

TEST REPORT

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Page 1 of 14 pages

**Centro de Experimentación y
Seguridad Vial MAPFRE, S.A.**

Calle Jorge Ruiz de Santayana 18. 05004 – ÁVILA

Tel.: 920 206 300 – Fax: 920 206 345

www.cesvimap.com



Sort of test

Study of the sensitivity and accuracy of a system to automatically detect and report on motor vehicle crashes.

Applicant

CalAmp Corp.
2177 Salk Avenue, Suite 200, Carlsbad, CA 92008
T: 760.438.9010 | F: 760.438.5835
CalAmp Corp. | www.calamp.com

Sample Identification

Brand: CALAMP
Model: LMU30H400-G1000
Serial number: 4562037510
IMEI of the SIM card: 352648069596054

Date/s of test

From 15/06/2016 to 16/06/2016

Date of reception

14/06/2016

Observations

Signatario/s autorizado/s

Authorized signatory/ies

Date of issue

08/23/2016

Enrique Zapico Alonso
Head of Electromechanical Department

The results and conclusions contained in this report relate solely to the samples tested at the time and conditions for measurements and tests were performed.
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1.- OBJECT

The purpose of this report is to validate if the ICN system (Instant Crash Notification), composed of the device installed in the vehicle, the communications system and the processing and reporting of data, is able to detect and assess the severity of crashes RCAR type, front and rear. It will also be verified if the ICN system does not cause false alarms during normal road operations with the device installed in a vehicle when driving over speed bumps or bumpy, steep slopes or sudden braking.

2.- DESCRIPTION OF THE SAMPLE

It is a "dongle" type device which is plugged the EOBD connector (OBDII) of the vehicle and through which the device gets its power supply and the vehicle identifier (VIN). It should be noted that apart from power, ground, and the VIN, the device is fully independent of the vehicle bus (VBUS)



Device object of test



Device installed on the vehicle (OBDII)

The device is equipped with a SIM card which enables the connectivity of the device to the mobile phone networks. In the event of a crash, the device sends a series of data files (using GPRS) to the remote server, where further filtering and data analysis is performed.

In this case the device sends the data utilizing UDP and the ICN message can be delivered to the receiver via SMS, email or by an API via web services.

The position is also reported using an integrated GPS antenna.

Brand	CALAMP
Model	LMU30H400-G1000
Serial number	4562037510
IMEI of the SIM card	352648069596054

The whole specifications of this device are attached in the Annex I of this report

3.- TEST PREPARATION

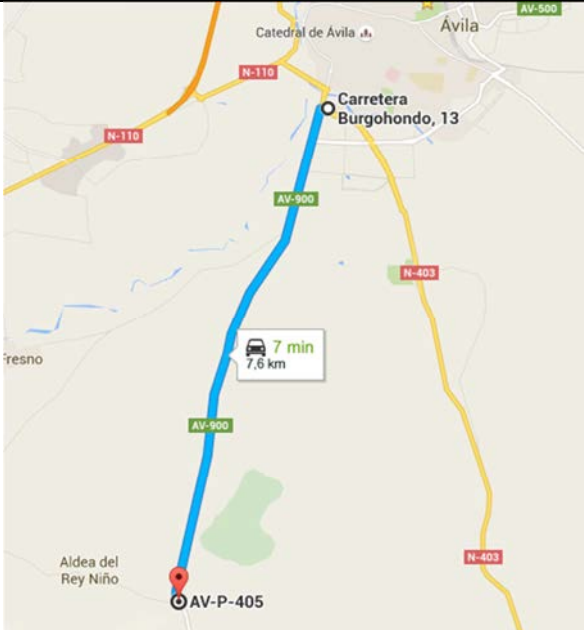
Calibration takes about 5 minutes while driving normally; the device sends an SMS message confirming the unit's calibration status. Once sent, the "Calibration OK" means::

- It has oriented its accelerometers so that already known X, Y and Z in the vehicle, regardless of the position in which it is mounted.
- Has made a diagnosis of the system and is operational

Calibration was done on 06/14/2016 and the device under test was mounted in the crash test vehicle. After the crash test, (performed on 06/15/2016) the same device was mounted on another vehicle (the first vehicle had already been damaged) for calibration prior to the road trials for false reporting (i.e. false positives) evaluation.

