D2.6 Final System Test Cases Report

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# Terms and abbreviations

## 1.1 Terms

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<tr>
<th>TERM</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>112</td>
<td>single European emergency call number supporting Teleservice 12 (ETSI TS 122 003)</td>
</tr>
<tr>
<td>Call Termination</td>
<td>termination of call and freeing up of line (usually achieved by hanging up the receiver or pressing 'end call' or similar on screen)</td>
</tr>
<tr>
<td>Mobile network</td>
<td>Mobile radio network based on 3GPP standards for circuit switched telephony, also known as GSM (2G) or UMTS (3G)</td>
</tr>
<tr>
<td>E112</td>
<td>emergency communications service using the single European emergency call number, 112, which is enhanced with location information of the calling user TS12</td>
</tr>
<tr>
<td>eCall</td>
<td>emergency call generated either automatically via activation of in-vehicle sensors or manually by the vehicle occupants; when activated it provides notification and relevant location information to the most appropriate Public Safety Answering Point, by means of a mobile network, carries a defined standardized minimum set of data (MSD) notifying that there has been an incident that requires response from the emergency services, and establishes an audio channel between the occupants of the vehicle and the most appropriate Public Safety Answering Point</td>
</tr>
<tr>
<td>eCall discriminator</td>
<td>one of two flags included in the emergency call set-up message within the Service Category IE, that may be used by the mobile network to filter and route automatically and manually initiated eCalls to a designated PSAP term “identifier” not used</td>
</tr>
<tr>
<td>eCall In-band Modem (eIM)</td>
<td>Modem pair (consisting of transmitters and receivers at IVS and PSAP) that operates full-duplex and allows reliable transmission of eCall Minimum Set of Data from IVS to PSAP via the voice channel of the emergency voice call through cellular and PSTN networks.</td>
</tr>
<tr>
<td>eCall service</td>
<td>end-to-end emergency service to connect occupants of an affected vehicle to the most appropriate PSAP via an audio link across a PLMN together with the transfer of a minimum set of data to the PSAP</td>
</tr>
<tr>
<td>eCall transaction</td>
<td>establishment of a mobile wireless communications session across a public wireless communications network and the transmission of a minimum set of data from a vehicle to a...</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>-------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>public safety answering point and the establishment of an audio channel between the vehicle and the PSAP</td>
<td></td>
</tr>
<tr>
<td>in-vehicle equipment</td>
<td>equipment within the vehicle that provides or has access to in-vehicle data required for the minimum set of data and any other data that is to be sent as part of or complementary to the minimum set of data to effect the eCall transaction via a mobile network</td>
</tr>
<tr>
<td>in-vehicle system (IVS)</td>
<td>in-vehicle equipment together with the means to trigger, manage and effect the eCall transaction</td>
</tr>
<tr>
<td>Minimum Set of Data (MSD)</td>
<td>standardized data concept comprising data elements of relevant vehicle generated data essential for the performance of the eCall service [EN 15722:2011]</td>
</tr>
<tr>
<td>most appropriate PSAP</td>
<td>PSAP defined beforehand by responsible authorities to cover emergency calls from a certain area or for emergency calls of a certain type</td>
</tr>
<tr>
<td>network access device (NAD)</td>
<td>device providing communications to a mobile wireless communications network with homogeneous handover between network access points</td>
</tr>
<tr>
<td>public safety answering point (PSAP)</td>
<td>physical location working on behalf of the national authorities where emergency calls are first received under the responsibility of a public authority or a private organisation recognised by the national government</td>
</tr>
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### 1.2 Abbreviations

