

# Recommendations and Regulations of the European Commission Regarding the Pan-European eCall

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**Abstract**— The paper presents the main actions conducted by the European Commission in the context of the eCall programme (the initiatives of Driving Group), the recommendations and requirements for introduction of the pan-European eCall (architecture, handling procedures, minimum set of data (MSD) content, performance criteria, etc.) as well as regulations concerning the pan-European eCall, particularly the status of the eCall project covering also the legal situation of eCall in the Member States including Poland.

**Keywords**— eCall, eSafety, in-vehicle system, minimum set of data.

## 1. Introduction

According to investigation and estimates made by the European Commission (EC) around 40, 000 people were killed and more than 1.7 million people injured in 2008 in road accidents across the European Union (EU). Road fatalities in EU have fallen by more than 27% since 2001, when EC published its *White Paper on European Transport Policy* [1]. Significant impact on this positive trend had *European Road Safety Action Programme* [2] and the *Intelligent Car Initiative* [3]. However, these fatality numbers indicate that the current actions towards reducing the number of accidents are not sufficient. Therefore the EC proposed that EU should set the target of decreasing the number of road fatalities by 50% by 2010 and start actions described in this paper.

## 2. The eCall Definition

The eCall is an emergency call generated automatically via activation of in-vehicle sensors or manually by vehicle occupants. When activated, the in-vehicle eCall system (IVS) will establish a voice connection directly with the relevant public safety answering points (PSAP). At the same time, a minimum set of accident data (MSD) will be sent to the eCall operator receiving the voice call. They will be sent during the call processing or immediately after the set up of emergency call.

The eCall is treated as a part of the E112 service (supplement of TS12) concerning data transmission from the IVSs to the PSAPs, especially including accurate location information (e.g., precise location, time and type of the accident).

The eCall is also the name of the emergency call project developed by the EC Member States to obtain a pan-European solution.

The eCall itself will not reduce the number of accidents but it is expected to improve response times in case of traffic accident and save lives by faster help.

## 3. The eCall Initiatives Conducted by the European Commission

From the beginning the European Commission has been coordinating actions concerning eCall and originated several initiatives related to it. The first initiatives addressed establishment of the eSafety Forum as well as working groups. Moreover, the EC organized high level meetings, elaborated regulations and introduced the eCall Memorandum of Understanding (MoU).

### 3.1. The eSafety Forum

Establishment of the eSafety Forum was a fundamental action of the EU concerning the eCall. It was a joint industry and public initiative for improving road safety by using information and communication technology (ICT). The main idea was to join forces and create a European strategy to accelerate the research and development, deployment and use of intelligent integrated safety systems including advanced driver assistance systems (ADAS) to improve road safety in Europe.

### 3.2. The Driving Group eCall

One of the working groups acting under the eSafety Forum is the eCall Driving Group (DG), established at the end of 2002, which identified the key stakeholders involved in the eCall process and outlined the functionalities of the interfaces to be established between the stakeholders. The DG eCall classified its members into the following four categories:

- automotive industry;
- mobile telecommunication industry;
- public emergency authorities and associated or cooperating service organizations;
- public social security organizations, private insurance companies and automobile clubs.

The DG eCall consists of several working subgroups established to solve different issues related to both the service chain and value chain. Objectives to solve by these subgroups include:

- performance criteria related to the eCall chain;
- functional requirements and the specifications for the eCall generator;
- PSAP requirements regarding receiving and handling eCall;
- cost and benefits for the insurance industry;
- cost of the in-vehicle system;
- overview of available studies.

Currently, DG eCall has 138 members.

### 3.3. Regulations on the Emergency Calls and High Level Meetings

Another initiative of the EC was publication of the directives, communications, recommendations as well as requirements on the emergency calls (112, E112 and eCall) implemented in the EU (see [1]–[17]).

Moreover, under the auspices of the eSafety Forum, 28 recommendations were developed on how the road safety could be improved through new technologies. These recommendations have led to establishment of dedicated working groups developing requirements towards the implementation of specific technologies or applications.

The DG eCall together with European Commission organize meetings in order to build consensus among participants, in particularly to specify the system, define the functional architecture as well as solve organizational issues. Some of them were dedicated to defining a road map for implementation of the eCall, some as a reaction to the communications from the EC calling for the Member States to sign the MoU and take necessary steps to deploy the eCall.

