Anritsu Advancing beyond

# Enhancing eCall/NG-eCall Reliability

- Effective Testing Solutions -

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# 1. What is eCall/NG-eCall?

Emergency Call (eCall) and Next Generation eCall (NG-eCall), also known as in-vehicle emergency call systems, automatically notify emergency assistance centers, or Public Safety Answering Points (PSAPs), from an In-Vehicle System (IVS) via a mobile network in the event of a traffic accident. These systems aim to enable a rapid emergency response, helping to reduce the severity of injuries to vehicle occupants and improve survival rates. eCall has become mandatory for newly registered vehicles in Europe and is increasingly being adopted in other regions worldwide.


In eCall/NG-eCall, the IVS detects a vehicle collision or is manually activated by the driver. It then reports the Minimum Data Set (MSD) to the PSAP via the mobile network base station to initiate a voice call. The MSD includes vehicle location, vehicle type, and vehicle number.

To understand the difference between eCall and NG-eCall, refer to Table 1 below, which summarizes their key features.

**Table 1 Comparison of eCall and NG-eCall Features.**

| System | Mobile Communication Networks | Switching Method | Features |
|---|---|---|---|
| eCall | 2G/3G | Circuit Switching (CS) | Widely adopted; utilizes low data traffic. |
| NG-eCall | 4G/5G | Packet Switching (PS) | Supports high-speed data and multimedia communication. |

eCall enables circuit-switched voice calls over 2G and 3G mobile networks. The European Commission began standardizing eCall in 2004, and it has been mandatory for vehicles in the M1 and N1 categories*1 since 2018. However, support for 2G and 3G networks will be phased out starting in the late 2020s.

The move towards standardizing Next Generation eCall (NG-eCall) using 4G (LTE) and 5G networks. These networks do not support circuit switching for voice calls but instead support packet switching. Therefore, NG-eCall leverages high-speed data transfer capabilities to provide more advanced information transmission than conventional eCall, such as live streaming of accident scenes.

*1 M1 category: Passenger vehicles with a driver's seat and up to eight additional seats.
N1 category: Trucks with a maximum weight of 3.5 tons or less


**Figure 1 Emergency Call System.**

# 2. Trends in Standards for In-Vehicle Emergency Call Systems

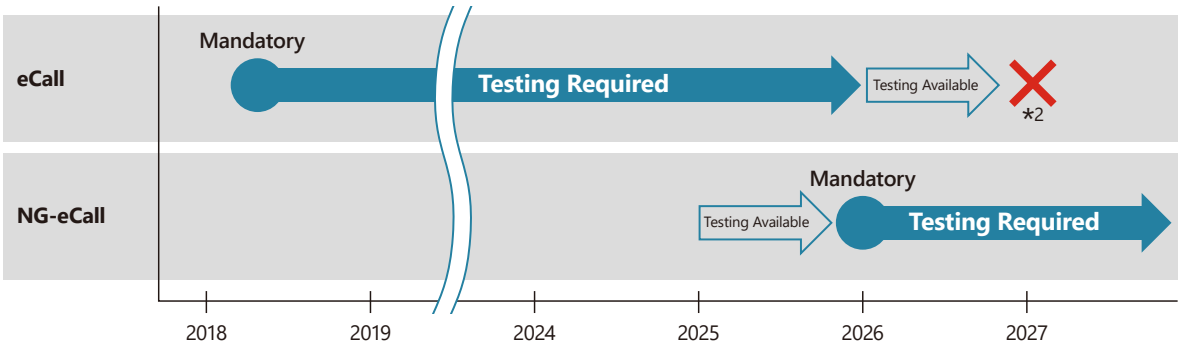
## 2.1 Europe

As of 2024, the European Union (EU) and the European Committee for Standardization (CEN) have completed or are considering the standardization of three types of vehicle emergency call systems: eCall, NG-eCall, and Hybrid NG-eCall.

