Keysight Technologies
E6950A eCall/ERA-GLONASS Conformance Test Solution

KEYSIGHT TECHNOLOGIES

Introduction

Emergency Call (eCall) is an in-vehicle road safety system developed to reduce fatalities, injuries and property loss in the event of a road accident by speeding up the emergency response times from the rescue team. An in-vehicle system (IVS) is installed in a vehicle and this IVS will trigger a 112 emergency call, either manually by passengers, or automatically in the event of a serious road accident. Once the IVS module is successfully connected to the most appropriate Public Safety Answering Point (PSAP), a Minimum Set of Data (MSD) is transmitted. This MSD contains the vehicle registration number, GPS location, a timestamp, direction of travel, the number of passengers and triggering mode (automatic or manual). This provides valuable information to enable the rescue team to reach the accident site as soon as possible. Once the MSD has been successfully received a confirmation is sent from the PSAP to the IVS module (ACK) and the connection to the PSAP transfers to a voice call allowing emergency services to speak to the car occupants.

eCall/ERA-GLONASS Conformance Test Solution Challenge

eCall /ERA-GLONASS Conformance Test Solution is an European Union and Russian Federation initiative created to combine mobile communication and satellite positioning to provide rapid assistance to passengers in the event of a collision.

Generally, an eCall module consists of an embedded computer that continuously monitors the crash sensors and vehicle position via satellite receivers. In the event a crash sensor is activated, the in-band modem will establish a connection to enable data transmission (MSD) to the most appropriate PSAP. A microphone and speaker system enables the driver or passenger to communicate with the PSAP operator. Each of these components plays an important role, hence they need to be tested for functionality in a real world environment to ensure overall system performance.

Testing of eCall/ERA-GLONASS modules brings many challenges; hence, the test solution should meet the following minimum viable functionalities:

- IVS modules must comply with eCall/ERA-GLONASS standards
- CEN/ETSI for eCall, GOST R 55530 for ERA-GLONASS
- Verify that the IVS modem is able to trigger an emergency call – both automatically and manually, and sets the eCall/ERA-GLONASS Flag appropriately
- Send the correct raw MSD data
- Establish a voice connection with the PSAP
- Produce logs of results/ACK/NACKS/timers for troubleshooting
- Optionally test audio quality
- MSD transfer using SMS
- MSD content extensions for additional detail on crash information and vehicle diagnostics

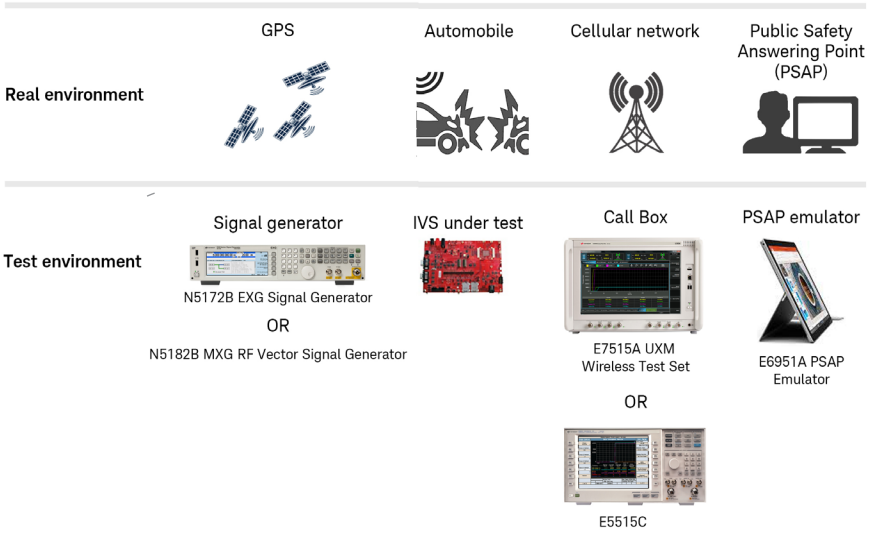
eCall/ERA-GLONASS Conformance Test Solution

The Keysight E6950A eCall/ERA-GLONASS Conformance Test Solution performs end-to-end functional and standard-compliance conformance testing of eCall/ERA-GLONASS modules, with optional audio performance analysis. The E6951A PSAP Emulator Software simulates a Public Safety Answering Point (PSAP) and controls a UXM or E5515C to emulate a cellular network and EXG to provide GNSS coordinates required by the IVS to compile the MSD. This setup makes it possible to verify if the IVS modem is able to trigger an emergency call, send the correct raw MSD data and establish a voice connection with the PSAP – fully independently of any real-world mobile network.