### 3.4. The eCall Memorandum of Understanding

The MoU was introduced in the half of 2004 by the DG eCall to actively investigate eCall solution and business cases. The main purpose of this initiative was acceleration of deployment as well as implementation of eCall built on the single pan-European emergency call number 112 by the end of 2010.

The MoU comprises necessary arrangements for implementing the eCall action plan and sets out the measures to be taken by the EC, Member States, automotive industry, telecoms and insurance industry.

## 4. The eCall Service Chain

The DG eCall identified six domains with separate responsibilities and tasks for the eCall service chain [4]. These domains are depicted in Fig. 1.

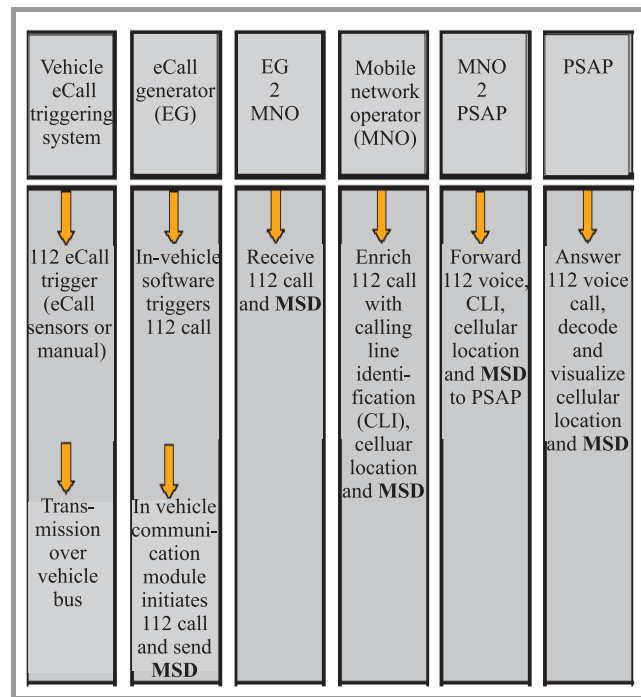


Fig. 1. The domains of the eCall service chain [4].

## 5. The eCall Architecture and Handling Procedure

The architecture of eCall system recommended by the DG eCall is illustrated in Fig. 2.

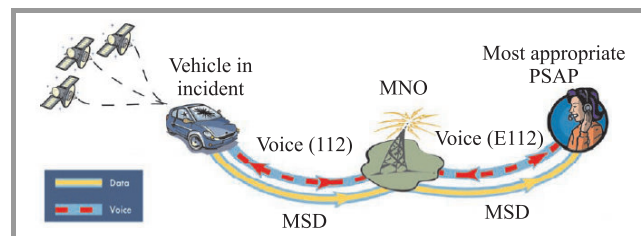


Fig. 2. The eCall system architecture [4].

Procedure for handling eCall:

- In the event of an accident the eCall generator should initiate eCall by sensor triggering and send eCall consisting of a pure voice (audio) telephone call based on 112 and the minimum set of data to the PSAP in automatic or manual manner.
- Handled by the mobile network, the eCall (voice and data) should be recognized as an 112 emergency call and enriched by mobile network operator (MNO) with the calling line identification (CLI) as well as location information (based on the best effort principle) and delivered to the appropriate PSAP.
- If MSD has been properly received, the PSAP should transmit an acknowledgement to the eCall generator.

Table 1  
Revised MSD [5]

Offset	Name	Size [byte]	Type	Unit	Description
0	Control	1	Bitfield		Bit 7: 1 = automatic activation Bit 6: 1 = manual activation Bit 5: 1 = test call Bit 4: 1 = no confidence in position Bit 3 – 0: 1 = reserved
1	VIN	15	Bitfield		Up to 20 VIN characters stored using 6 bits per character with no padding
16	Timestamp	4	Unsigned integer	Seconds	Timestamp of incident event. Seconds elapsed since midnight, January 1st, 1970 UTC
20	Latitude	4	Signed integer	Milliarcsecs	GNSS position latitude (WGS84)
24	Longitude	4	Signed integer	Milliarcsecs	GNSS position longitude (WGS84)
28	Direction	1	Unsigned integer	Degrees	Direction of travel (based on last 3 positions)
29	Service provider	4	Unsigned integer	IPv4	Service provider IP address (optional)
33	Optional data	107	String	To be defined	Additional data, i.e., crash information (optional)
	Sum	140			

Explanations: VIN – vehicle identification number, UTC – universal coordinate time, a.k.a. Greenwich mean time, GNSS – global navigation satellite system, WGS84 – world geodetic system 1984 (a standard for identifying global position).