**Table 2 European Regulations and Corresponding Test Standards.**

| | eCall | NG-eCall | Hybrid NG-eCall |
|---|---|---|---|
| EU Regulation | 2017/79 | 2024/1180*1 | Unissued |
| Mandatory Start Date | March 31, 2018 | January 1, 2026 | Under consideration |
| E2E Conformance Test | 16454: 2015 | 17240: 2018*1 | 18052: 2024 draft*1 |
| Technical Specification | 16062: 2015 | 17184: 2022*1 | 17905: 2023 |

*1: Information as of December 2024 and subject to change.




*2: Vehicles not supporting NG-eCall will invalidate the certification of conformity.

**Figure 2 eCall and NG-eCall Implementation Schedule.**

eCall has been mandatory in new vehicles since March 31, 2018, according to EU Regulation 2017/79. Therefore, new vehicles and IVS require certification body approval before commercialization. The European Committee for Standardization (CEN) sets the technical specifications, requiring compliance with CEN TS 16454:2015, which specifies end-to-end test methods for eCall systems.

NG-eCall, based on the technical specification CEN TS 17184:2022, utilizes the IP Multimedia Subsystem (IMS*3) to define the High-Level Application Protocol (HLAP). HLAP outlines the communication methods and message structures for eCall services. The conformance test specification, CEN TS 17240, includes detailed specifications of HLAP and the corresponding test methods. NG-eCall will become mandatory in Europe from January 1, 2026.

Hybrid NG-eCall is a standard aiming for interoperability between 4G and 2G/3G networks. This standard is being developed separately from NG-eCall as technical specification CEN TS 17905:2023. Since 2G/3G networks are scheduled to shut down in Europe within a few years, delaying the mandatory start of NG-eCall in 2026 is not feasible. Interoperability will require additional time to develop, therefore, CEN TS 18052, a specification for conformance testing, is currently in progress.

eCall and NG-eCall systems are crucial evaluation criteria of the European New Car Assessment Programme (Euro NCAP), an independent organization that assesses the safety of new vehicles. Incorporating these systems is indispensable for improving vehicle safety. Euro NCAP provides information to help consumers choose safe vehicles and encourages automakers to enhance safety performance. Installing eCall and NG-eCall is also a significant factor for the manufacturers aiming to improve their market competitiveness.

*3: IMS: A technology that enables services using voice and video over IP-enabled carrier networks.

## 2.2 United Nations (UN) Regulations

The United Nations Economic Commission for Europe (UNECE) enacted UN Regulation No. 144 (UN-R144) as part of a plan proposed by the UN General Assembly to reduce traffic accident fatalities worldwide. UN-R144 establishes comprehensive technical requirements and testing methodologies for vehicles equipped with eCall and NG-eCall systems, including system configuration, operation, and data communication protocols. Implementing eCall and NG-eCall systems in the European Union (EU) in compliance with UN-R144 ensures interoperability and enhances safety standards across EU member states. The regulation came into force in July 2018 and applies to EU countries that are UNECE members, as well as to Japan and other nations.

## 2.3 Trends in South Korea and Japan

As of December 2024, neither South Korea nor Japan has mandated the implementation of eCall systems. However, both countries have made significant progress in adopting and standardizing emergency call technologies.

Various manufacturers in South Korea have already introduced their emergency call technology systems, and these systems are expected to continue to proliferate in the future. The Intelligent Transport Society of Korea (ITS Korea), an organization dedicated to promoting Intelligent Transport Systems (ITS) technology and establishing standards, has established ITSK-WD-19003 as the test standard for the Korean version of eCall and NG-eCall.

In Japan, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) adopted and implemented UN-R144 in 2018. This regulation legally establishes the technical requirements for automatic accident and emergency call systems, facilitating the standardization of eCall systems in Japan. Major Japanese manufacturers, such as Toyota, Honda, and Nissan, are focusing on safety technologies and are increasingly integrating eCall systems into new vehicles. Additionally, since 2020, the Japan New Car Assessment Program (JNCAP) has included the "Automatic Accident Emergency Call System" as one of its key assessment indicators.