Vehicle for crash detection:

Calibration date.	06/14/2016
Brand	JAGUAR
Model	XE
VIN	SAJAB4BNGGA930764

Picture of the vehicle	
Calibration route	

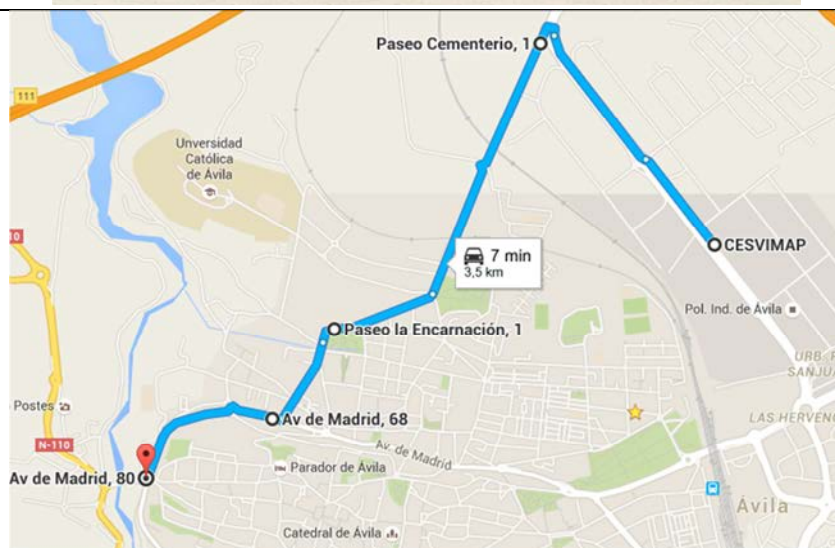
Vehicle for fake alarms test:

Calibration date.	06/15/2016
Brand	MITSUBISHI
Model	OUTLANDER PHEV
VIN	JMBXDGG2WGZ012021

Picture of the vehicle



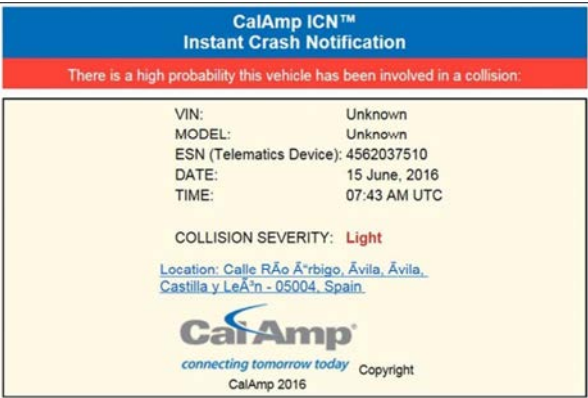
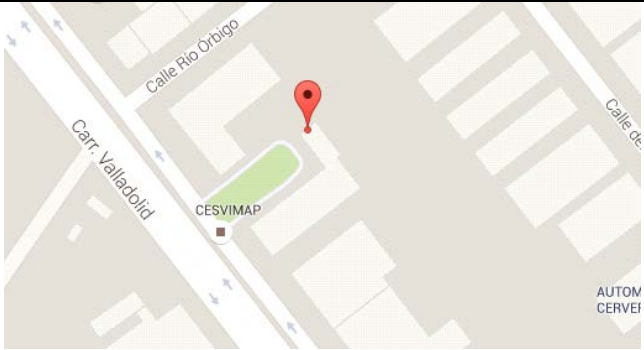
Calibration route