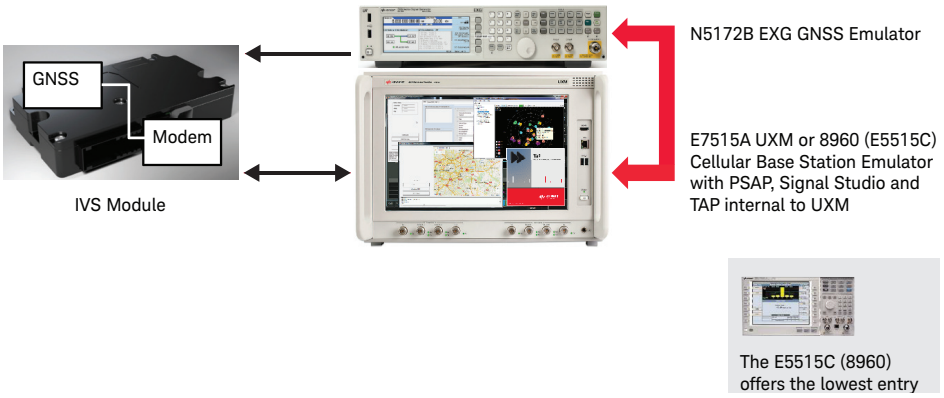
Solution Architecture

The Keysight eCall/ERA-GLONASS conformance test solution is based on the following architecture:

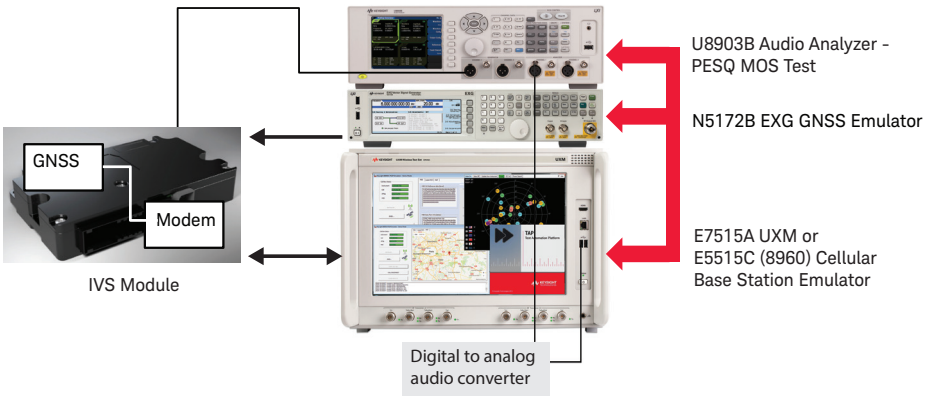
In the test environment, a signal generator provides GNSS coordinates, simulating what the satellite system does in the real environment. The IVS represents the automotive vehicle, while the UXM (or E5515C) is used to emulate a cellular network in the real world mobile network. The PSAP software can run inside the UXM, or on a separate PC when using with E5515C.



The diagram on the right shows a recommended instrument setup for eCall/ERA-GLONASS module functionality testing. You have the option to either generate static GNSS signals or dynamic GNSS signals, depending on N5172B EXG configuration. Please refer to the Keysight eCall/ERA-GLONASS Conformance Test Solution Configuration Guide for details (literature part number 5992-1726EN).