## 3. Necessity of Test In-Vehicle Emergency Call Systems

Manufacturers need to ensure that vehicles equipped with eCall systems comply with national and regional regulations. Therefore, developing eCall systems requires the use of test methods approved by certification bodies, conducting design verification, and incorporating the results back into the design. If these tests are not performed, verification items may be overlooked during development. This oversight can prevent the product from being certified in type approval tests and may lead to increased costs and delayed market launch due to subsequent troubleshooting.

In the event of actual accidents, 4G and 5G mobile networks may be unavailable, requiring connections to 2G/3G networks and sometimes preventing calls to PSAPs. Therefore, developing an eCall system requires testing that simulates various usage conditions.

Specific issues include the following

- **Difficulty in Building a Testing Environment:**
  Conducting tests that replicate accident conditions in a real environment is impractical because emergency calls to PSAPs cannot be made during testing, and recreating on-road environments requires extensive and expensive equipment.
- **Reproduction of Diverse Communication Environments:**
  Beyond mobile networks like 3G and 4G, replicating varying signal conditions caused by weather and geographic location is necessary. However, the simulating and testing of all possible conditions in a real environment is challenging.
- **Support for a Large Number of Test Items:**
  In addition to normal communication conditions, it is also necessary to test alternative scenarios such as PSAPs not being able to respond. Identifying and executing all these test cases requires an enormous amount of time and effort.
- **Need for Expertise and Training Costs:**
  Accurately implementing test items based on testing standards requires advanced knowledge of communication technologies and systems. Moreover, continuous training is essential to keep up with new technologies and standards, which entails significant costs in human resource development.

To overcome these challenges, sophisticated test equipment that simulates real-world environments is essential. The following sections show how Anritsu test equipment can rise to these challenges.

# 4. Test Solutions for In-Vehicle Emergency Call Systems

In eCall testing, engineers need to verify communication quality and messages for an IVS connects to a mobile network and a PSAP. Anritsu offers the eCall Tester MX703330E, software that simulates actual networks and evaluates the eCall/NG-eCall functionalities of IVS.

This software is recognized as a PSAP simulator for eCall certification testing by testing organizations accredited by European government agencies and others.