The eCall should be a “sleeping” application run by the eCall generator which acts only when the generator detects an incident serious enough for triggering an automatic eCall or passengers in the vehicle generate a manual eCall.

### 5.1. The eCall Activation

An automatic eCall trigger signal should be assigned to different crash types, e.g., front, rear, side and roll crashes. It should be generated by the airbag control module and associated or not with other sensors data (e.g., radar, speed, gyro, axle load). The eCall generator is responsible for sending an automatic eCall trigger signal to PSAP and the vehicle manufacturers are responsible for determination of the parameters of this signal. It is required that a number of false eCalls sent by the eCall generator shall be reduced to minimum, because activation of emergency calls should be safe and robust.

Manual activation depends on the specific human machine interface for the eCall generator. The eCall may be initiated by holding the eCall button down for three seconds or pushing the button twice within five seconds. The eCall

system in vehicle should be designed in a way minimizing probability of unintended actions and number of false calls.

### 5.2. The eCall Minimum Set of Data

The DG eCall recommends that the MSD includes important information to help send the emergency services to the site of the accident and to speed up the response. The first proposal of MSD content for eCall was given in [4]. The revisions to this proposal given in [5] are illustrated in Table 1.

The proposed revisions include definitions of: signed and unsigned status of integers, big-endian byte order, encoding for degrees as well as an initial time for the timestamp field. According to these revisions, the last 4 bits of control field should be zero. The reserved bits should be cleared to allow future MSD receiving implementations to detect an earlier version MSD. The vehicle identification number (VIN) is stored using 6 bits per character and a terminating character defined to distinguish between VINs of differing lengths. They also specify requirement added to pad the service provider field when optional data present. This

field contains the IPv4 address of service provider stored as series of 4 1-byte, unsigned integers. Optional data field should not be padded out to its full length. Although this field may contain up to 107 bytes, unused bytes in the field do not need to be padded to reach the full length of 107 bytes. All of these revisions are described in greater detail in [5].

According to DG eCall recommendation, the Committee European de Normalization (CEN) is responsible for finally standardization of MSD content.

### 5.3. The PSAP Structures and Scenarios

Emergency call structure may include two levels of PSAP (PSAP 1 and PSAP 2) served by the same public body; where PSAP 1 means the first point of contact for eCall and PSAP 2 is the actual emergency operator handling the emergency situation. It may also be built as publicly operated PSAP 1 as well as service provider or telecom operator operating as PSAP 1 under control of emergency agency/public authority. To minimize the necessary investment, the DG eCall recommends that current PSAP structures were revised, e.g., through public/private partnerships.

### 5.4. Performance Criteria

The DG eCall recommends end-to-end performance criteria related to timing, quality of service (QoS), PSAP, mobile networks, location and map accuracy. In the DG eCall recommendations the experiences from comparable automatic and manual vehicle emergency or assistance calling systems and current PSAP systems and emergency response systems have been taken into account.

Short response time is critical for the efficient handling of the eCall. Performance criteria related to end-to-end timing in the eCall service chain are illustrated in Fig. 3.

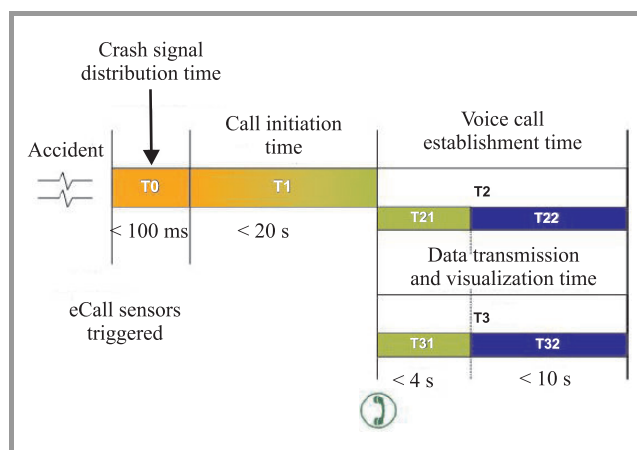


Fig. 3. End-to-end criteria for eCall service chain [4].