<table>
<thead>
<tr>
<th>TERM</th>
<th>DEFINITION</th>
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<tr>
<td>2G</td>
<td>Second generation mobile network, based on 3GPP standards, also called GSM</td>
</tr>
<tr>
<td>3G</td>
<td>Third generation mobile network, based on 3GPP standards, also called UMTS</td>
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<tr>
<td>3GPP</td>
<td>Third generation partnership Project</td>
</tr>
<tr>
<td>ACK</td>
<td>Acknowledgement</td>
</tr>
<tr>
<td>AleC</td>
<td>Automatic Initiated eCall</td>
</tr>
<tr>
<td>API</td>
<td>application programming interface</td>
</tr>
<tr>
<td>AREU</td>
<td>Azienda Regionale Emergenza Urgenza</td>
</tr>
<tr>
<td>AT</td>
<td>Attention (part of modem instruction, e.g. to dial as specified in ETSI TS 127 007)</td>
</tr>
<tr>
<td>AVL</td>
<td>Automatic Vehicle Location</td>
</tr>
<tr>
<td>BSC</td>
<td>Base Station Controller</td>
</tr>
<tr>
<td>CAN</td>
<td>Controller Area Network</td>
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<tr>
<td>CITA</td>
<td>road traffic management centre (Luxembourg)</td>
</tr>
<tr>
<td>CRC</td>
<td>Cyclic Redundancy Check</td>
</tr>
<tr>
<td>CLI</td>
<td>Caller Location Information</td>
</tr>
<tr>
<td>CTI</td>
<td>Computer Telephony Integration</td>
</tr>
<tr>
<td>DGT</td>
<td>Traffic General Directorate (Spain)</td>
</tr>
<tr>
<td>DL</td>
<td>Data Logger</td>
</tr>
<tr>
<td>ETSI</td>
<td>European Telecommunications Standards Institute</td>
</tr>
<tr>
<td>ECC</td>
<td>Emergency Control Centre</td>
</tr>
<tr>
<td>EPT</td>
<td>Entreprise des Postes et Télécommunications (Luxembourg)</td>
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<tr>
<td>ESA</td>
<td>European Space Agency</td>
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<tr>
<td>EUCARIS</td>
<td>EUropean CAR and driving license Information System</td>
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<tr>
<td>GIS</td>
<td>Geographic Information System</td>
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<tr>
<td>GMV</td>
<td>Grupo Mecánica del Vuelo Sistemas, S.A.U.</td>
</tr>
<tr>
<td>GNSS</td>
<td>Global Navigation Satellite System</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile communications, also called 2G</td>
</tr>
<tr>
<td>HGV</td>
<td>Heavy Goods Vehicle</td>
</tr>
<tr>
<td>HLAP</td>
<td>High Level Application Requirements</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>HLR</td>
<td>Home Location Registry</td>
</tr>
<tr>
<td>HMI</td>
<td>Human Machine Interface</td>
</tr>
<tr>
<td>HPLMN</td>
<td>Home Public Land Mobile Network</td>
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<tr>
<td>HW</td>
<td>Hardware</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communications Technology</td>
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<tr>
<td>IMEI</td>
<td>International Mobile Equipment Identity</td>
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<tr>
<td>IMSI</td>
<td>International Mobile Subscriber Identity</td>
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<tr>
<td>ITS</td>
<td>Intelligent Transportation System</td>
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<tr>
<td>IVR</td>
<td>Interactive voice response</td>
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<tr>
<td>IVS</td>
<td>In-Vehicle System</td>
</tr>
<tr>
<td>KPI</td>
<td>Key performance indicator</td>
</tr>
<tr>
<td>LCV</td>
<td>Light commercial vehicle</td>
</tr>
<tr>
<td>MleC</td>
<td>Manually Initiated eCall</td>
</tr>
<tr>
<td>MNO</td>
<td>Mobile Network Operator</td>
</tr>
<tr>
<td>MSISDN</td>
<td>Mobile Subscriber ISDN (integrated services digital network)</td>
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<tr>
<td>MSC</td>
<td>Mobile Switching Centre</td>
</tr>
<tr>
<td>MSD</td>
<td>Minimum Set of Data (EN 15722)</td>
</tr>
<tr>
<td>NAD</td>
<td>Network Access Device (e.g. a GSM or UMTS module)</td>
</tr>
<tr>
<td>NRN</td>
<td>Network Routing Number</td>
</tr>
<tr>
<td>OBD</td>
<td>On-Board Diagnostics</td>
</tr>
<tr>
<td>OBU</td>
<td>on-board-unit</td>
</tr>
<tr>
<td>OEM</td>
<td>original equipment manufacturer</td>
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<tr>
<td>P2W</td>
<td>Powered-two-wheel vehicles</td>
</tr>
<tr>
<td>PABX</td>
<td>private automatic branch exchange</td>
</tr>
<tr>
<td>PER</td>
<td>packed encoding rules (ASN.1)</td>
</tr>
<tr>
<td>PLMN</td>
<td>Public Land Mobile Network</td>
</tr>
<tr>
<td>PSAP</td>
<td>Public Safety Answering Point</td>
</tr>
<tr>
<td>PSTN</td>
<td>public switched telephone network</td>
</tr>
<tr>
<td>SIM</td>
<td>Subscriber Identity Module (GSM/3GPP)</td>
</tr>
<tr>
<td>SUT</td>
<td>System Under Test</td>
</tr>
<tr>
<td>SW</td>
<td>Software</td>
</tr>
<tr>
<td>TPS</td>
<td>Third Party Service</td>
</tr>
<tr>
<td>TPSP</td>
<td>third Party Service Provider</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>TS12</td>
<td>Teleservice 12 ETSI TS 122 003, see also 112</td>
</tr>
<tr>
<td>UMTS</td>
<td>Universal Mobile Telecommunication System, also called 3G</td>
</tr>
<tr>
<td>USIM</td>
<td>User Service Identity Module</td>
</tr>
<tr>
<td>VIN</td>
<td>Vehicle Identification Number</td>
</tr>
<tr>
<td>VLR</td>
<td>Visited Location Register</td>
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2 Introduction

2.1 Purpose of this Document

This deliverable document describes the Final System Test Cases Report and will report the final implementation results also related to technical and operational upgrades. It will also give an overview about the implementation of eCall in the different Member States. A full description of the implementation is already available in the document D2.3 Hardware and Software implementation.

2.2 Structure of Document

This document describes the implementation results separately for each member state pilot site. There is also a common chapter comparing the results.

2.3 HeERO Contractual References

HeERO is a Pilot type A of the ICT Policy Support Programme (ICT PSP), Competitiveness and Innovation Framework Programme (CIP). It stands for Harmonised eCall European Pilot.

The Grant Agreement number is 325075 and project duration is 24 months, effective from 01 January 2013 until 31 December 2014. It is a contract with the European Commission, DG CONNECT.