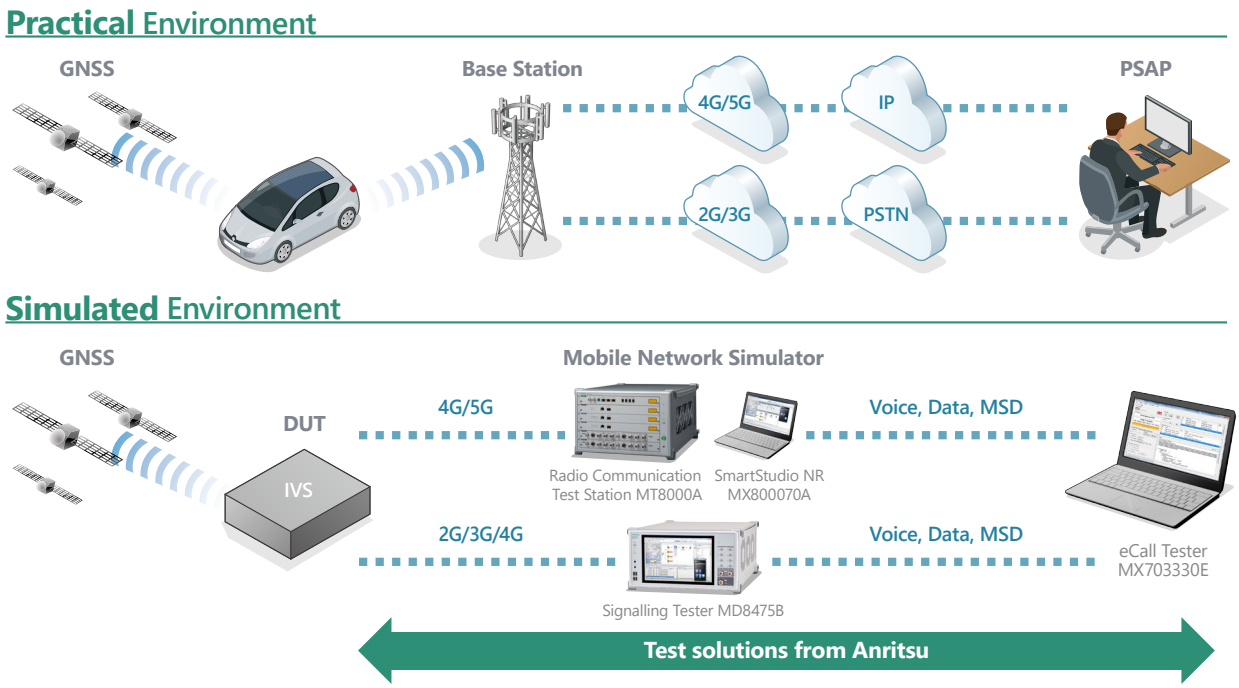



**Figure 3 Comparison of Actual and Test Environments.**

The eCall Tester utilizes Anritsu's mobile network simulators, namely, the radio communication test station MT8000A or the Signalling Tester MD8475B, to reproduce a wide variety of communication conditions and create a simulated network. This capability makes it possible to generate out-of-range conditions, handovers, roaming scenarios, and so on. MSD transmission and reception tests, which are difficult to perform on an actual network, can also be conducted quickly and reliably.

Utilizing this test solution improves the efficiency of establishing the development of eCall-compliant IVS and the testing environment for type certification, reducing the work hours required to build the testing environment and lowering training costs for test personnel.

Anritsu offers certification testing options for eCall standards defined in various countries, including:

- European eCall
- Europe NG112 (LTE)
- ERA-GLONASS
- South Korea (South Korean eCall)

Section 4.1 presents the functional testing solutions required during the development of in-vehicle emergency call systems, and Section 4.2 presents solutions for automating testing during type approval.

## 4.1 Functional Testing Solutions During Development

Figure 4 shows the test system used for verification during the development phase. This system consists of the eCall Tester MX703330E, the mobile network simulator MT8000A or MD8475B, and the Device Under Test (DUT). This configuration is suitable for testing with the eCall Tester while allowing the fine-tuning of parameters.

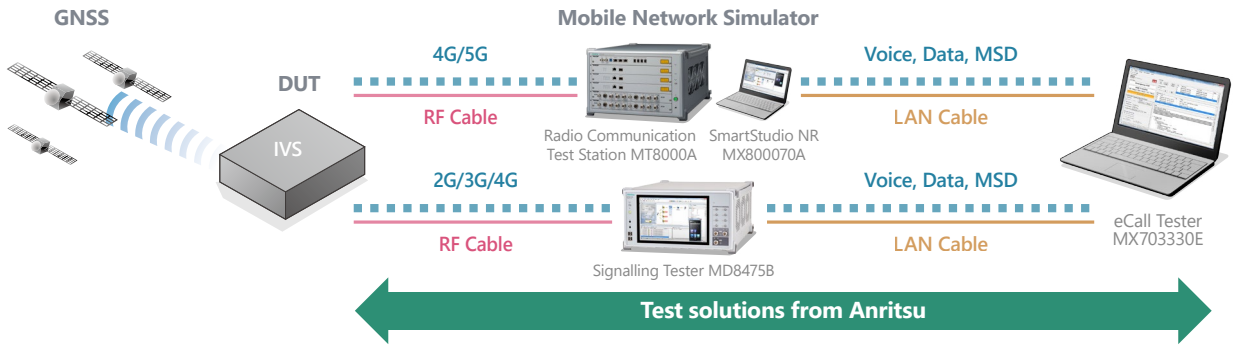



**Figure 4 Functional Test System During Development.**

The operation of each device in the test system is as follows:

**eCall Tester:**

Software for testing in-vehicle emergency call systems. It controls the mobile network simulator, sends and receives voice and data to and from the DUT via the simulator, and displays the test results. It supports eCall and NG-eCall functional tests.