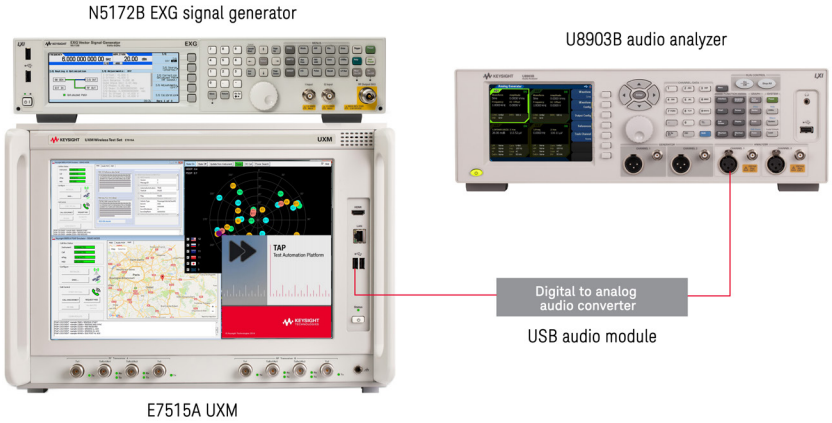


Keysight also offers an option to include audio performance analysis using the U8903B audio analyzer and DAC (Digital to Analog Converter), as shown in the figure on the right:



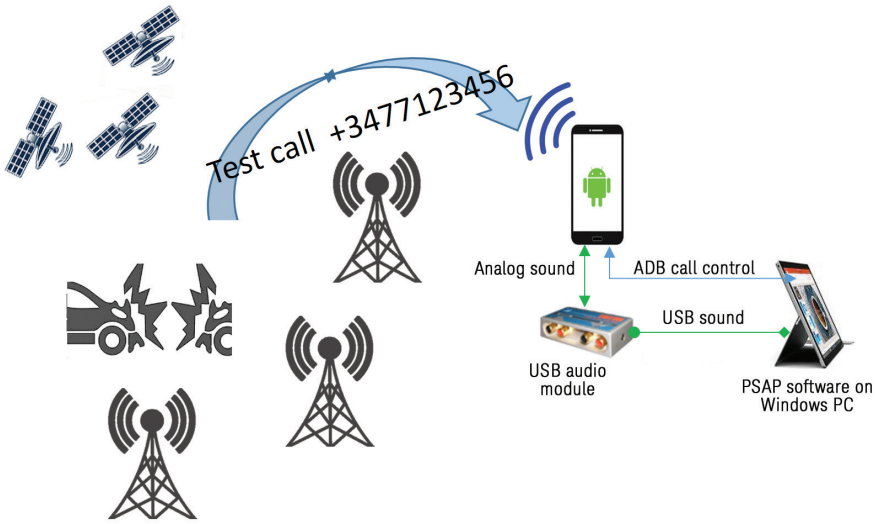
The PSAP software runs inside the UXM. It can be optionally run on a separate PC when used with the E5515C.

It is also possible to perform audio quality testing of the eCall using the Keysight U8903B Audio Analyzer. This requires an analog audio path connection between the E7515A UXM or the E5515C/E call box. The E5515C/E can be connected directly to the U8903B using the existing analog audio In/Out ports.



The E6951A PSAP Emulator may also be used in conjunction with a commercial mobile phone with an active cellular connection in a live network environment.

This will test the IVS module using a real cellular network in place of the network emulators such as the UXM.



E6951A PSAP Emulator in live network setup

Hardware Elements

With the eCall/ERA-GLONASS conformance test solution, you can leverage your existing/standard lab equipment, with the reassurance that the hardware acquired can be reused for many other tests and applications.

N5172B EXG

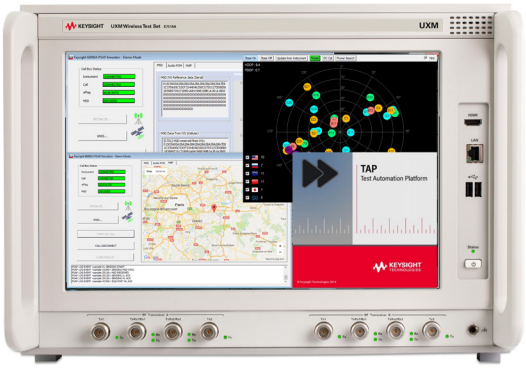
www.keysight.com/find/exg

To help you quickly create signals that meet the needs of specific standards and measurements, the EXG is compatible with Keysight Signal Studio software. Its suite of signal-creation tools addresses cellular communications, wireless connectivity, audio, video, positioning, tracking and general-purpose applications.

