



Clarification Paper
EG1- eCall Performance Criteria
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Authors

Yann Bouler (Renault) – YB
Emilio Davila-Gonzalez (EC) – EDG
Chris Frencken (Navteq) – CF
Alfred R. Krappel (Motorola) – AK
Rasmus Lindholm (eSafety Support) – RL
Jan Malenstein (KLPD) – JM
Lennart Strandberg (Autoliv) – LS

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Chapter 1 - Introduction

1.1 Objectives

The objective of this clarification paper is to define the minimum performance criteria for the automotive eCall in such a way that a minimum of 5% of road fatalities can be saved per year in EU-25 and reduce in average the severity by 15% per year could be accomplished, while keeping the costs for the different stakeholders across the eCall service chain to a minimum.

1.2 eCall System Overview

The in-vehicle eCall is an emergency call generated either manually by vehicle occupants or automatically via activation of in-vehicle sensors. The eCall trigger is transmitted over the vehicle-specific bus (CAN, MOST or other) to the in-vehicle system. The in-vehicle system aggregates the MSD as specified and agreed by the eCall stakeholders (based on MoU). When activated, the in-vehicle eCall system will establish a 112-voice connection directly with the relevant PSAP (Public Service Answering Point), this being either a public or a private eCall centre operating under the regulation and/or authorization of a public body. At the same time, a minimum set of data (MSD) will be sent to the eCall operator receiving the voice call see Figure 1.

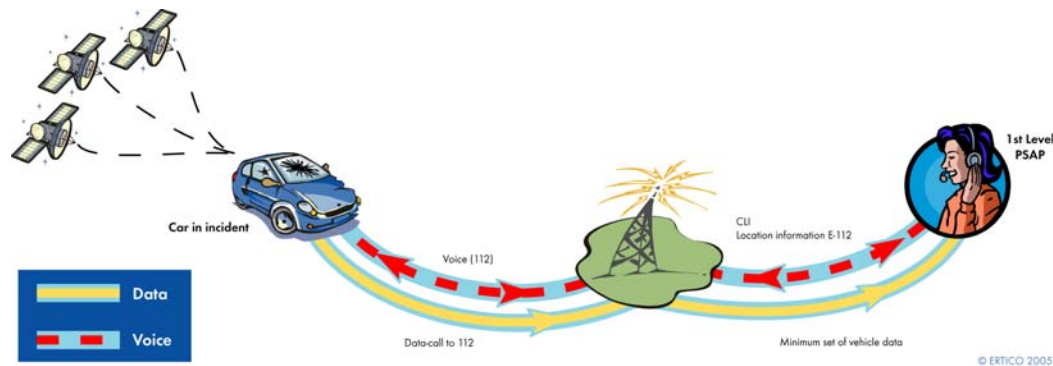


Figure 1: eCall System Overview

1.3 Domains

The Pan-European in-vehicle emergency call eCall involves a number of different stakeholders all with separate responsibilities and tasks, which even overlap. In order to provide a clear understanding of the different aspects of the eCall chain six different domains have been identified see Figure 2. A more detailed description of the six domains and the link between them can be found below.