The principal EC Project Officer is:

Aude Zimmermann  
EUROPEAN COMMISSION  
DG CONNECT  
Office: BU 31 – 6/35  
B - 1049 Brussels  
Tel: +32 296 2188  
E-mail: aude.zimmermann@ec.europa.eu

One other Project Officer will follow the HeERO project:

Dimitrios AXIOTIS  
Dimitrios.AXIOTIS@ec.europa.eu

Address to which all deliverables and reports have to be sent:

Aude Zimmermann  
EUROPEAN COMMISSION
Any communication or request concerning the grant agreement shall identify the grant agreement number, the nature and details of the request or communication and be submitted to the following addresses:

**European Commission**  
**Communications Networks, Content and Technology**  
**B-1049 Brussels**  
**Belgium**

By electronic mail: CNECT-ICT-PSP-325075@ec.europa.eu
3 Implementation Overview

The paragraphs below describe the implementation for IVS, PSAP and Mobile Network Providers - if applicable - on each pilot site.

3.1 Belgium

3.1.1 eCall flag in Mobile network

3.1.1.1 eCall flag implementation requirements
For the purpose of the HeERO pilot project in Belgium, the Mobistar mobile network was used to verify the functioning of the public eCall implementation. For this purpose, the mobile network was adapted to detect the eCall flag as part of the TS12 emergency call.

3.1.1.2 eCall pilot implementation plan
Prior to the real HeERO pilot, an internal Mobistar validation of the eCall function was conducted in the Mobistar Lab environment. This was performed after the software upgrade of the Mobistar MSC test platform had been carried out.

Once validated, the rollout of the software upgrade was performed and the eCall function was activated in one operative MSC (covering the HeERO pilot site), for a limited amount of time (during HeERO pilot).

3.1.2 Filtering instance
Belgium decided to have a special way of implementation of eCall a filtering instance was created this route of implementation was selected owing to concerns over high volumes of false or inappropriate calls flooding the PSAP. This filtering instance was implemented at Touring on a dedicated server using the “eCall Router” software of OECON Product & Services GmbH. According to the specifications Touring provided material in order to perform the installation.

3.1.3 PSAP implementation
The PSAP’s are technically managed by ASTRID (Service provider of PSAP). ASTRID has two main data centres; those are connected to all PSAP’s in Belgium. The setup within the AASTRID network was implemented as follows:
The gateway software was created as a custom development for Belgium. This software allows a redundant setup, which can connect to the filtering instance. Since the EN16102 protocol (TPSP protocol) was chosen for the connection to the filtering instance, this also allows connections to private eCall providers.

3.2 Bulgaria

3.2.1 Establishing eCall environment

3.2.1.1 IVS development

ICOM

A prototype of eCall IVS by ICOM was based on common fleet management equipment, manufactured by ICOM, where some extra features for eCall like in-band modem were added. 10 vehicles have been equipped.

TUS

One prototype and one working module have been built by TUS. External hardware for the IVS include: 12V power supply; GPS/GSM antennas; audio I/O connection; airbag deployment indication connection.

3.2.1.2 eCall flag implementation

MNO provided a temporary workaround for "eCall flag" simulation – mainly a re-mapping of the test number as call-routing in the mobile switching centre(s) to call PSAP/112 via a dedicated number until real eCall flag implementation.
3.2.2  **eCall test service implementation**

3.2.2.1  **HW delivery**

The hardware required to implement the eCall test service is subject of subcontracting and included an eCall Test-/Development Centre is designed as a test platform for vehicle manufacturers, OEMs and in-vehicle system (IVS) developers for developing and testing of eCall vehicle components and also simulating a PSAP during testing or for demonstration purposes. It splits the MSD (Minimum Set of Data) from the voice connection (PSAP modem). The voice connection to the existing HiPath 4000 is established once the MSD is received. Thus, the eCall Identifier is equipped with standard ISDN (BRI/PRI) trunks to receive eCalls from the Mobile Providers and has outgoing ISDN (BRI) connection to forward the calls to HiPath 4000.

3.2.2.2  **HW installation**

The HW installation was also subject of subcontracting which followed the HW delivery on site.

3.2.3  **Adaptation of the existing PSAP**

The adaption of the existing PSAP was subject of subcontracting. The 112-signalling protocol as it was used till now on the 112-PRI trunks remains unchanged. Thus, no eCall flag including the manual/automatic initiation attribute is forwarded to the 112-System. As result of this prerequisite the following work flow was implemented:

- The IVS initiates an eCall either as a result of an automatic initiation or the manual interaction of the occupants.
- MNOs identify eCalls with an eCall-Flag (manual and automatic) and route it to the central eCall Service number of HiPath 4000.
- HiPath4000 forwards the call to the eCall Test and Development server. The cell ID encoded in the B-pty number is delivered to the HiPath ProCenter.
- The eCall Identifier accepts the eCall request and establishes the connection with the IVS.
- The eCall Test and Development server detects the MSD transmission request and ensures the MSD transmission
- The eCall Test and Development server requests the VIN (MSD) at the VIN-Decoder (optional).
- Once the MSD + VIN data are received, the eCall Test and Development server initiates a second voice call via its outbound trunks back to HiPath 4000 to a specific service number.

- Once the call taker accepts the call, the eCall Test and Development server connects both calls and establishes an end-to-end voice connection between IVS and the call taker. Instantly the call taker sees the covered area of the mobile antenna.

- If necessary the call taker may trigger resend and call back functionalities of the eCall Test and Development server by utilizing special buttons in the user interface.

3.3 Denmark

3.3.1 General overview of the technical solution

The routing of 112-calls is based on geographical dependencies by the four PLMNs in Denmark. A 112-call will always be routed to the nearest PSAP.

The three PSAPs in Denmark are operated by the National Police (2 PSAPs) and the Copenhagen Fire Brigade (1 PSAP).