The end-to end QoS specifications include a requirements that 85% of all activated and sent eCalls should successfully reach the PSAP by 2010, than 89% all of them by 2015

and 92% by 2020. Moreover, 90% of all accidents of severity crossing the thresholds for triggering an eCall should be successfully reported by the eCall generator to the mobile network by 2010, 95% by 2015 and 98% by 2020. The eCall generator should be reprogrammable in order to change the MSD structure, e.g., service provider and vehicle identification fields.

For the eCall as the pan-European emergency service, the PSAPs in any Member States should handle 99% of all received calls.

Mobile network operators should provide full roaming capabilities in their core networks and treat the eCall as a 112 call with the same priority and reliability.

Precise location of the vehicle involved in an accident should be based on the best performance that satellite based location can provide at any time. For correct location a satellite system should currently guarantee accuracy equal or better than 50 m (for 50% of cases) and equal or better than 150 m (for 95% of cases).

For mapping accuracy, completeness of the road geometry should be kept down to the lowest local level and accuracy of the road geometry should be precise to 15 meters. No less than 99.9% roads of categories 1 to 4 must have a name; for category 5 the requirement is 97%.

### 5.5. Privacy

All Member States involved in development of the eCall should be obliged to comply with the directives related to protection of data and privacy of citizens as in case of the 112 service.

The DG eCall recommends to treat the eCall as a public service built on top of the pan-European single emergency number 112. Moreover, the citizens should be informed about eCall capabilities when buying a vehicle, especially about the data transferred to the PSAP.

From the point of view of the DG eCall, the data should be controlled by PSAP, or by private organization indicated by the public authorities to perform that role.

### 5.6. The eCall Certification

According to the DG eCall recommendation, the following entities should be responsible for the certification of components of the eCall system:

- the vehicle manufactures: for certification of the eCall generator (using existing certification procedures);
- the mobile network operators: for certification of their networks;
- the PSAPs: for certification of the PSAP system (along with the PSAP operators' procedures for handling eCall);
- all stakeholders involved in the eCall chain: for the certification of interoperability of the eCall service.

### 5.7. The eCall Deployment Plan

As agreed by the DG, the eCall road map assumes that all Member States will be ready to upgrade their PSAPs by September 2009 and to introduce of eCall as standard option in all vehicles granted type approval from 1 September 2010.

Moreover, it was assumed that all key stakeholders had signed the MoU by the end of 2006. Actually only half of the Member States have already signed the MoU.

According to the road map a full specification was ready and deployment of the eCall system began in mid-2007. Actually, the final ETSI/3GPP (The European Telecommunications Standards Institute/Third Generation Partnership Project) standards on emergency call handling and eCall data transfer as well as CEN standard regarding MSD content for eCall have not yet been published.

Full-scale field tests had been performed from the beginning of 2008, but in fact such tests were performed only in some Member States: in the Scandinavian countries, Germany and Austria.

## 6. The Status and the Basic Regulations of the eCall

The eCall project is treated as a part of the European eSafety programme built as a supplement to the single European emergency call number system (112). According to this, the regulations regarding eCall consist of two levels.

The first level comprises of the EU law for emergency services, especially for the enhanced 112 (E112). The fundamental regulations on emergency services are included in the Universal Service Directive [6]. It includes the obligation for the Member States to ensure an appropriate answer and handling of the calls made to 112, as well as the obligation for public telephone network operators to make caller location information available to authorities handling emergencies. The obligations concerning calling location information are included in Commission Recommendation [7]. According to this document, for every European emergency number 112 call, the public telephone network operators should, initiated by the network, forward (push) to public safety answering point the best information available on the location of the caller, to the extent technically feasible. All location information should be accompanied by an identification of the network from which the call originated.

The second level includes documents directly addressing the eCall. Currently, the eCall project is defined only in the optional/additional documents of the European Commission (e.g., communications, recommendations, programs, etc.) but it is not described in the obligatory EU low level acts (e.g., directives).

### 6.1. The EU Regulations Regarding the eCall Project

In communication from the Commission to the Council and the European Parliament [8], the eCall is presented as a project of emergency call initiated from the vehicle based on E112 with delivery of precise location information to the PSAP.