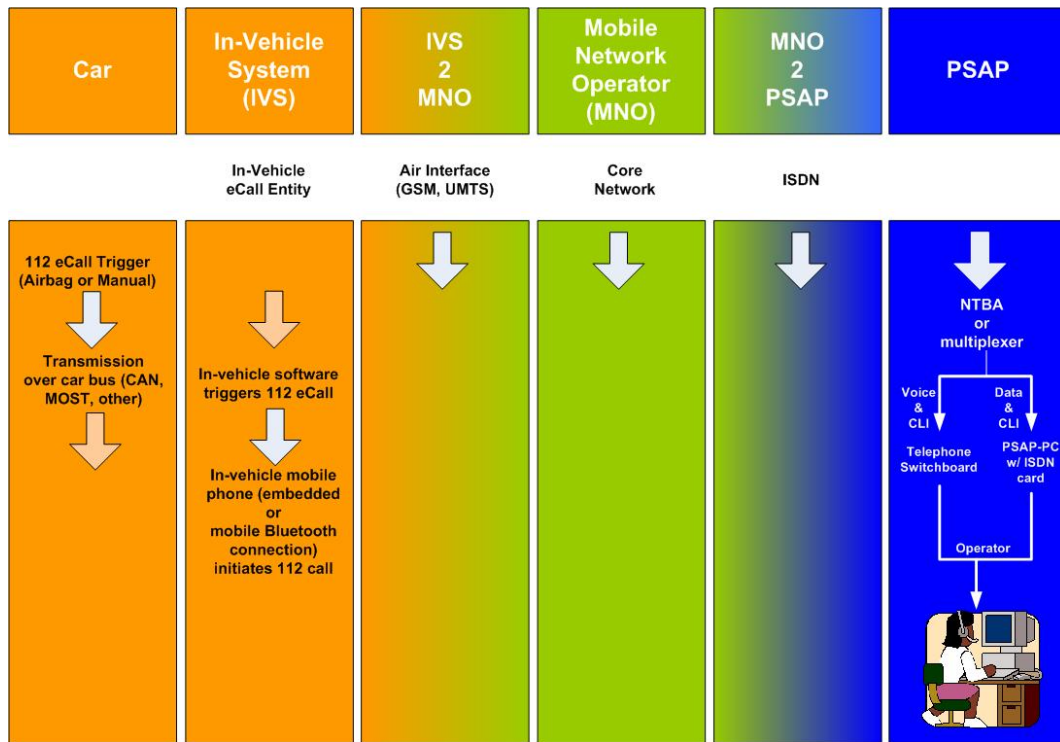


Figure 2: The 6 domains of the eCall service chain

Vehicle: The vehicle domain is detecting an accident, either manually (by the driver or passenger pushing the eCall button) or automatically through the deployment of the eCall triggers, which is typically based on more than one sensor input. The deployment information is then sent to the in-vehicle system (IVS). The vehicle domain is also responsible for delivering all the required information to the IVS that is part of the Minimum Set of Data (such as e.g. the VIN number).

IVS: The IVS consists of four parts (GNSS device, Network Access Device (NAD), Processor and HMI) all with separate responsibilities. The IVS “bundles” all information related to the eCall, i.e. triggering of eCall (automatic/manual), location, direction of travel etc. into the MSD. This block of information is then sent out through the NAD together with the established voice connection to the PSAP.

IVS2MNO: The IVS2MNO interface relates to the transfer of eCall voice and MSD from the NAD within the IVS to the MNOs core network, which means that the focus here is only the transmission. Issues like communication channel, bearer, transport protocol and specifications of the network will be the focus.¹

¹ GSME Position Paper on eCall, GSM Europe, 18 November 2005



MNO: The focus within this domain is mainly on how the transport of MSD and voice should be done through the network using the GSM network available today. Issues like SIM/USIM in the NAD, standards and network upgrades, integration efforts, possible network infrastructures re-dimension and possible new network support are all issues related to the Mobile Network Operator.²

MNO2PSAP: This domain is the interface between the MNO and PSAP. Due to the large potential number of eCall systems across the EU, the large number of telecom operators and the structure of PSAP it is important that the transmission of both voice and MSD is done in a standardised way.²

PSAP: When both voice and MSD are delivered to the PSAP “door” the PSAP domain focuses on getting both voice and MSD to the same PSAP operator. The operator will then handle the eCall in an appropriate way that meets the operational procedures for PSAPs.

1.4 Identified stakeholders

The table below describes the different stakeholders involved in the 6 different domains.

Domain	Responsible	Stakeholder
Vehicle	Vehicle Manufacturers	Vehicle Manufacturers In-Vehicle System Suppliers Airbag control-unit Manufacturers PSAP
In-Vehicle System	Vehicle Manufacturers Mobile device manufactures GNSS receiver manufactures	Vehicle Manufacturers In-Vehicle System Suppliers Mobile Device Manufacturers Mobile Network Operators PSAP GNSS receiver manufactures
IVS 2 MNO	Vehicle Manufacturers Mobile Network Operators	In-Vehicle System Suppliers Mobile Network Operators Vehicle Manufactures Mobile Device Manufacturers
Mobile Network Operator	Mobile Network Operator	Mobile Network Operator Member States
MNO 2 PSAP	Mobile Network Operator PSAP	PSAP Mobile network operators Fixed Network Operators PSAP equipment suppliers
PSAP	PSAP	PSAP equipment suppliers PSAP operators Member States GIS suppliers

² GSME Position Paper on eCall, GSM Europe, 18 November 2005

Chapter 2 - eCall Performance Criteria

The Performance criteria outlined in this chapter are linked to the different domains within the eCall service chain. Before going into the details of the individual domain performance criteria, overall end2end performance criteria are defined so that the target of reducing fatalities by 5% and server injuries by 15% per year in EU-25 can be achieved.