The Copenhagen Fire Brigade (CFB) and the National Police make use of the same PBX and Call Centre vendor, but the PBX-models are not the same, and each instance is programmed very differently, as they have different needs.

Also the PSAP applications used by the two PSAP-operators are different proprietary legacy solutions developed by their own group IT or by third party vendors according to specifications.

The eCall service in Denmark will use the existing LIF-server infrastructure in the PSAP network for mobile phones, and the recently launched 112-App.

As 112-calls are routed by the PLMNs to the nearest PSAP, all three PSAPs will be equipped with an in-band modem solution making them able to extract the MSD-information and placing it on the LIF-server. By end 2014 the implementation at National Police is not finished due to a need for a total upgrade of the PBX-solution, therefore only the PSAP at the Copenhagen Fire Brigade is ready to receive eCall following the decided national solution.
3.3.2 Test systems

3.3.2.1 PSAP-SUT

In order to test the eCall functionality without disrupting the running 112-service in Denmark a test PSAP environment (PSAP-SUT) was established at the Copenhagen Fire Brigade.
The PSAP-SUT uses the same components as the final system in order to create an environment as close to the real system as possible. The PSAP-SUT uses an ISDN PRI and an in-band modem in conjunction with a modem server.

The ISDN PRI is a separate ISDN with its own pre designated number for test purposes only, to avoid interfering with the ordinary 112-calls.

In order to keep trace of errors and to measure KPIs within the defined performance framework a logging of relevant data was performed at the PSAP-SUT and at the Test IVS.

### 3.3.2.2 Test IVS

Three different IVS-vendors were selected for the Danish eCall pilot project, but only two managed to deliver Dormant SIM (eCall-only) capable IVS-units. A test fleet of 10 vehicles was equipped with IVS-systems from both vendors.

### 3.3.3 Implementation activities PSAP

#### 3.3.3.1 Copenhagen Fire Brigade

In order to establish the testing facilities a number of prerequisites have been carried out.
- Establishment of an ISDN PRI Flex with 8 channels, acquired through the governmental framework agreement. The acquisition was made by the group IT at CFB.

- In order for the ISDN PRI to function an ISDN PRI card was inserted and configured in the PBX located at the CFBs headquarters.

- After configuring the ISDN PRI and testing that calls actually are received by the PBX, IVR-functions for the eCall testing have been programmed in CFB’s call centre solution Solidus eCare.

- Finally the eCall PSAP modem was installed and configured.

The above tasks were carried out by CFBs service provider.

Parallel to the testing of the eCall functionality in the test environment the necessary changes in the Copenhagen Fire Brigades PSAP application were carried out in order to support the eCall service.

The necessary modifications in the PSAP application and subsequent testing were carried out by group IT at CFB. The modification involves among other:

- GIS-display
- Enriched MSD-display

3.3.3.2 National Police

The test, and later on production environment will use a dedicated eCall LIF-server hosted by the Danish National Police.

All three PSAPs will establish a connection to this server in order to set and retrieve MSD-information.

This was the agreed plan however the National Police took the decision to leave the consortium owing to technical difficulties. However once the difficulties are resolved the identified plan will be resumed, but outside of the lifetime of this project (Q1 2015)

3.3.4 Implementation activities MNO

In order to pass the eCall flag, the Danish PLMNs will patch their AXEs. Each PLMNs infrastructure is in the process of being upgraded, with verifications tests expected to be carried out H1 2015.

3.3.5 Implementation activities IVS

The IVS-vendors selected for the Danish eCall pilot are Fujitsu-Ten and GMV.
The pilot has used refitted IVS-equipment in 10 vehicles from the Danish Ministry of Transportation (Trafikstyrelsen) representing both vendors. SIM cards used were:

- Normal domestic SIM Card connecting to one of the four PLMNs
- Simulated Dormant SIM Card connecting to two of the other three PLMNs
- Normal roaming SIM Card, actual PLMNs used are not known

### 3.4 Luxembourg

#### 3.4.1 The core functionality

In Phase 1 the Luxembourg partners installed IVS units into a fleet of six test vehicles. These triggered test eCalls both manually and automatically. The IVS units used were provided by FICOSA, NXP and Fujitsu TEN. They comply with the CEN and ETSI standards. Special IVS systems from FICOSA have been used in transporters to send the MSD with the extended data set as defined in the CEN document on HGV eCall.

The eCalls were sent via the Luxembourg MNO partner in the project, POST Luxembourg. POST Luxembourg implemented the eCall flag in the middle of 2014.

NB: It is important to note that POST Luxembourg discovered an important potential routing problem after implementing the eCall flag in their switches (Ericsson). MNOs should therefore verify that the specified eCall routing, through Bits 6 and 7, can be handled by their switches. As Luxembourg only has ever had one PSAP there has never been a need to implement a specific routing for 112 calls other than directly to this number. As the eCall server solution in Luxembourg uses a long number interface calls could not be routed to this number even though the eCall Flag was activated, because the Bit routing could not be followed. A new version of the MSC software will be delivered in Q2 2015 that will correct this problem.

The MNO will eventually deliver eCall messages to the designated entry points in the POST Luxembourg network. The PSAP is connected via ISDN to the network.

At the PSAP entry point manual and automated eCalls are handled according to the functional design. This does not yet include the connection with EUCARIS due to ongoing discussions occasioned by Luxembourg’s strict privacy laws.