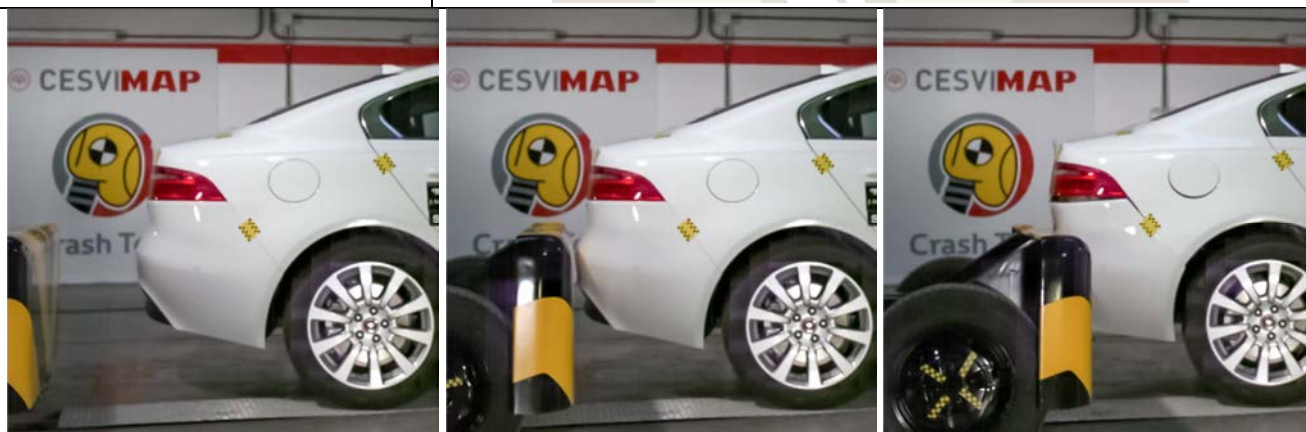


4.- TESTS

On June 15, rear and front crashes are performed with the device installed and calibrated on the vehicle Jaguar XE. The next day, on 16th it is performed the fake detection test with Mitsubishi vehicle. Accelerometers are installed over the airbag unit in order to compare results.

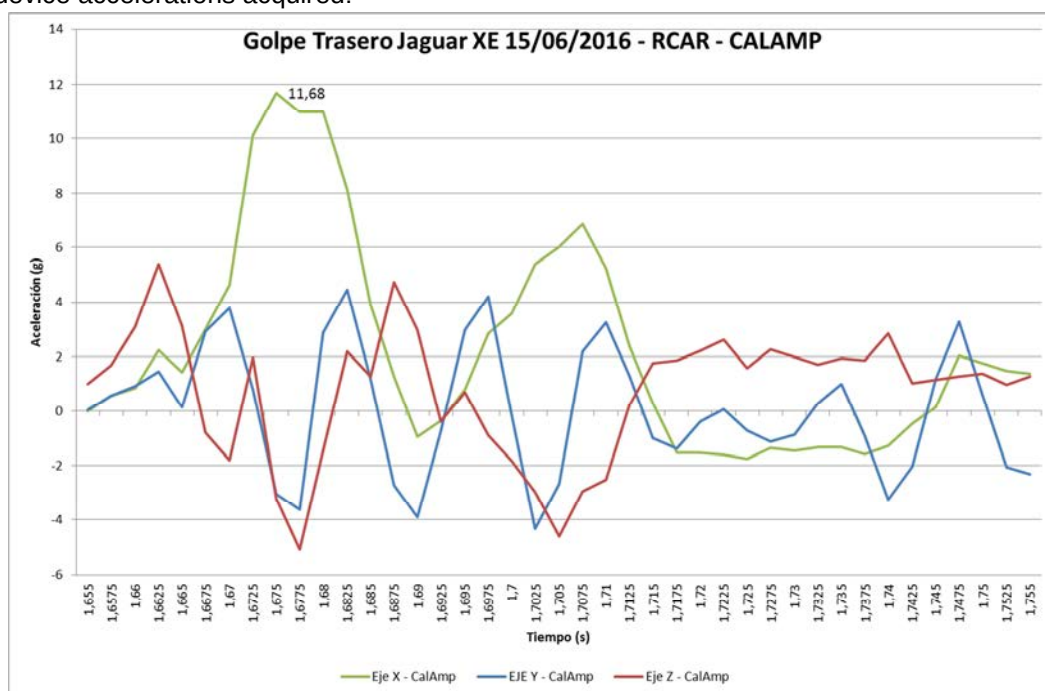
4.1.- Rear crash detection

Kind of crash	Rear crash type RCAR
Overlap	40%
Mean speed of impact	15,23 km/h (9,46 mph) against mobile rigid barrier weight 1400 kg
Angle of collision	10º from longitudinal axis
CalAmp device detects the crash?	Yes
Telematic alarm	
Location given by CalAmp system	