2.1 End2end performance criteria

Availability [%]

The availability of the system, i.e. the number of eCalls that are successfully placed when needed (automatic triggering) or wanted (manual triggering) can be derived from previous studies that shows that up to 2500 people can be saved per year through the pan-European eCall service³ Other studies such as the recent study made in Finland showed that 5% of all fatalities could be reduced if all cars had an eCall service⁴.

Taking into account that availability depends on a number of factors like network availability, crash proofness of the system, accurate crash sensor deployment, etc. the overall availability targets has to follow technical and economical improvements over time which will result in the following performance criteria for the eCall service:⁵

- By 2010 – 90% of all activated and sent eCalls should successfully⁶ reach the PSAP
- By 2015 – 95% of all activated and sent eCalls should successfully* reach the PSAP
- By 2020 – 98% of all activated and sent eCalls should successfully* reach the PSAP

Precise location [m]

The location of a vehicle involved in an accident is an important factor for the PSAP operator when dispatching the emergency service vehicles to the scene of the accident. The target for satellite location data precision is as a minimum in all environments:

- ≤ 50 meters (in 50% of all cases)⁷
- ≤ 150 meters (in 95% of all cases)

³ COM(2005) 431 final – 14.09.2005

⁴ Impacts of an automatic emergency call system on accident consequences. Ministry of Transport and Communications, Finland. AINO publications 14/2005, ISBN 952-201-966-6.

⁵ Revision clause is added with the objective to evaluate the overall performance criteria in 2014 for 2015

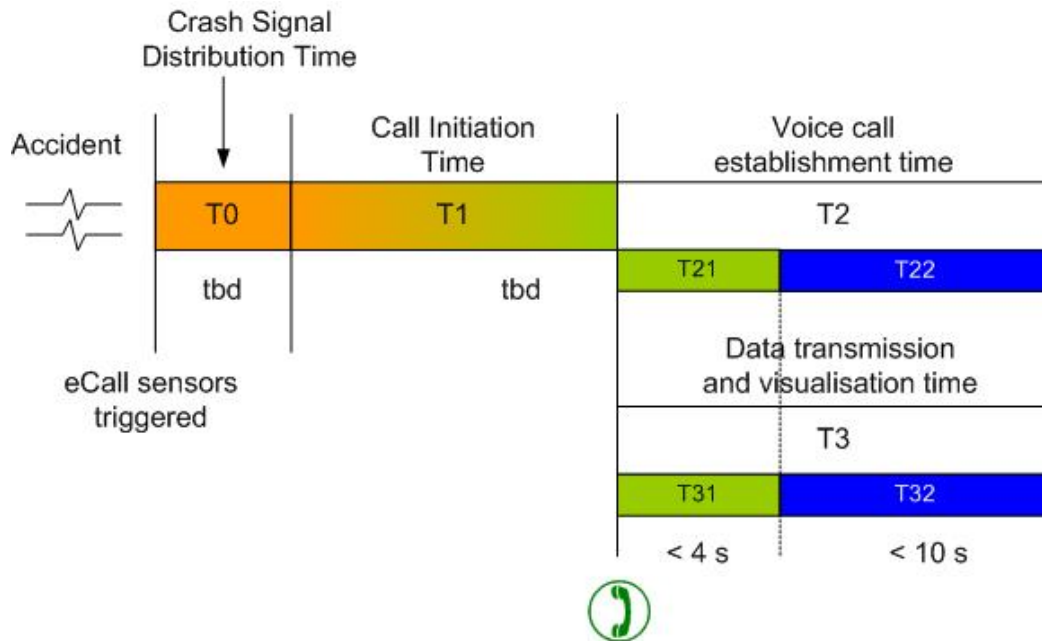
⁶ Successful means that, at a minimum, the MSD has to be transmitted and the acknowledgement received

⁷ This is measured against the standard WGS84

Timing [s]

The figure below represents the overall performance criteria for the timing split in the different domains related to the eCall service. As the figure shows T0 and T1 still needs to be defined but the performance criteria for T0 and T1 in relation to time is that time from when the accident occurs to the eCall has been initiated (T0+T1) must not exceed 20 seconds.