**Mobile Network Simulator:**

Simulates the operation of a wireless base station and generates control signals from the mobile network to create out-of-range conditions, handovers, roaming scenarios, and more. The DUT connects to this simulator.

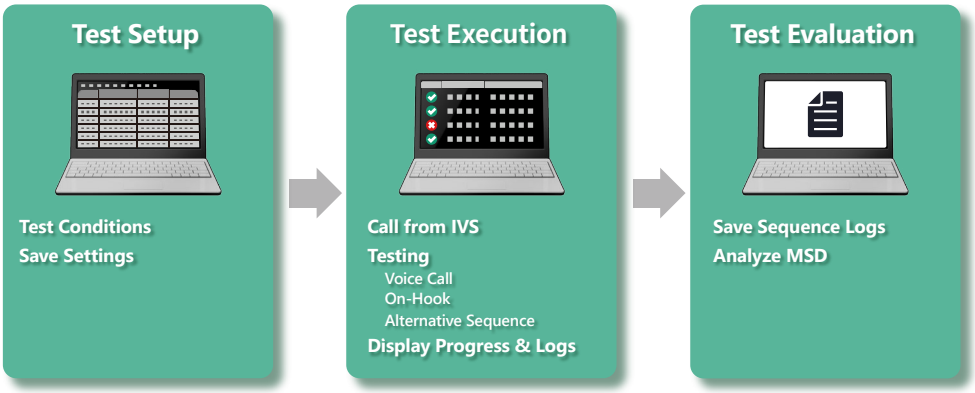
**Simulator Usage:**

For 4G and 5G: Radio Communication Test Station MT8000A

For 2G, 3G, and 4G: Signalling Tester MD8475B

**SmartStudio NR:**

Software used to control the MT8000A




The testing process is as follows:

**Test Setup:**

First, set the test mode, communication method, and test conditions in the eCall Tester.

- Test Modes: eCall, ERA-GLONASS, NG112 LTE eCall, and South Korean eCall modes.
- Communication Systems Supported: GSM/GPRS, W-CDMA, LTE, and NR (SA). Optionally, it can switch between different communication systems, such as from GSM/GPRS to W-CDMA.
- Test Conditions: The following settings can be configured:
  - ► Delay from receipt of a message from the DUT to PSAP response
  - ► Frequency and power during communication
  - ► Behavior during network failures, such as response rejection

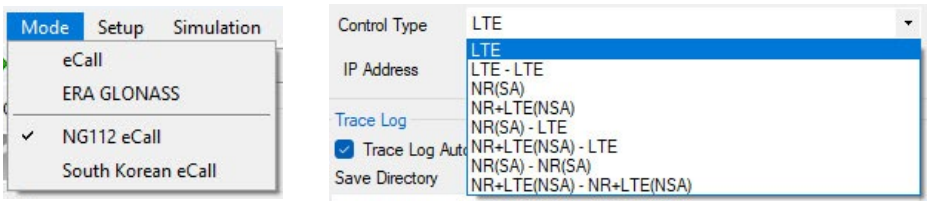
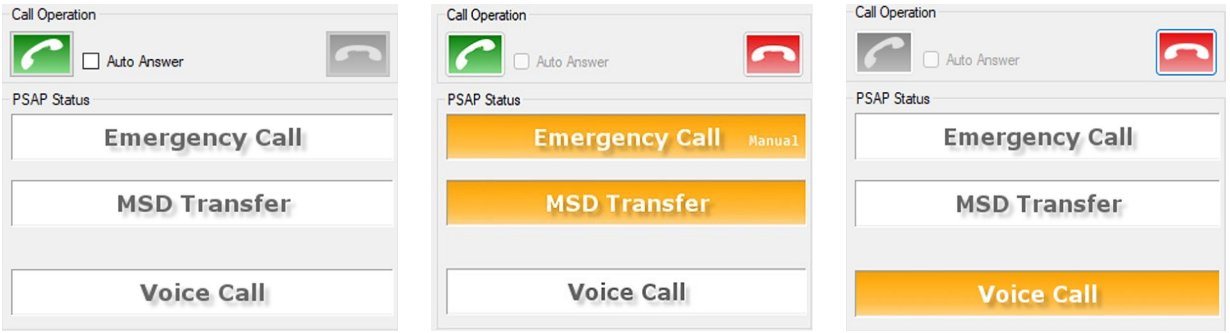