In the next EC communication [9], the eCall project was presented as a part of i2010 strategy and an element of information society included in the *Intelligent Vehicles* project. Moreover, the scope of the eCall functionality, possibility of integration with 112 and eCall deployment plan by 2009 as well as responsibility of the DG eCall, a list of the stakeholders involved in eCall and precise obligations for Member States was given.

In the third EC communication, a summary of introduction of a single European emergency call number as well as eCall in particular Member States was done [10]. The purpose of this document was mobilization of the Member States and branch environment to accelerate deployment of the eCall project. Moreover, it was focused on the influence of the Member States on adoption of a PSAP to handle the eCall and signing of the MoU by all EU Members.

In communication [11], EC is considering three possible policy options for progress of the eCall deployment:

- not intervening and leaving the introduction to market forces;
- supporting voluntary introduction by industry;
- mandating introduction through regulatory measures.

One of the regulatory measures, which EC will plan to take in 2010, is a recommendation to the Member States targeting MNO on the transmission of eCall, including MSD from the in-vehicle system to the PSAP. The second is a proposal for a regulation under the vehicle type-approval legislation [12] for the mandatory introduction of the in-vehicle part of the eCall service in new type-approved vehicles in Europe starting with certain categories (i.e., first in passenger cars and light commercial vehicles (categories M1 and N1) for which an appropriate triggering mechanism exist, and later in other vehicle categories). The last is the assessment of a potential regulatory measure for the necessary upgrading of the PSAP infrastructure required for proper receipt and handling of eCalls, in the framework of the proposed directive on the deployment of intelligent transport system (ITS) in Europe.

Paralelly to the above mentioned EC deliverables, other documents have been also elaborated and published. One of them was report on road safety [13] accepted by the European Parliament in April 2006 that indicates, e.g., on the costs regarding eCall, especially costs level from point of view of vehicle manufacturers. In June 2008 the European Parliament accepted the intelligent car report [14]. The main issue of this report is a problem concerning the introduction of eCall, especially in the context of the pilot tests performed in 2007–2008 and the signing of MoU by selected Members States.

In December 2008, the EC adopted the ITS action plan [15], in which support for eCall deployment is treated as one of EU actions. In the same time was adopted the ITS directive proposal, which provides for a legal instrument (i.e., a regulatory committee) to impose measures on the Member States, notably for the “*harmonized introduction of pan-European aCall*” [16]. Moreover, an announcement of the final version of standards necessary for deployment of eCall as well as the proposals of new regulations for introduction eCall project was given.

### 6.2. Voluntary Character of the eCall Project

Analyzing the documents elaborated by EC one can say that currently participation in the eCall project is voluntary. This note regards all stakeholders involved in eCall project – the Member States, the automotive industry, the mobile and fixed telecommunication industry, the public emergency authorities, the public social security, automobile clubs, etc. The Member States were only obliged to meet the requirements related to the emergency call number E112. They should apply harmonized conditions and principles to the provision of caller location information to emergency services for all calls to the single European emergency call number 112. Moreover, they should enable to make emergency calls using the single European emergency call number 112 and other national emergency number as well as to make all calls free of charge and without having to use any means of payment. The Member States should also provide that emergency calls should be routed to, and handled within, the appropriate emergency control centre. For each emergency call for which the subscriber number has been identified, the public telephone network operators should provide the capability to public safety answering points and renewing the location information through a call back functionality for the purpose of handling the emergency. The whole of eCall project has been defined as a pan-European public-private partnership, what means that this project has a voluntary character.

### 6.3. Legal Situation of the eCall Project in the Member States

The EC periodically controls how the obligations concerning handling emergency to the E112 are met by the Member States, but for the eCall project the EC monitors progress only in the countries which have signed MoU.

Currently, 15 Member States have signed the eCall MoU: Austria, Czech Republic, Cyprus, Estonia, Finland, Germany, Greece, Italy, Lithuania, Netherland, Portugal, Slovenia, Spain, Sweden and Slovakia as well as Norway, Suisse and Iceland. The six countries have announced willingness to sign shortly (e.g., Belgium, Bulgaria, Luxemburg, Poland, Romania and Hungary). With their signature, they commit themselves to actively support the timely implementation of the pan-European in vehicle emergency call system. The Member States that have not signed MoU

inform EC about studies and analysis conducted by the appropriate public administration units or the interested institutions.