The overall performance criteria related to timing for the whole eCall service must not exceed 34 seconds.



2.2 Vehicle

eCall is building on the enhanced single pan-European emergency call E112, which is already a European service promoted and regulated by the European Commission. This also means that the E112 is the back-up solution if the IVS fails to make an eCall. The differences between E112 and eCall is the MSD and the fact that eCall can be automatically triggered.

The vehicle manufacturers for each vehicle type must define trigger levels for automatic activation individually. Standardized threshold levels cannot be defined due to the different mechanical structures of road vehicles.

2.3 In-Vehicle System (IVS)

Location

Location data must be available when a crash occurs, i.e. it must not happen that the unit has to run through a warm or even a cold start procedure – this is because a pearl chain has to be stored in the eCall system to calculate the direction of travel (the heading information from GNSS is not adequate) and acquire the fix after the crash typically takes too much time.

MSD bundling

The bundling of the MSD is done by the IVS.

HMI

The HMI of the IVS has to inform the driver, if the eCall system on board is not properly functioning.

Triggering / cancellation criteria

The Strategy for the automatic triggering of eCall must be set up so that it is as safe and robust as possible in order to prevent false eCalls. Associating the automatic triggering with a reliable control unit, which is fully tested could minimise the potential false automatic eCalls.

A strategy for the manual triggering must be developed for each vehicle specific human machine interface so that eCall will not be triggered accidentally. Different scenarios examples have been thought of such as; holding the eCall bottom down for three seconds to trigger the eCall or push it twice within 5 seconds. Manual trigger strategy must be defined individually by the vehicle manufacturers for each vehicle type in such a way that unintended activation is unlikely.

Timing

The time between crash detection by a sensor or by pressing the eCall button and the call initiation should not exceed 20 seconds. The NAD is responsible for the call initiation. An acknowledgement

from the PSAP to the IVS that the MSD has successfully been transmitted has to be presented to the driver and stored by the IVS.

The recommended performance criteria in relation to timing are:

- Crash signal distribution time T0 [time from airbag detonation (i.e. time of crash output signal generation) to reception at the eCall system] - XXX seconds. TDB, by the vehicle manufacturers
- Bundling of the MSD within XXX seconds.
- Acknowledgement time XXX seconds. (PSAP sending an acknowledgement to the IVS that the PSAP has received the MSD)

2.4 IVS2MNO

Time

The recommended performance criteria in relation to timing are:

- Call initiation time T1 XXX seconds. [Time from crash signal reception until the NAD successfully* registers on the network and initiates a E112 call (☎)]

*To be clarified: scan for strongest channel time [time it takes the mobile phone to scan for the strongest channel].

2.5 Mobile Network Operator

eCall is a pan-European system which is building on 112 and E112, which means that full roaming capabilities should be provided. Regarding the back-up solution if eCall fails the Mobile Network operators should still provide the cellular location based on the best effort principle. This also means that the Mobile Network Operators should treat eCall as an E112 call with the same priority through their core network and add the MSD to the E112 call.

2.6 MNO2PSAP

Time

The recommended performance criteria in relation to timing are:

- Voice call transmission time T21 < 4 Seconds. [Time it takes for the voice call to reach the PSAP]
- MSD transmission time T31 < 4 Seconds. [Time it take to transfer the MSD to the PSAP]

Since the MSD transmission technologies are voice-based, i.e. transmitted as part of the voice channel, the voice call and MSD transmission time are assumed to be identical (even if this might not be a 100% correct statement theoretically).

2.7 Public Service Answering Point

Map accuracy

In the case of an emergency call, one critical phase of the process is to be able to locate precisely on a map the position of the caller from GNSS coordinates pairs (one or several) and to derive an address which can be sent to emergency services.

The target for the map accuracy is 15m – measured against WGS84.