ECalls concerning HGV and transports of dangerous goods was also examined in Luxembourg. Parallel ESA project dangerous goods tracking service is in the process of
being implemented as a prototype (DG-Trac service). The goal is to provide specific information about potentially dangerous goods loaded in a vehicle to the operator in addition to the MSD information. So far only recommendations have been made as to possible specifications and standards.

3.4.2 Hardware and software required

3.4.2.1 PSAP (112)

In order not to disturb the operational processes in the Luxembourg PSAP, the pilot was performed on separate systems which were however installed at the PSAP. ECall router and server software were installed as a virtual machine on the standard PSAP server. An ISDN/IP gateway was connected to the server via IP-based Ethernet and to 4 S0 interfaces coming from the PSAP PBX.

The eCall infrastructure will be implemented into the Luxembourg PSAP as shown in the following figure.

![Luxembourg Pilot Site Implementation](image)

**Figure 4: Luxembourg eCall PSAP architecture**

For the operator a new separate PC will be installed on a separate desk in the PSAP. During manual tests trained PSAP operators have operated this PC.
3.5 Spain

3.5.1 Public Safety Answering Point (PSAP)

3.5.1.1 Intermediate PSAP in DGT

The architecture chosen in Spanish eCall pilot is based on an intermediate PSAP, hosted by the Traffic General Directorate (DGT). Mainly, this intermediate PSAP will have a filtering function for every manual or automatic eCall before transferring it to the appropriate Regional 112 or discarding it. This pilot architecture might be different in some aspects from the one which has been tested in the pilot, anyhow, and it is under discussion at present.

For this Spanish eCall pilot, two different HW and SW platforms were supplied for eCall reception and handling: CoordCom (Ericsson) and SENECA (Telefónica). Some different DGT information systems were integrated with both platforms, mainly DGT ATEX (Telematic Access for External Organizations) and LINCE (DGT’s alert system).

3.5.1.1.1 Telefónica PSAP

PSAP is based on Telefónica emergency platform Séneca. This platform includes integration bus based on OASIS EENA standards which allows an easy integration and interaction with 112 PSAPs, GIS system to improve eCall location, and Computer Telephony Integration (CTI) through CISCO JTAPI with DGT corporate telephony.

Software adaptations for eCall and integrations with DGT systems were developed on the platform in the pilot scope.

Hardware support for platform is based on VMWare virtual machines. Voice integration with DGT Cisco CallManager PBX is obtained through trunk SIP linking Séneca MSD decoder.

Intermediate PSAP has available two agent workstations with Séneca software ready to use for Spanish pilot activities.

3.5.1.1.2 Ericsson PSAP

The chosen system implementation for the Spanish eCall pilot was based on the following HW Platform:

- 1 combined database/application/communication server, for intermediate DGT PSAP system, comprising:
  - 1 high availability HP Proliant DL 380p G8 server with redundancy in hard disks, network interface cards, power supply and fans.
1 ISDN communication media board from Dialogic Corporation to handle telephony and VoIP communication and thus, receive the eCall in the system

- 1 Client workstation, for intermediate PSAP Operator, based on HP Compaq 8200, supplied with 3 monitors

![Figure 5: CoordCom Operator position](image)

The chosen **SW platform** was based on **CoordCom 5.4** release. The eCall functionality was introduced in CoordCom products starting from CoordCom 5.2 and it has been used in HeERO1 Swedish and Croatian pilots. The platform includes a **GIS module: ResQMap 3.2**; and the ISDN communication module where MSD is received and decoded without needing additional HW. It communicates with external In-Vehicle Systems (IVS) according to the eCall standard.

### 3.5.1.2 Regional 112 Pass

The integration between intermediate PSAP and regional 112 PSAP has been implemented in order to allow real emergency eCalls to be transferred from intermediate PSAP to the right geographical 112 PSAP.

Each Spanish region has its own 112 service, with its particular protocols, procedures and systems to solve an incident. In the Spanish eCall pilot, a single interface has been defined in order to make sure the intermediate PSAP in DGT always sends the same information, no matter which geographical 112 PSAP is the recipient of the information.

The following figure illustrates the process involving the incident management made in the 112 PSAPs.
3.5.1.2.1 Regional 112 PSAP implementation strategy

From a technical point of view, the integration solution has been achieved using an interoperability bus that coordinates and integrates the communications between the intermediate PSAP and the regional 112 PSAP.

This interoperability bus uses models made with OASIS emergencies protocols based on EDXL. The concrete protocol will be a Telefónica protocol ESAP for communication between regional or national PSAPs. This protocol will provide:

- Connectivity
- Intelligent routing
- Synchronous and asynchronous messaging
- Transaction management
- Information transformation
- Safe communications

The following figure illustrates the different protocols and possible interactions within the management of emergencies.
The integration using the interoperability bus is implemented as a native integration in every regional PSAP actually using a Telefónica PSAP platform. That means that, within the scope of HeERO2 project, the integration with Madrid PSAP, Galicia PSAP and Castilla y León PSAP are achieved using the interoperability bus.

The Regional 112 Comunidad Valenciana PSAP implementation strategy is slightly different from the other regions. This relates to the CoordCom software platform and some operational protocols that have been created or modified in the regional 112 PSAP to manage eCalls so that have implied configuration adaptation in CoordCom system at 112 Comunidad Valenciana accordingly. The PSAP platform provides Web Services interfaces for the easy integration of external systems. In the pilot these interfaces were used to send the incident information (including the eCall MSD data) to the DGT systems and to the Regional PSAP.