**Figure 5 Example of Setting Screen**

**Test Execution:**

The IVS initiates the call or sends an MSD to start the eCall/NG-eCall test. Depending on the test, the tester selects the "Answers (Off-hook)" or "Ends" (on-hook) button on the PSAP side.




(a) Before the start of the test

(b) Received emergency call and MSD from the DUT

(c) PSAP starts a call

**Figure 6 Status Display During Test in eCall Tester.**

Figure 6 shows an example of PSAP status transitions.

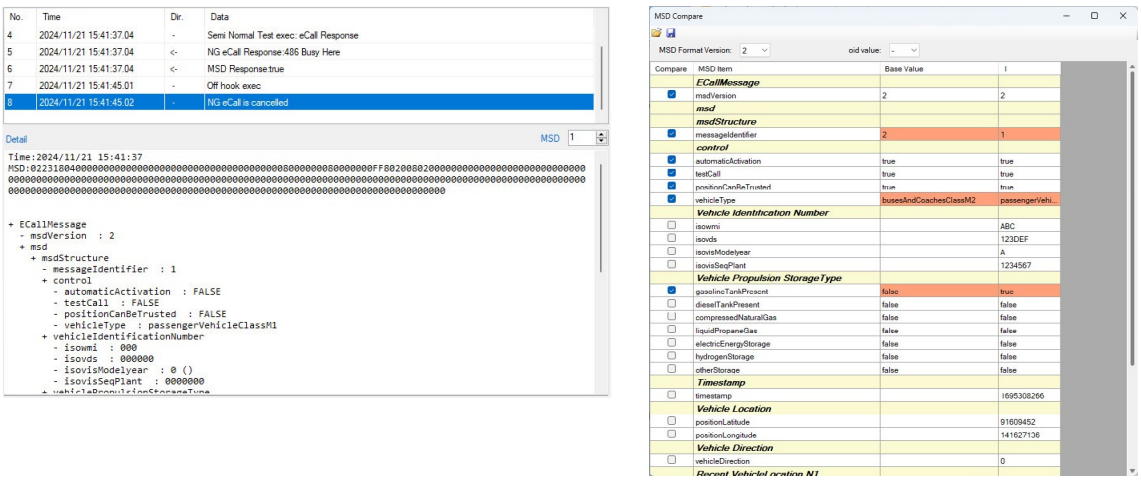
(a) State existing when the simulation begins, and the DUT is turned on.

(b) IVS initiates a call, and PSAP receives the emergency call and MSD. The PSAP can choose to initiate or reject the call.

(c) When the call is initiated, a callback function loops back the audio spoken into the IVS, allowing a user to check the voice quality on the IVS receiver.

**Test Evaluation**

After the test is completed, logs of the test results for each test item are stored in the eCall Tester. From these logs, the MSD is decoded and compared with expected values to verify the test results.




(a) Log of test results for each test item

(b) MSD message comparison

**Figure 7 Display of Test Results.**

## 4.2 Automated Solutions During Type Approval

Anritsu's automation software, SmartStudio Manager MX847503A, is used for certification testing to obtain type approval. Test scenarios can be installed in SmartStudio Manager to ensure compliance with the standards.