E7515A UXM

www.keysight.com/find/uxm

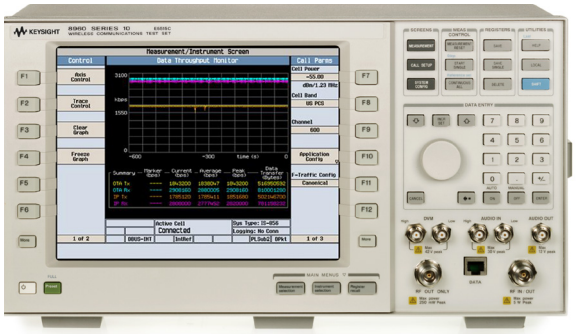
The UXM is a highly-integrated signaling test set created for functional and RF design validation in the 4G era and beyond. It provides the integrated capabilities you need to test the newest designs, delivering LTE-Advanced Pro data rates up to 1 Gbps now and handling more complex requirements later. When the team counts on you to know when a new chipset or UE will pass, count on the UXM to help you make a clear call.



E5515C 8960 Series 10 Wireless Communications Test Set

www.keysight.com/find/e5515c

The E5515C 8960 wireless communications test set is the world's most trusted solution for 2G and 3G wireless device manufacturing and RF design and verification.



U8903B Audio Analyzer

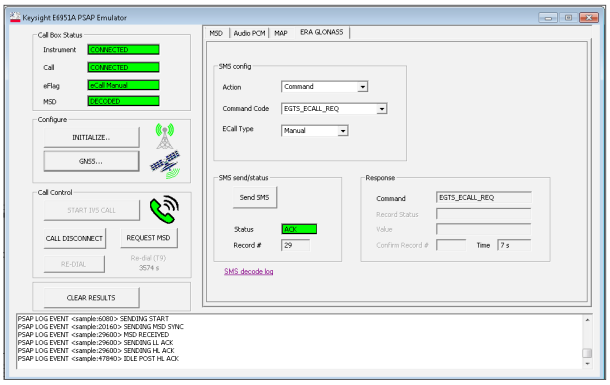
www.keysight.com/find/u8903b

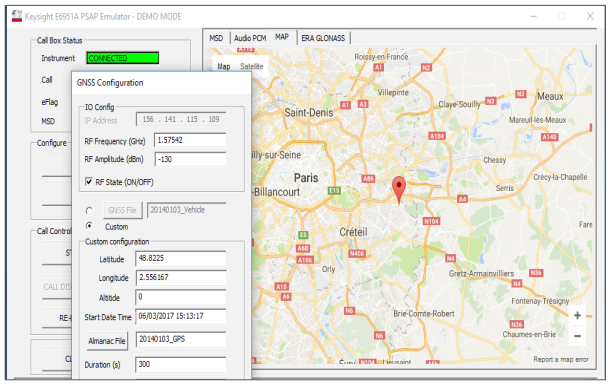
Make multi-functional and higher performance audio measurements with the U8903B audio analyzer. With extremely low residual distortion of < -110 dB, the U8903B allows you to measure the most demanding audio devices with high accuracy. Perform audio measurements via a *Bluetooth*® link with the new *Bluetooth* option, and make the highest resolution two-channel measurements available when you expand your bandwidth to 1.5 MHz. With these options and more, the U8903B audio analyzer offers you a configurable audio test solution to meet your specific audio application needs.