The EU countries that launched the eCall project have adopted their own implementation approaches. In France the eCall project is developing based on SMS communications instead of eCall data transfer – in band modem solution. Due to different priorities concerning development of emergency call system the UK is not interested in the eCall project in a form defined by the EC.

In each country being MoU signatory the structure of the eCall project management is different. Generally, the unit responsible for eCall project is an appropriate minister (e.g., minister of transport) as well as some central administration organ. Moreover, for purposes of the project the operational coordinator is indicated (e.g., PSAP administrator, trust of interested stakeholders, etc.). The governments of the Member States nominate their delegates to the eSafety Forum and to the eCall Driving Group.

In all the European countries the eCall project has mixed public-private partnership character. On the side of private institutions the project is introduced on the voluntary basis. In no country participation in the eCall project by players that are necessary to implementation of the eCall (e.g., vehicle manufacturers, telecom operators, etc.) is not obligatory. The same principle holds for the eCall users – the plans concerning obligatory participation in the eCall do not exist for them.

### 6.4. Legal Situation Regarding eCall Project in Poland

Polish law was adjusted in 2008 to enable implementation of regulations of directive on electronic communications concerning the emergency calls [17]. It was possible due to change of the telecommunications law as well as the law on state medical rescue. According to these new regulations the network operators are obliged to ensure that emergency call routed to 112 will be delivered to the appropriate PSAP. From 31 December 2010 calls may be delivered to other subjects that were chosen to perform PSAP role by regional administrative authority (governor of a province). Moreover, network operators were obliged to pass the information related to location of network terminations initiating calls to number 112 to the Polish telecom regulator (UKE). Mobile network operators should pass these informations in real time. Management of data base with location information and other user's data is the responsibility of president of UKE. Moreover, The regulation of the Ministry of Interior Affairs and Administration (MSWiA) of 17 September 2007 on the detailed organization of PSAP was published; it includes, e.g., the requirements for equipment and functionality of PSAPs.

Thanks to these changes the Polish law is currently adjusted to the EC recommendation mentioned above. It doesn't mean however that full practical solutions included in this recommendation were implemented in Poland. It should be noted that no separate regulation for the eCall exists in Poland. Generally, the Polish government supports initia-

tive to build electronic system to inform emergency services about road accidents.

## 7. Conclusion

The EC recommendations and requirements for the pan-European eCall already exist. Part of the standardization works concerning some technical problems for eCall reaches final versions, e.g., ETSI requirements for communications of citizens with authorities/organizations in case of distress (e.g., for emergency call handling) and 3GPP requirements for eCall data transfer based on an in-band modem solution.

Several problems are still waiting to be addressed and solved. One of them is a question whether a subscriber identity module (SIM) card is required for the eCall set up. About half of the Member States are in favor and a half are against. In this situation the analysis of cost of SIM management versus business case should be performed. Based on the results of that estimation an appropriate solution should be selected, for example – provide “eCall flag” and allow in-vehicle emergency calls in all European States, either with or without a SIM. It may be also allowed to use basic low-cost eCall devices without a SIM or provide an ad hoc low cost eCall SIM. Moreover, it is possible to select solution with one SIM number for all vehicles as no ID is needed.

The second problem is related to the “eCall flag”. According to an opinion of the stakeholders involved in project, the “eCall flag” is needed and it should be included in the update of the telecommunications regulations (USD).

The next one is embedded or brought-in/nomadic IVS. The embedded solution provides reliability and robustness. The brought-in solution may not be reliable or robust enough in all electrical and mechanical environments but allows bundling with other services, solves life-time issue as well as SIM management. The stakeholders suggest support of a dual architecture with built-in safety and security functions and all other possibilities via telematics terminal, e.g., high end: built-in, lower end: nomadic.

Other identified problems regard PSAP workload, elaboration of standards for MSD transmission, privacy, etc. Although an emergency service center can act as a filter, it may cause delay, while allowing calls directly could increase PSAP workload.

The eCall as a standard in all cars can spearhead upgrade of the emergency services in Europe. An authoritative Eurobarometer study investigated users’ attitudes towards intelligent vehicle safety systems in Europe finding that over 70% of the respondents in the EU want to have eCall in their car.

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