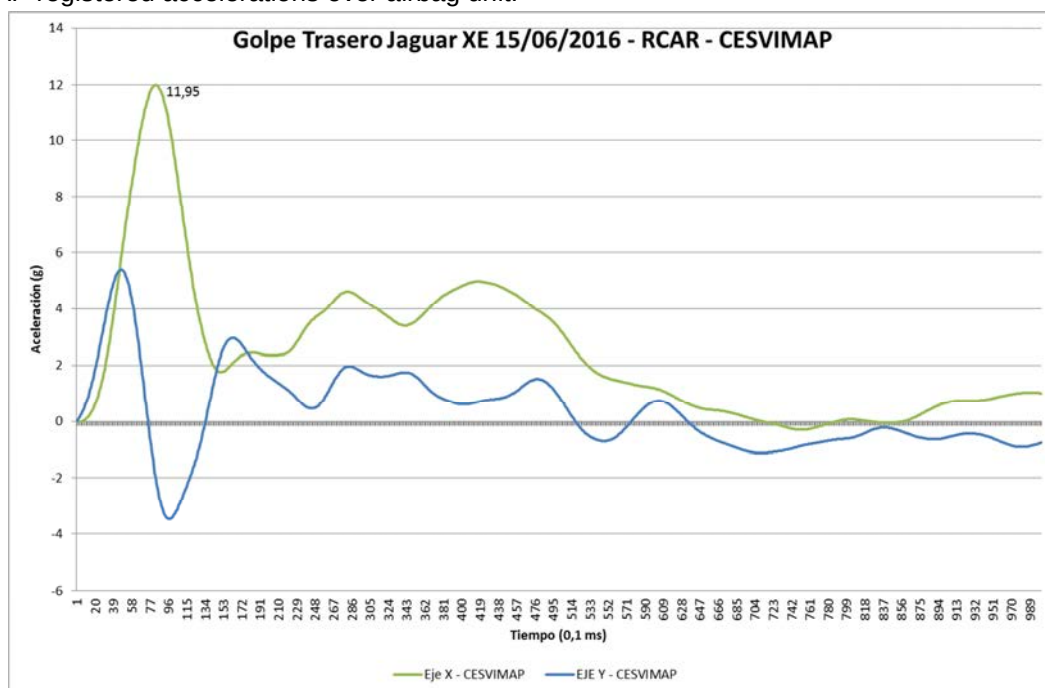


Rear crash graph:

CalAmp device accelerations acquired:



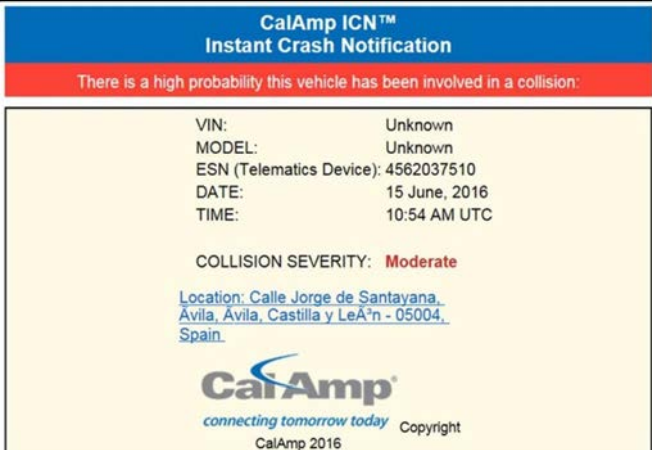
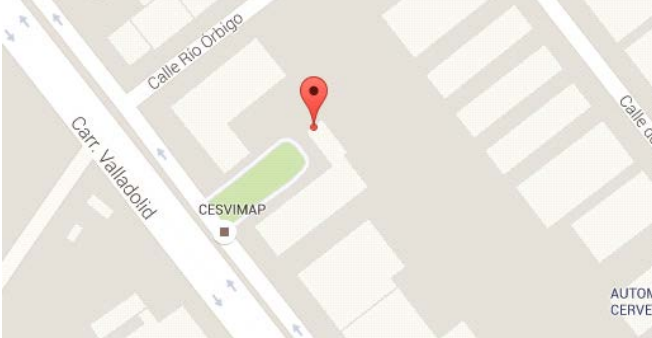
CESVIMAP registered accelerations over airbag unit.