3.5.2 Mobile Network Operator (MNO)

Telefónica has been the single MNO directly involved in the HeERO2 project.

At the moment eCall flag has not been deployed in network due to final decision about exposed eCall routing based on it, is still under discussion.
3.5.3 **In-Vehicle Systems (IVS)**

3.5.3.1 **CTAG IVS**

CTAG has equipped 4 vehicles with CTAG IVS. The HMI has been integrated in the instrument board of each vehicle.

![Pilot Vehicles and HMI integration examples](image)

*Figure 8: CTAG Pilot Vehicles and HMI integration examples.*

In addition, CTAG has developed a tool within the eCall tracking centre which allows monitoring the tests remotely and generating events in real time during the operation phase such as automatic eCall triggering through CTAG data logger, also installed within each vehicle.

![CTAG Tracking tool and automatic eCall remote triggering. CTAG data logger.](image)

*Figure 9: CTAG Tracking tool and automatic eCall remote triggering. CTAG data logger.*
In order to ensure interoperability of CTAG IVS, the equipment was tested together with 22 IVS providers against 11 PSAP’s across Europe in the interoperability event eCall#2 Testfest – Essen 2013, obtaining excellent results.

### FICOSA IVS

The FICOSA IVS implementation will consist of two major items:

- IVS unit including HW and SW implementation
- HMI unit including HW implementation

The strategy considered will be focused on autonomous installation, so there has not been a vehicle integration (in terms of CAN connection and vehicle wiring harness); the installation was detachable from vehicle and then able to be added potentially to a new different vehicle if requested or for testing purposes is needed.

### U-10A (GMV’s IVS)

GMV’s IVS is based on the on-board unit model U10, which was modified to comply with the specifications and standards of pan-European eCall. Some Hardware modifications were made in order to incorporate audio functionalities to GMV’s IVS. In particular, microphone and speaker features have been added. Moreover, a new amplification stage has been integrated before audio signals reach microphone and speaker elements. Also some Software modifications included in the framework of HeERO2 project were devoted to the implementation of a functional eCall application running on GMV’s IVS.

In order to ensure interoperability of GMV’s IVS, the equipment was tested against different PSAPs across Europe in the interoperability event eCall#2 Testfest – Essen 2013 and eCall#3 Testfest – Vigo 2014, obtaining excellent results.

### P2W

The implementation of the P2W eCall system is made up of two independent modules: the on board module and the helmet’s module. The main module detects the incident and manages the emergency call. The module in the helmet allows a more complete incident
evaluation. The integration of the information from the helmet’s sensors can assess the severity of the expected driver’s head injuries.

Figure 10: P2W eCall system

Every IVS system performs two different functions: the detection of the incident (the trigger of the call) and the management of the emergency call. In the case of P2W vehicles the most challenging part was (and still is) the detection of the incident. In case of cars and other type of vehicles, the signal used to trigger the eCall is the airbag activation signal. Nevertheless, the vast majority of P2W does not have airbag. Moreover, the limitations related to weight and size to design a P2W oriented IVS are bigger. In addition, due to the lack of stability of a vehicle with two wheels, it is most difficult to differentiate an incident from regular driving performance. This is the reason why the major part of implementation is oriented on the incident detection.

The main module’s development is divided into hardware and software implementation. As we have already a preliminary emergency call module, the first step was to adapt and improve it to the new requirements. This was done for the middle of March 2013. On the one hand, the main adaptation of the incident detection module was the implementation of the wireless communication between the sensors and the processing unit. This characteristic allows us to have a greater freedom selecting the location of sensors. On the other hand, to enhance the incident detection algorithm we have made an exhaustive analysis of the most
common incident typology. We have concluded that if we are able to detect the collisions and the leaving of the road we will detect the 80% of P2W incidents.

Regarding hardware implementation, the next step was the development of a new module to integrate the communication with the helmet’s module. Next, the software of the module has been implemented and finally the severity information was included in the main algorithm in order to complete the MSD.

Hardware modifications on helmet electronics have been planned to have better and robust connectors for all the sensors as well as new electronic functions to make the system fully reliable. The system will be updated as well with new sensors to try to detect the incident, and not only the head injury severity, from the helmet to act as a redundant detection and triggering system since the IVS cannot detect at present all kind of incidents, this way the incident detection can be improved.

P2W eCall systems were tested in real conditions in collaboration with Madrid PSAPs. The tests have been divided in 2 main groups: communication with PSAP and incident detection, additionally internal laboratory tests were carried out in order to integrate the whole system (helmet and in vehicle system) with a PSAP emulator.

3.5.4.1 Incident detection tests

10 helmets equipped with the impact sensors delivered to “Cuna de Campeones” Race School on 10th of June, 2014. Instructions on how to use the helmets were provided to the School in order to make sure every user will handle the helmets in an appropriate way not to lose any single incident data collection. Additional incident detection system was equipped in a motorcycle.

