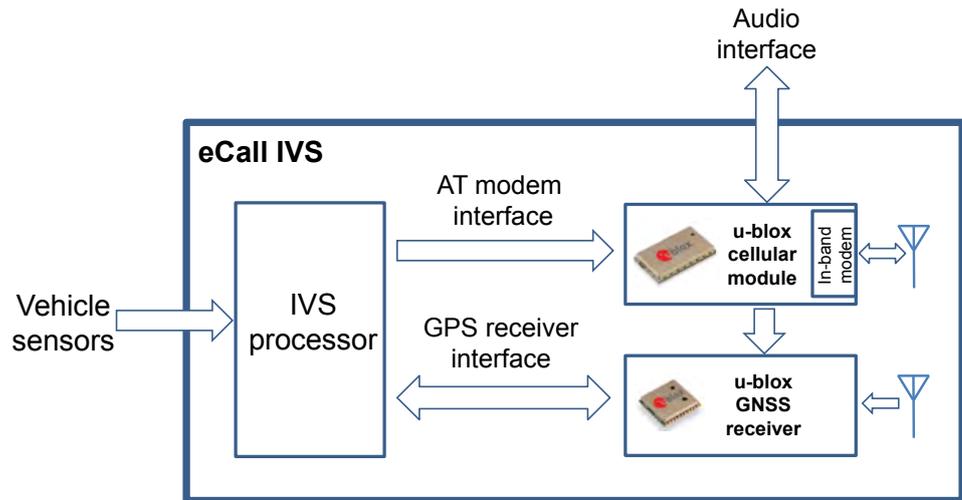


Fig. 6: The u-blox IVS eCall system

- 1) the IVS Application Processor (main controller)
- 2) the GSM/3G modem (SARA-G3 or LISA-U2 GSM/UMTS modem modules)
- 3) the GPS receiver (UBX-G8030 chip or MAX-7 GPS/GNSS module)

The IVS processor controls the wireless module (the GSM/3G module, or "Network Access Device", with eCall in-band modem capability,) through AT commands. Optionally, the u-blox GNSS device can be controlled through the same AT interface as the modem.

The entire In-Vehicle System (IVS) is subject to eSafety-eCall recommendations defined by ETSI. The u-blox eCall solution complies with the following ETSI/3GPP eCall recommendations:

- NAD (Network Access services) and USIM eCall extensions according to ETSI/3GPP Release 10: 3GPP TS 51.010-1 [10], 3GPP TS 24.008 [11], 3GPP TS 31.102 [12] and ETSI TS 127.007 [13]
- In-Band Modem solution according to 3GPP Release 10: 3GPP TS 26.267 [4], 3GPP TS 26.268 [5] and 3GPP TS 26.269 [6]
- eCall application protocol according to EN 16062:2011 [8] for the applicable parts

The high level application protocols, procedures and processes required to provide the eCall service over the mobile communications network is defined in the ETSI document "Intelligent transport systems: eSafety - eCall high level application requirements (HLAP)", document number EN 16062:2011.

eCall: ETSI requirements

The following table summarizes u-blox' IVS solution conformance according to the main requirements of the ETSI eCall specification:

EN 16062:2011 Table 2 - Conformance points for the in-vehicle system				
Main Object	Composed of:	Conformance Points	u-blox Conformity	Comments
IVS Normal operating mode	Activation of pan-European eCall	Conforming to 7.2	OK	Parts up to IVS AP: a) Format MSD and set eCall type through +UECALLTYPE
	Call set-up	Conforming to 7.3 only for the subclauses relative to IVS application layer	OK	
	MSD transfer	Conforming to 7.4 only for the subclauses relative to IVS application layer	OK	Parts up to IVS AP: a) eIM control through AT+UECALLDATA b) Handling of T7 timer and Loudspeaker control through AT+UECALLVOICE
	Application layer ACK	Conforming to 7.5 only for the subclauses relative to IVS application layer	OK	
	No receipt of application ACK	Conforming to 7.5.3	OK	
	Request "SEND MSD"	Conforming to 7.5.4 and 7.6 only for the subclauses relative to IVS application layer	OK	Parts up to IVS AP: a) data transmission progress indication b) MSD formatting and sending through AT+UECALLDATA
	Check audio link to vehicle occupants	Conforming to 7.8	OK	

Fig. 7: u-blox modem compliance with eCall application protocol EN 16062:2011

For detailed information about u-blox' IVS solution for European eCall, please refer to the u-blox application note "eCall / ERA GLONASS implementation in u-blox wireless modules", document number WLS-CS-11004-A. The note provides an overview of IVS implementation of the automated emergency response systems eCall and ERA GLONASS including introduction, IVS and eCall conformity, eCall control through modem AT interface, and a description of u-blox' in-band modem simulation system including a u-blox' proprietary simulation system of an eCall-enabled Public Safety Answering Point (PSAP).

The application note is available on u-blox' website at:
www.u-blox.com/en/download/resources-application-notes/wireless-application-notes.html

About the Author



Carl Fenger

Carl Fenger

Carl has 25 years of international experience working in the semiconductor, software, telecoms, and GPS industries based in the USA and Switzerland. Carl is a published author of numerous technical articles and conference papers in the areas of embedded computing, telecom services billing, and broadband multimedia distribution. Carl holds a Bachelors of Science in Electrical and Computer Engineering from the University of California. Carl is a classical pianist and avid chess player.

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 more than 400 people. Founded in 1997, u-blox is listed on the SIX Swiss Exchange.

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Any comments relating to the material contained in this document may be submitted to:

u-blox AG
Zuercherstrasse 68
8800 Thalwil
Switzerland
info@u-blox.com