Maximum accelerations and the evolution of the chart are similar in both cases.

Note: The acquisition frequencies of the test device is 400 Hz while the one which is set by CESVIMAP is 10 kHz and CFC (60) filtering, that's why the chart provided by CalAmp equipment has less mild forms.

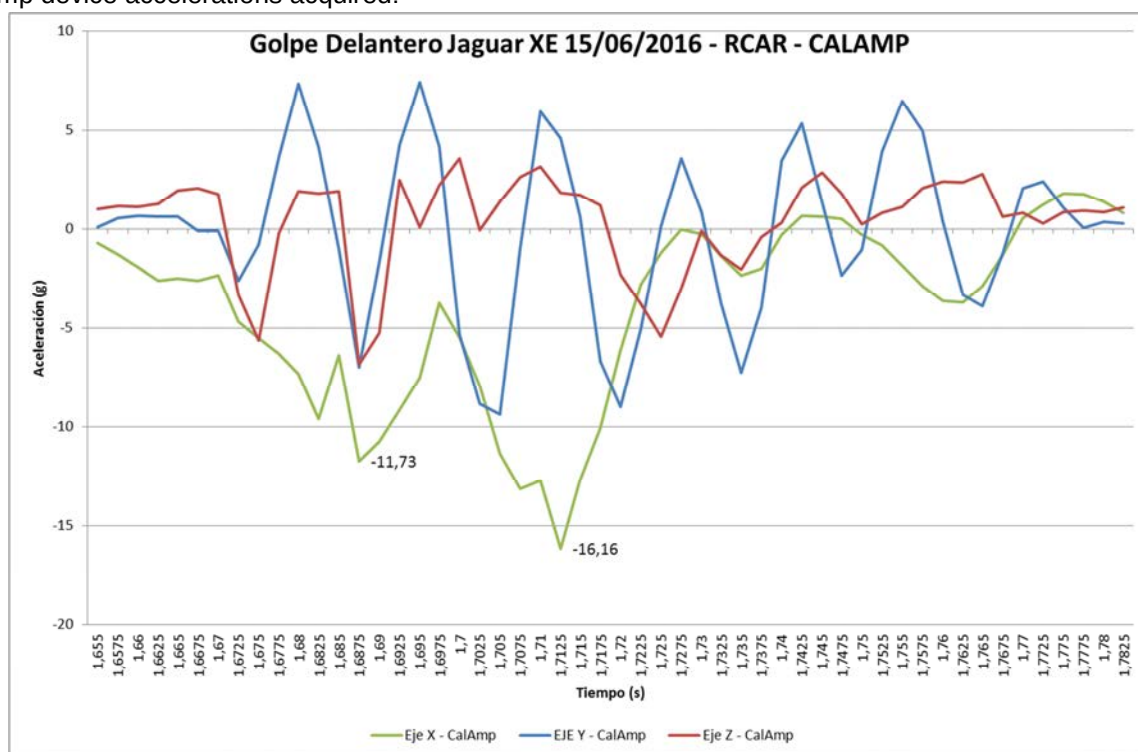
4.2.- Front crash detection

Kind of crash	Front according to RCAR
Overlap	40%
Mean speed of impact	15,23 km/h (9.46 mph) against rigid barrier of 35Ton
Angle of collision	-10° to the longitudinal axis
CalAmp device detects the crash?	YES
Telematic alarm	
Location given by CalAmp system	