Figure 11: Motorbike for incident detection
- P2W test has been performed up to 2014/7/28 under supervision

<table>
<thead>
<tr>
<th>Helmet nº</th>
<th>On Board Unit</th>
<th>Name (*)</th>
<th>Age</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>CPV</td>
<td>6</td>
<td></td>
<td>Minimotos</td>
</tr>
<tr>
<td>1</td>
<td>MRC</td>
<td>9</td>
<td></td>
<td>MiniGP 110</td>
</tr>
<tr>
<td>3 y 5</td>
<td>HG</td>
<td>16</td>
<td></td>
<td>CEV</td>
</tr>
<tr>
<td>2</td>
<td>AI</td>
<td>11</td>
<td></td>
<td>MiniGP 140</td>
</tr>
<tr>
<td>4</td>
<td>AC</td>
<td>11</td>
<td></td>
<td>MiniGP 140</td>
</tr>
<tr>
<td>7</td>
<td>RS</td>
<td>13</td>
<td></td>
<td>MiniGP 140</td>
</tr>
</tbody>
</table>

Table 2 eCall P2W Helmet usage

<table>
<thead>
<tr>
<th>Day</th>
<th>Place</th>
<th>Training schedule</th>
<th>Helmet time use (h)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/6/14</td>
<td>Kartódromo Chiva</td>
<td>18:30-20:00h</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12/6/14</td>
<td>Kartódromo Chiva</td>
<td>18:30-20:00h</td>
<td>1</td>
<td>incident (1)</td>
</tr>
<tr>
<td>17/6/14</td>
<td>Kartódromo Chiva</td>
<td>18:30-20:00h</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>19/6/14</td>
<td>Karting Manises</td>
<td>18:30-20:30h</td>
<td>1,5</td>
<td></td>
</tr>
<tr>
<td>24/6/14</td>
<td>Kartódromo Chiva</td>
<td>18:30-20:00h</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>26/6/14</td>
<td>Karting Manises</td>
<td>18:30-20:30h</td>
<td>1,5</td>
<td></td>
</tr>
<tr>
<td>1/7/14</td>
<td>Kartódromo Chiva</td>
<td>18:30-20:00h</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3/7/14</td>
<td>Karting Manises</td>
<td>18:30-20:30h</td>
<td>1,5</td>
<td></td>
</tr>
<tr>
<td>8/14</td>
<td>Kartódromo Chiva</td>
<td>18:30-20:00h</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10/7/14</td>
<td>Karting Manises</td>
<td>18:30-20:30h</td>
<td>1,5</td>
<td></td>
</tr>
<tr>
<td>15/7/14</td>
<td>Kartódromo Chiva</td>
<td>18:30-20:00h</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>17/7/14</td>
<td>Karting Manises</td>
<td>18:30-20:30h</td>
<td>1,5</td>
<td></td>
</tr>
<tr>
<td>22/7/14</td>
<td>Kartódromo Chiva</td>
<td>18:30-20:00h</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>24/7/14</td>
<td>Karting Manises</td>
<td>18:30-20:30h</td>
<td>1,5</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 Usage and Incidents Logged

Apart from the above reported tests, each rider performs extra tests on their own which are not supervised but are suitable for the HeERO tests. In fact, the second incident reported had place in a private test session held on 9/7/14 in Chiva circuit. The on board unit did not register any incident.

In the first incident, the track grip was too low and bike sliced on a curve. The helmet did not impact on the circuit; so any measurement could not be registered from helmet sensors.

The second incident was caused by pilot inattention on a curve. Bike expelled the rider above the handlebar and felt down impacting with the head on the floor. The impacted floor was a gravel trap. Helmet shell and visor were scratched. NZI dismantled the helmet and analysed the protective padding. Protective padding was not affected at all, showing that there were not damages than outer scratches to the shell. The helmet impact detection
electronics did not register any event since there was no impact energy transmitted to the user's head.

![Damaged helmet](image)

**Figure 12: Damaged helmet**

### 3.5.4.2 PSAP communication tests

#### Test architecture

The test setup for the IVS of the P2W is described below:

- The IVS has 3 main parts, the helmet itself, the incident detection unit and the call unit.
  - The intelligent helmet measures the impacts in the head and provides an incident severity index, which may be useful for PSAP operators.
  - The on board incident detection unit send the order for making a call to the call unit. For the detection it uses several inertial sensors and an algorithm for processing the information given by them. A manual activation button is included in this module for a manual emergency call. It receives the severity index from the helmet by Bluetooth.
  - The call unit is the responsible for making the call and sending the MSD to the PSAP. An audio channel is established with the helmet via Bluetooth.

- The PSAP emulator is composed by an electronic board and a PC with PSAP software. The Software provides the main functionality for a PSAP operator: MSD decoding, call tracking, etc.

The call between IVS and the PSAP emulator is a real call under a real Network, which increases the cost of each test, but results more realistic and closer to the final behaviour. The schema of the test architecture is shown in the next figure.
Figure 13: P2W Test architecture

Figure 14: P2W with IVS installed
Test results

The test results can be shown in the next table, where calls has been divided in successful calls (OK), Failed Calls and other where the voice connection has been established, but with some errors in the MSD, usually related to positioning.

<table>
<thead>
<tr>
<th>Type of call</th>
<th>Total Calls</th>
<th>OK</th>
<th>Failed Calls</th>
<th>Connected with MSD error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>40</td>
<td>39 (97.5%)</td>
<td>0 (0%)</td>
<td>1 (2.5%)</td>
</tr>
<tr>
<td>Automatic</td>
<td>40</td>
<td>38 (95.0%)</td>
<td>0 (0%)</td>
<td>2 (5.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>77 (96.25%)</td>
<td>0 (0%)</td>
<td>3 (3.75%)</td>
</tr>
</tbody>
</table>

Table 4 eCall P2W Test Results

3.6 Turkey

3.6.1 Mobile network

There are three mobile network operators in Turkey: TURKCELL, VODAFONE and AVEA. In the Turkish pilot, eCall flag was implemented and tested only on TURKCELL network in Antalya. There was no need for additional HW but a new SW had to be implemented on the TURKCELL side. TURKCELL’s current test system in Istanbul was used for eCall flag related IVS-MNO-PSAP integration tests, before field tests took place in Antalya.