The E-MERGE project recommends that the vehicle send its last 3 GPS positions (See Emerge final report: Direction of travel derived from the last three GPS positions with 30 meters interval, which also has been adopted by the DG eCall.⁸

The performance criteria for the mapping accuracy are:

- Road geometry
 - Completeness of the road geometry down to the lowest local level: a road is present or not in the DB; and
 - Accuracy of the road geometry: the geometry is precise to 15 meters.
- Road naming
 - In Artery category 1 to 4: 99.9% must have a name;
 - In Artery category 5: 97% must have a name; and
 - Accuracy of the road naming: each road name must be the correct.

Operational procedure

The Operational procedures related to the PSAP operator when receiving an emergency call differ from Member State to Member State with respect to the performance indicators that are expressed in time. These performance indicators do have however one common denominator: in all Member States they are laid down in lawgiving regulations.

But overall the operational procedure is the same:

- Answering incoming emergency calls
- Evaluation of incoming calls
- Forwarding to 2nd stage PSAP or emergency control room
- Answering of incoming emergency calls from the 112 centre by the 2nd stage PSAP or emergency control room
- Dispatching of emergency unit
- Time to arrive on the location of the emergency

⁸ GTP, Encoding Specification, 21 March 2003, Version 1.0 (22.17 and 22.18)).



The different sequential stages are governed by the performance indicators. A matrix of these indicators of 3 different Member States is captured in the Position Paper produced by the sub-working group PSAP eCall requirements.⁹

These stages are based on vast experience and best practice. The difference in the time criteria is mainly dependent on the task description of the PSAP. Some member states assign full evaluation of the incoming 112 calls before forwarding them further, while in other member states the time that the message lives at the 112 centre has to be as short as possible, the focus here on time rather than on evaluation.

Time

The recommended performance criteria in relation to timing are:

- Voice call PSAP reaction time T22 <10 Seconds. [Time it takes the PSAP to relay the voice call to an operator and answering the call] 90% of incoming calls have to be answered within 10 seconds.¹⁰
- Data forwarding and mapping time T32 <10 Seconds. [Time it takes the PSAP to relay the data to the same operator that also received the voice call and to visualize it]. It is assumed that this pure machine-to-machine operation is faster than the human reaction time, specified under T22. Hence defining the identical value as under T22 seems to be a very realistic target.
- Acknowledgement time XXX seconds. (PSAP sending an acknowledgement to the IVS that the PSAP has received the MSD)

⁹ Clarification Paper – sub-working group PSAP eCall requirements, Jan Malenstein KLPD, Andy Rooke, Sussex Police... February 2006

¹⁰ Clarification Paper – sub-working group PSAP eCall requirements, Jan Malenstein KLPD, Andy Rooke, Sussex Police... February 2006

Chapter 3 - Conclusion

The availability of eCall, i.e. the number of eCalls that are successfully placed when needed (automatic triggering) or wanted (manual triggering) are recommended by the EG.1 sub-working group to be that:

- By 2010 – 90% of all activated and sent eCalls should successfully¹¹ reach the PSAP
- By 2015 – 95% of all activated and sent eCalls should successfully* reach the PSAP
- By 2020 – 98% of all activated and sent eCalls should successfully* reach the PSAP

The recommendations EG.1 group is that the maximum time from an accident occurs to the PSAP operator visualizes the MSD and answers the emergency call should not exceed 34 Seconds.

Since eCall is building on the Enhanced single pan-European emergency call number E112 it is recommended that eCall should be given the same priority through the mobile network with full roaming capability but also reliability as E112.

The precision of the GNSS positioning within the MSD for an eCall is recommended to be as a minimum in all environments;

- ≤ 50 meters (in 50% of all cases)¹²
- ≤ 150 meters (in 95% of all cases)

It is recommended that the performance criteria for the digital map implemented at the PSAPs have a accuracy with a minimum of 15 meters – measured against WGS84.

¹¹ Successful means that, at a minimum, the MSD has to be transmitted and the acknowledgement received

¹² This is measured against the standard WGS84

Chapter 4 - References

- 3GPP TR 22.967 V1.1.0
- MSD definition 10102005 v1.5.doc
- PSAP requirements – document by Jan Malenstein
- Emergency call – accident profile and power back-up need discussion paper; document by the joint Renault/PSA accident LAB
- AirBag deployment strategy (Autoliv presentation)
- MSD description (s)
- CGALIES final report
- EC 2nd eSafety Communication: Bringing eCall to the citizen
- Finish study on safety impacts of eCall