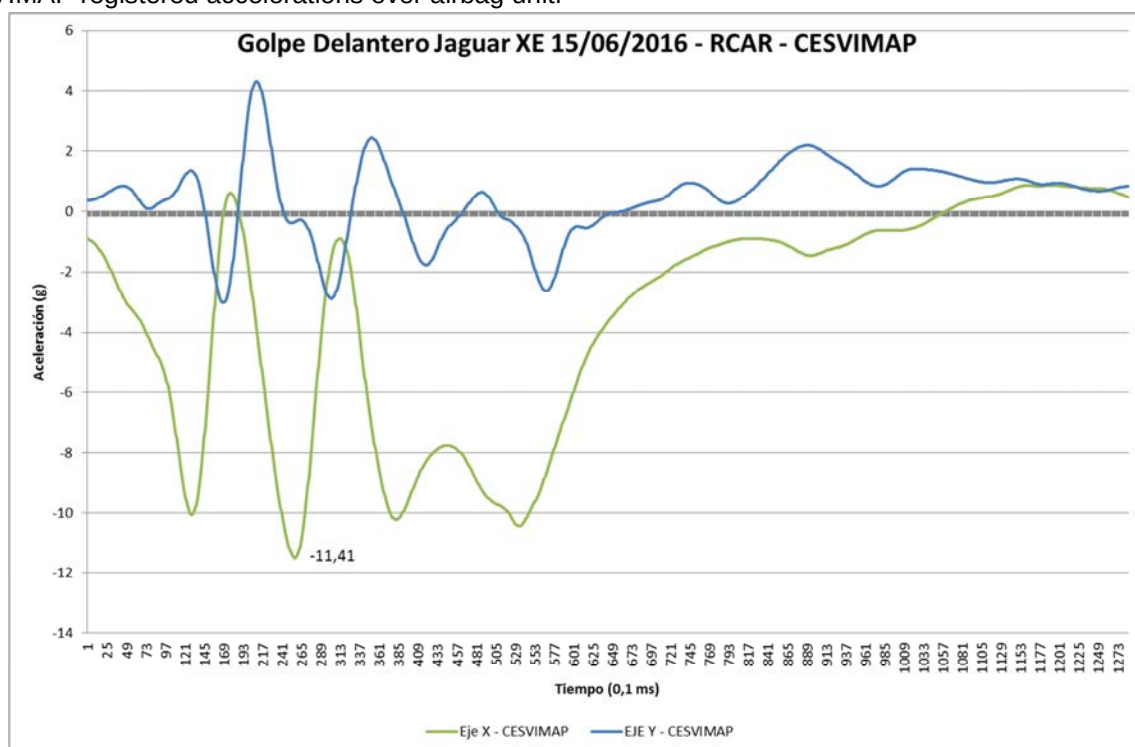


Front crash graph:

CalAmp device accelerations acquired:



CESVIMAP registered accelerations over airbag unit.

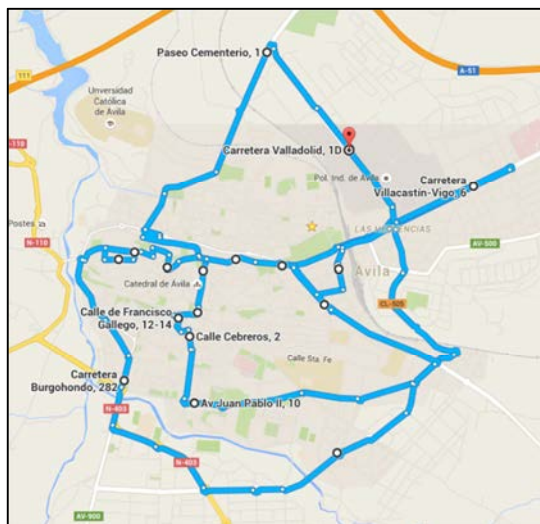


Maximum acceleration has an important deviation probably due to an internal resonance and the type of the filter. However, the moment of the maximum acceleration detected by CESVIMAP is shown in the chart of CalAmp. The chart evolution is similar in both cases.

Note: The acquisition frequencies of the test device is 400 Hz while the one which is set by CESVIMAP is 10 kHz and CFC (60) filtering, that's why the chart provided by CalAmp equipment has less mild forms.

4.3.- False alarms verification

After calibrating the device under test in the Mitsubishi Outlander PHEV, the following route was followed to evaluate the system's false alarm management capability.



Test route

No alerts sent by the device are observed. Then, the device works correctly in the performed route.

