Successful Deployment of eCall Live Crash Test

There is a growing necessity to conform to automotive safety regulations for emergency calls (eCalls). One popular car maker wanted to push its safety standards to the next level by implementing live crash testing for its onboard eCall electronic control unit (ECU) or in-vehicle system (IVS). It soon ran into implementation challenges.

In the eCall system, the IVS detects a crash, for example, by sensing when the airbag deploys, and automatically triggers a mobile phone connection via 112 (or other designated emergency call number) to the nearest available public safety answering point (PSAP). The IVS transmits accident details such as geographical position, the severity of the crash, and vehicle identification number to the PSAP, and then uses the same line to create a voice call to a call center assistant.

While the best innovations can deliver expected results in the lab, the real proof is when it comes to mission-critical technology. The focus on eCall systems has received intense interest among car makers ever since the European Union (EU) mandated that all new vehicles for the EU market sold after April 2018 must have an eCall system. In Russia, a similar global positioning system called ERA-GLONASS has been in use since 2015.
According to EU estimates, eCall reduces emergency response times by 40 percent in urban areas, and 50 percent in rural areas. It is also estimated to reduce fatalities by at least 4 percent, and the number of severe injuries by 6 percent.

This car maker knew the best way to test the resilience of its IVS in the event of a road accident was to subject the system to a simulated high-speed impact.

The Challenge: Emulating Realistic Over-the-Air (OTA) Environments

In the past, the car maker only tested their IVS performance in their laboratory. However, moving their tests from the laboratory and manufacturing environments onto a vehicle headed for a collision at 40 mph created various test setup challenges.

Although their crash test facility already hosted some of the automotive industry’s most advanced crash simulation technology, the crash hall did not provide for realistic over-the-air (OTA) tests.
Initial set-up challenges:

1. EU test protocols did not allow test facilities to use the public 112 emergency call number for certification tests; the OEM had to set up their own mobile network simulation system.

2. Constraints related to the elongated footprint of the crash hall; the test engineers had to ensure even and stable coverage, especially under the high-speed test environments.

3. Guarantee the tests would not accidentally trigger the live public telecommunication network.

4. The test team had to ensure the emulations worked flawlessly. Any false fails would mean a very costly re-test — as an average of two cars were crashed per day, and each crash test cost between $100,000 to $500,000.

The Solution: Customizable Emulation for Different Networks

After visiting the crash test facility and understanding the customer’s test requirements and existing constraints, the Keysight test engineers recommended a comprehensive solution built upon its E6950A eCall/ERA-GLONASS Conformance Test Solution — customizable to meet the customer’s criteria:

- Ensure the IVS modules comply with eCall/ERA-GLONASS standards; CEN/ETSI for eCall, and GOST R 55530 for ERA-GLONASS
- Verify the IVS modem can trigger an emergency call — both automatically and manually, and sets the eCall/ERA-GLONASS flag appropriately
- Send the correct raw minimum set of data (MSD) with content extensions for additional details on crash information and vehicle diagnostics
- Establish a voice connection with the PSAP, and test the audio quality
- Produce logs of results/ACK/NACKS/timers for troubleshooting

PSAP emulation was provided by the robust E6951A PSAP Emulator, certified by NavCert for delivering compliance tests for the EN 16454 and EN 15722 standards. NavCert is an independent assessments body for global navigation satellite system (GNSS) and eCall products and solutions.
The N5172B EXG signal generator created GNSS coordinates, simulating what the satellite system does in the real environment. An E7515A UXM was used to emulate a cellular network in the real world mobile network as shown in Figure 1.

The Keysight team configured a distributed antenna system throughout the entire 160-meter long crash hall to ensure even coverage and a stable connection to the test equipment.

The sophisticated test set-up enabled calibrated and optimized measurements flawlessly, even as the vehicle slammed into the obstacle at 40 mph with the eCall IVS onboard alongside the crash dummy.

Figure 1: Keysight’s N5172B EXG Signal Generator

Figure 1: Keysight’s NavCert certified solution emulates various components of automotive emergency call systems
The Results: Further Qualification of eCall Conformance Test Capabilities

The car maker was extremely satisfied with the execution and results of its live crash tests for their eCall systems, which ensured the IVS was not only crashworthy, but able to perform flawlessly to save lives and mitigate injuries and potential fatalities.

As a leader in automotive safety, the car maker knew it had to meet and wherever possible, surpass compliance standards for eCall or ERA-GLONASS test requirements. Its crash test laboratory served its vehicle lines and provided many sought-after services for other car makers. The growing autonomous driving car market is expected to push their collision test capacities to the fullest, and this new live eCall crash test capability helps extend their range of test services.
With the meticulous attention to detail that Keysight gave to the live crash test requirements, the car maker knew it had a reliable solution, which would produce the right results for every car that went through testing in their crash hall, and get it right on the first attempt, saving anywhere from $100K to $500K per car tested. The car maker has started to explore duplicating similar eCall live crash tests for their crash test labs in other countries.

For more information: www.keysight.com/find/ecall