TURKCELL uses ERICSSON switches in their infrastructure. In order to route the eCall flagged emergency calls to the related eCall PSAP, new switch configuration was implemented. SW updates and configurations were performed for this purpose.

3.6.2 IVS

Two types of eCall IVS equipment was used in the Turkish pilot; one from Civitronic (RENAULT) and another one from Magneti Marelli (TOFAŞ).

Installations were done in four vehicles. Two vehicles were equipped with Civitronic devices; the other two were equipped with Magneti Marelli devices.

RENAULT and TOFAŞ were responsible for the installation.

Both RENAULT and TOFAŞ tested manual eCalls.

3.6.3 PSAP

Tasks that were realized during the pilot project implementation:

A) Call centre part
• Integration of PSAP in-band modem into the ASELSAN's PSAP solution
• Checking and handover of MSD information into the operator's call taker application
• Checking voice connection with the vehicle

B) Application part
• MSD handling
• Presentation and visualization of MSD in call taker application
• Visualization of incident location in GIS
• Voice connection with the vehicle
• Statistics and testing related developments in call taker application

3.6.4 Fixed Network Operator

Tasks that were realized during the pilot project implementation:

A) Interconnection of ASELSAN and TURKCELL test systems
   a) Related hardware (ISDN PRI) installation
   b) Routings and related network configuration

B) Interconnection of eCall PSAP with FNO network
   a) Related hardware (ISDN PRI) installation
   b) Routings and related network configuration
   c) Routing of eCalls to the eCall PSAP
4 Implementation Results

During the project runtime the six WP2 Coordinators from the Member States regularly updated a table with their implementation status. The table was created in August 2013 after the regular implementation phase was finished. It was updated when the tests should have been started according to the schedule. And it was updated again to create this document.

4.1 IVS Implementation

The IVS section of the Implementation Status was divided into three parts:

- **Information**: General information about the device, the vendor (mostly their part of the project), the model number and the number of installed devices.
- **Installation process** contains information about the availability (some partners were still developing their IVS’s when the project had started), about the actual installation date and the installation mode (integrated or removable)
- **Initial testing** showed if and when the IVS was tested and was ready for the following HeERO test suite

In HeERO2 a total of 55 devices from 13 different vendors have been used for testing. Six of them were integrated in the car, the other ones were removable. One device was designed for the after-market in November 2013 85% of the devices was ready and installed. At the scheduled start of testing 95% were ready. The latest tests have been performed with all (100%) of the devices enabled. Thus test results will show the complete range of IVS.

4.2 PSAP Implementation

The PSAP implementation was a more centric part of the work in HeERO2. In addition to this the partners have selected different ways of implementing eCall in their PSAP infrastructure, so results are not as comparable as in the IVS section.

The PSAP section of the Implementation Status was divided into four parts:

- **PSAP Location** (self-explaining)
- **Decision process**: We knew from the first HeERO project that this was an underestimated part of the project – decision and procurement took much longer than primarily predicted. This is more a question of the political and financial decision process than of the technical decision itself. So this part was much more on the focus
of the WP2 coordinator than before. In this part of the table the partners should fill in their choice of system, the current status of their procurement process, the eCall System Manufacturer and finally the (predicted) date of process termination.

- **The Installation process** covered the eCall system installation itself, the interfaces to the PBX and to the PSAP software and the (predicted) date of process termination.

- **Initial testing** showed if and when the PSAP installation was tested and was ready for the following HeERO test suite.

In HeERO2 a total of 13 PSAPs (with alone 5 in Spain) were upgraded and eCall-enabled. In addition Belgium implemented a “filtering instance”, which was the first time this way of eCall implementation was realised. It was also the first time the EN16102 interface definition was ever used for eCall MSD transmission.

In November 2013 only 70% of the PSAPs were ready for testing, but all Member States had at least one eCall-enabled PSAP in the starting blocks. The other PSAPs joined the tests one after the other. In October 2014 the Belgium Filtering Instance passed the final tests (but had been already online since March 2014).

Most of the partners used PSAP extensions already available on the market, which had grown since the first HeERO project. Using these products made it much easier to upgrade the PSAPs. Once a member state had finished the procurement process, the technical upgrade was established very soon. Integration into the existing PSAP software is only completed in some Member States, but this was not a mandatory objective anyhow. Some MS have decided to update the complete software system later than 2014 and delayed the eCall integration according to their schedule.

### 4.3 MNO Implementation

Mobile Network Providers have to setup the eCall discriminator flag into their systems. Once this is only a minor software setup, but instead of attaching IVS devices to cars or to add eCall technology to PSAPs, this step means to exchange a vital part of the operational Mobile Network. Thus the MNOs are quite hesitant implementing this addition to their network. It has to be integrated into their software enrolment plan.

In HeERO2 we find the same situation as in the earlier HeERO project. Some Member States – mostly those with MNOs directly involved in the project – have enabled at least one network with the eCall Flag. Other Member States have advised a Mobile Network with the eCall flag at the start of the project, but at the end of 2014 the networks are still working with
non-eCall-flag software. Some partners tested their equipment under a special environment or a work-around. So the result for this part of the implementation is only mixed. Fortunately all MNOs have scheduled the eCall flag implementation until 2016.