5.- CONCLUSIONS

- The calibration of the device takes approximately 5-10 minutes, preferably on straight and flat road although in reality the system self-adjust in a very precise way on virtually any road type.
- Once calibrated, the system permits disconnection for 15-20 minutes from the vehicle power without losing that calibration, thanks to an internal battery system.
- The system detected both front and rear accidents made on Jaguar XE, reporting the precise localization (position) and intensity (severity) of each.
- The acceleration values measured by the ICN system of CalAmp regarding the accident are precise and very similar to them registered by CESVIMAP although in the front crash a resonance occurs that raises the intensity of the maximum acceleration. The growth of the graphics are appropriate.
- The system did not generate false alarms (device was installed on the Mitsubishi Outlander's PHEV EOBD connector) even when performing sudden braking, traversing over speed bumps at high velocity, traveling over bumpy surfaces, as well as sharp turns.

Ávila at August 23, 2016

Test technician



Rodrigo Encinar Martín

Head of Electromechanical Department



Enrique Zapico Alonso

6.- PHOTO REPORT



Positioning of front crash



Dummy positioned in the vehicle



Front side with damage



Rear side with damage



Device installation location



Rear crash



Moment before the front crash



Speed bump (high crosswalk)



Speed bump (high crosswalk)



Street view



Street view



Cobblestone area

7.- ANNEX I: equipment specification sheet



EXPERIENCE THE ADVANTAGE

- Superior cellular and GPS wireless performance
- Built-in cellular and GPS antenna for easy installation
- Built-in OBD-II connector to read vehicle bus data
- Built-in accelerometer for driver behavior capabilities and impact detection
- Pre-impact data capture capabilities
- Power sleep modes
- Up to 20,000 buffered messages
- Optional fit Bluetooth 4.0 dual mode
- Over-the-air configuration and firmware download
- OBD-II comprehensive I/O

The LMU-3030 is an economical, full featured vehicle tracking product designed for easy and reliable installation in automobiles. The LMU-3030 is an ideal solution for automotive insurance, driver behavior management, auto rental and automotive applications when access to the vehicle diagnostics interface (OBD-II) is required.

COMPETITIVE PRICE, COMPETITIVE TECHNOLOGY, COMPETITIVE EDGE

The LMU-3030 full featured tracking unit from CalAmp features a small size, superior GPS design, OBD-II interface, and 3-axis accelerometer. These features enable the LMU-3030 to access vehicle diagnostic interface data, track vehicle speed and location, plus detect hard braking, cornering or acceleration. Superior internal antennas for both cellular and GPS eliminate the need for professional installation and make the LMU-3030 install quick, easy and inexpensive. Messages are transported across the cellular network using enhanced SMS or UDP messaging providing a reliable communications link between the device and your application servers. The LMU-3030 is designed to dramatically reduce cost, power and size while significantly improving field reliability in 12 volt passenger or light-duty vehicles.

FLEXIBILITY

The LMU-3030 employs CalAmp's advanced industry leading on-board alert engine, (PEG™) (Programmable Event Generator) to monitor external conditions and support customer-defined exception-based rules to meet your application requirements. PEG monitors the vehicle environment and responds instantaneously to pre-defined threshold combinations related to time, date, motion, location geo-zone, input and other event combinations. This behavior can be programmed by CalAmp before shipment, at a customers facility, or over-the-air once the unit has been fielded.

OVER-THE-AIR SERVICEABILITY

The LMU-3030 leverages CalAmp's management and maintenance system, PULS™ (Programming, Updates, and Logistics System), for over-the-air configuration parameters, PEG rules and firmware. This out-of-the-box hands free configuration and automatic post-installation upgrades can monitor unit health status across your customers' fleets to identify issues before they become expensive problems.



LMU-3050 SPECIFICATIONS

GENERAL

Communication Modes	GPRS/EDGE/HSPA and CDMA 1xRTT packet data, UDP and SMS
Location Technology	50+ channel GPS (with SBAS)
Messages	20,000 buffered messages
Geo-Fence	25 radial and 25 polygonal geo-fences on-board device, user definable
Configuration	Automatic over-the-air firmware and configuration updates via PULS™

GPS

Location Technology	GPS
Enhancement Technology	SBAS: WASS, EGNOS, MSAS, GAGAN
Tracking Sensitivity	-162 dBm
Acquisition Sensitivity	-148 dBm
Location Accuracy	2.0m
AGPS capable	