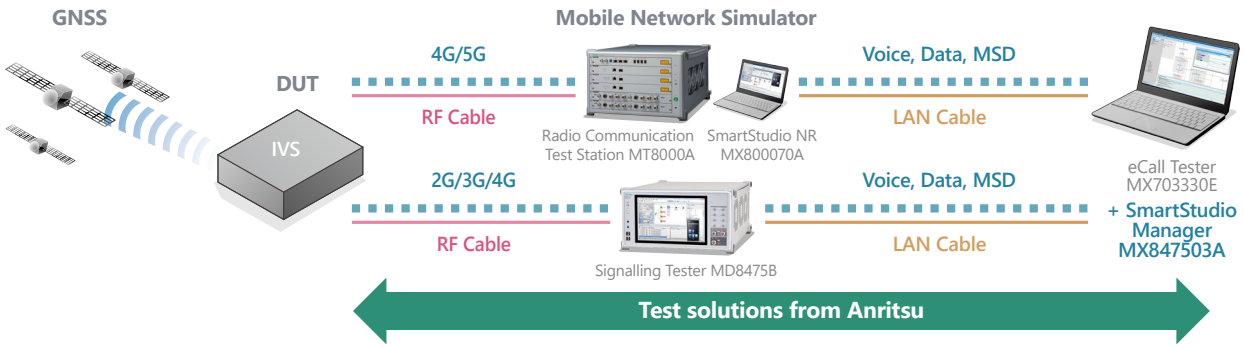
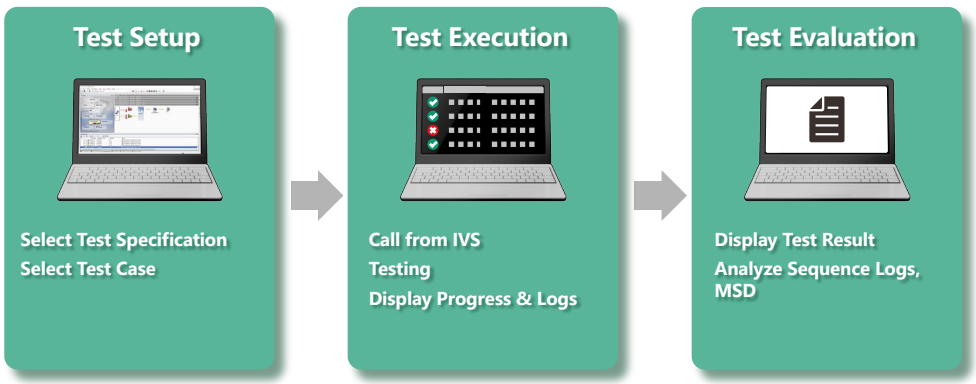



**Figure 8 Automated Test System Using SmartStudio Manager.**

**SmartStudio Manager**

Software that uses the eCall Tester to perform tests in compliance with the standards.

The flow of test execution with SmartStudio Manager is as follows:




**Test Setup:**

Select a test standard and then select the test items defined in that standard. Figure 9 displays the tests defined in the test standard CEN TS 17240.

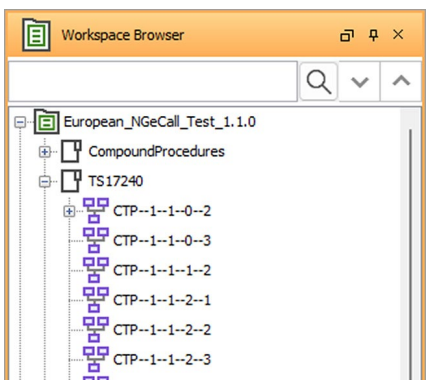



**Figure 9 Test Item Selection Screen**

**Test Execution:**

The real-time status and log can be monitored during the test.