CELLULAR

Data Support	SMS/ UDP Packet Data
Operating Bands (MHz band)	
GSM/GPRS	850/900/1800/1900
CDMA/1xRTT	850/1800
HSPA/UMTS	800(VI)/850(V)/900(VIII)/ 1700(IV)/1900(II)/2100(I)
Transmitter Power	
GSM/GPRS	850/900 32.5 dBm 1800/1900 29.5 dBm
CDMA/1xRTT	850 24 dBm 1800 23 dBm
HSPA/UMTS	(all bands) 23 dBm
HSPA data rates	5.6 Mbps upload 7.2 Mbps download
HSPA Fallback	EDGE/GPRS/GSM quad band EDGE MCS1-MCS9 3GPP Release 6

CERTIFICATIONS

Fully certified FCC, CE, IC, PTCRB, Applicable Carriers

DEVELOPMENT SUPPORT OPTIONS

Customized hardware and software development available on request

MOUNTING

Via built-in OBD-II connector
Self-adhesive mounting with OBD-II extender cable

CONNECTORS, SIM ACCESS

SIM Access Internal
Built-in OBD-II/EOBD-II interface via J1962 compliant connector

About CalAmp

CalAmp Corp. (NASDAQ: CAMP) is a proven leader in providing wireless communications solutions to a broad array of vertical market applications and customers. CalAmp's extensive portfolio of intelligent communications devices streamline otherwise complex machine-to-machine (M2M) deployments. These solutions enable customers to optimize their operations by collecting, monitoring and efficiently reporting business critical data and desired intelligence from high-value remote assets. For more information, please visit www.calamp.com.

COMPREHENSIVE I/O

OBD-II Interface	OBD-II interface: J1850 PWM, J1850 VPW, ISO-9141-2, ISO-14230, KWP 2000, ISO-15765 CAN Vehicle interfaces are multiplexed to allow full connectivity to retrieve all codes made available by the firmware stack
Outputs	None
Communications Status	LED's: OBD, Cellular and GPS
Bluetooth	Bluetooth 4.0 Dual Mode (optional fit)

ENVIRONMENTAL

Temperature	-30° to + 75° C (connected to primary power) -40° to + 85° C (storage)
Humidity	95% R.H. @ 50° C non-condensing
Shock and Vibration	SAE J1455
EMC/EMI	CE, GCF, eMark (all pending)
RoHS Compliant	

PHYSICAL

Dimensions	1.5 x 2.5 x 0.98" (43 x 64 x 25mm)
Weight	1.83oz / 52g (with battery)
Enclosure	Rugged textured plastic enclosure

ELECTRICAL

Operating Voltage	9-16 VDC Vehicle Systems
Sleep Mode	4.9mA @ 13V (deep sleep) 66mA @ 13V (radio-active sleep) 66mA @ 13V (SMS+UDP connection, GPS off) 114mA @ 13V (continuous transmit)

OBD DATA EXTRACTION

Detection	Automatic detection of vehicle interface services
Extraction	Transmission of standard EOBD codes, plus manufacturer specific codes which are made available by the embedded OBD firmware stack
Scripts	Download of vehicle specific diagnostic scripts dependent on vehicle model variant

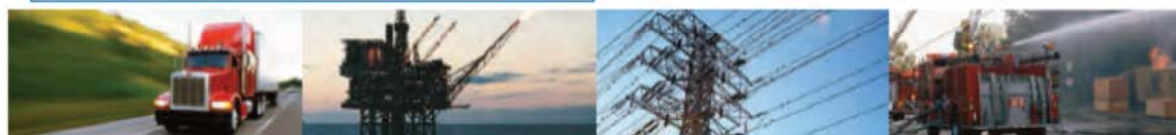
KEY FEATURES

- Low power sleep mode <3mA
- Superior GPS and cellular quality
- Built-in 3-axis accelerometer for motion, tilt, and impact detection
- Built-in OBD-II connector to read vehicle bus data
- Built-in cellular and GPS antenna
- 25 geo-fences
- 20,000 buffered messages
- Optional OBD-II connector cables
- Optional splitters and extensions
- Optional serial cable

CalAmp Corp.

2117 Salk Avenue, Suite 200, Carlsbad, CA 92008
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All specifications are typical and subject to change without notice



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