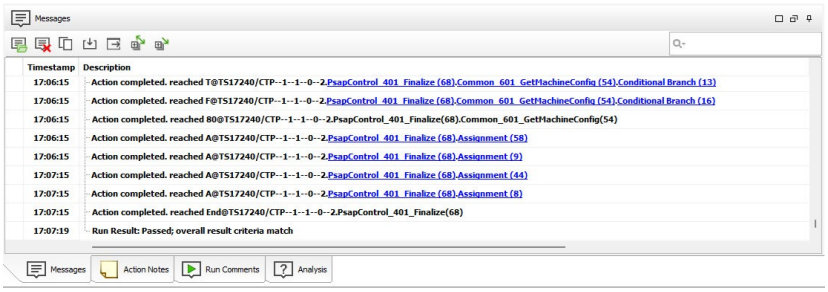



**Figure 10 Test Log During Execution.**

**Test Evaluation:**

After the test, SmartStudio Manager determines whether the IVS performed as expected and saves the sequence log. The pass/fail determination can also be saved as a PDF file.

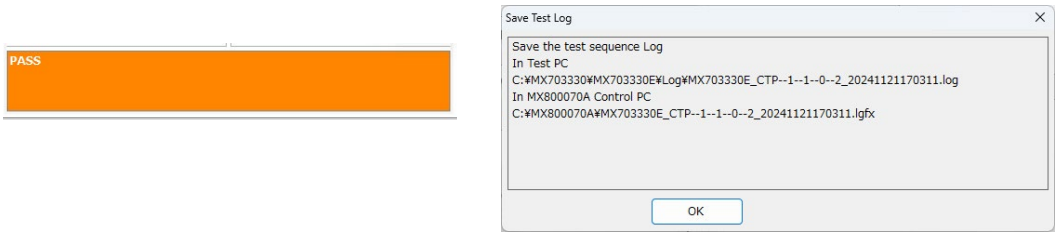



**Figure 11 Pass/fail Determination of Test Results.**

**TS17240 Test Report**

Test Title:CTP--1--1--0--2
Model Name:
Test Date:2023/07/19 08:49:51
Author:

Test Result:PASS

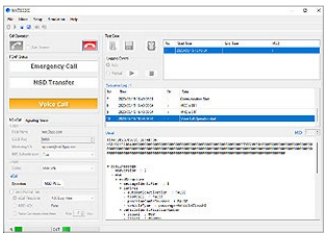
Test Items:

| No. | Test Item | Result | Remark |
|---|---|---|---|
| 1 | Perform necessary steps for the IVS to attempt to register on the network | - | |
| 2 | Wait for network registration | Pass | |

**Figure 12 Example of Displaying Test Results as a PDF File.**

# 5. Test Solutions

**eCall Tester MX703330E**



The eCall Tester MX703330E is software designed for simulating PSAP servers and analyzing MSDs. It complies with European test standards and is used for functional testing during the development stage as well as in test environments for type approval.
Web: eCall/NG-eCall

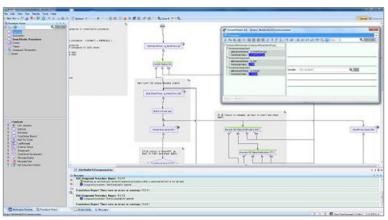
**Radio Communication Test Station MT8000A**

The Radio Communication Test Station MT8000A is a base station simulator that connects to the eCall Tester to simulate 4G and 5G mobile networks. It supports both RF (Radio Frequency) measurements and protocol testing for 5G NR (New Radio).
Web: Radio Communication Test Station MT8000A

**Signalling Tester MD8475B**

The Signalling Tester MD8475B is a base station simulator that connects to the eCall Tester to simulate a wide range of standards from 2G to 4G LTE-Advanced in a single unit.
Web: Signalling Tester (Base Station Simulator) MD8475B

**SmartStudio Manager MX847503A**



The SmartStudio Manager MX847503A is software that automates the operation of eCall tests. By adding options, this software can also be used for type approval testing.
Leaflet: Efficient Test Environment for Exponential Increase in Number of CA Band Combinations