Software Elements

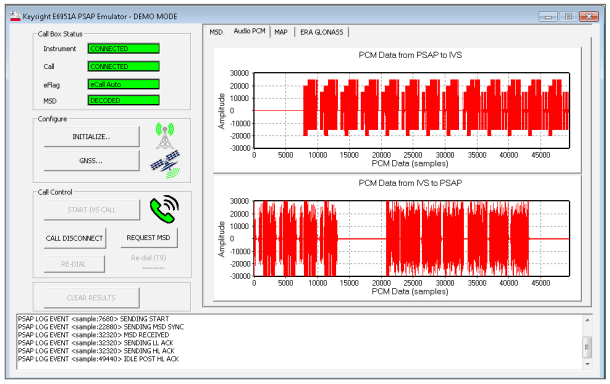
E6951A Public safety answering point (PSAP) software can be installed in the UXM or run separately on a PC. It is used to decode MSD data and respond to the IVS.

- Software has a simple UI and each button is activated only when it is required.
- Simply hook up and run - message details covering when IVS is in eCall/ ERA-GLONASS communication will be displayed.
- You can check every MSD line item to verify that IVS is reporting accurately.
- A dedicated ERA- GLONASS tab is provided to allow the configuration and sending of SMS messages.

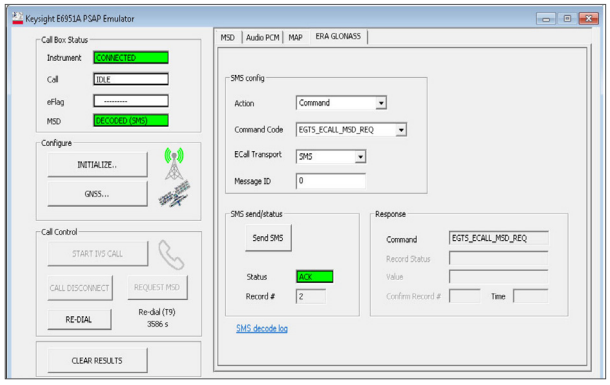




E6951A PSAP software also can indicate location using decoded MSD data, with zoom in/zoom out and movable drag functions.



E6951A PSAP Audio: Audio PCM data displaying and recording



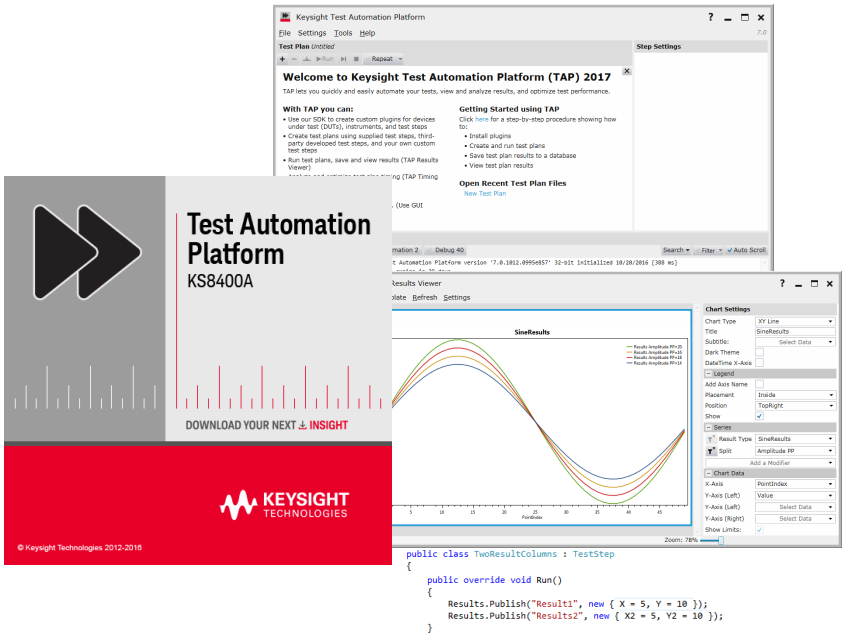
To view a log of the SMS message exchange, click the SMS decode log hyperlink. This opens the log file PSAPsms.txt stored in the instrument's AppData folder (e.g. C:\Users\instrument\AppData\Roaming\Keysight\E6951A).

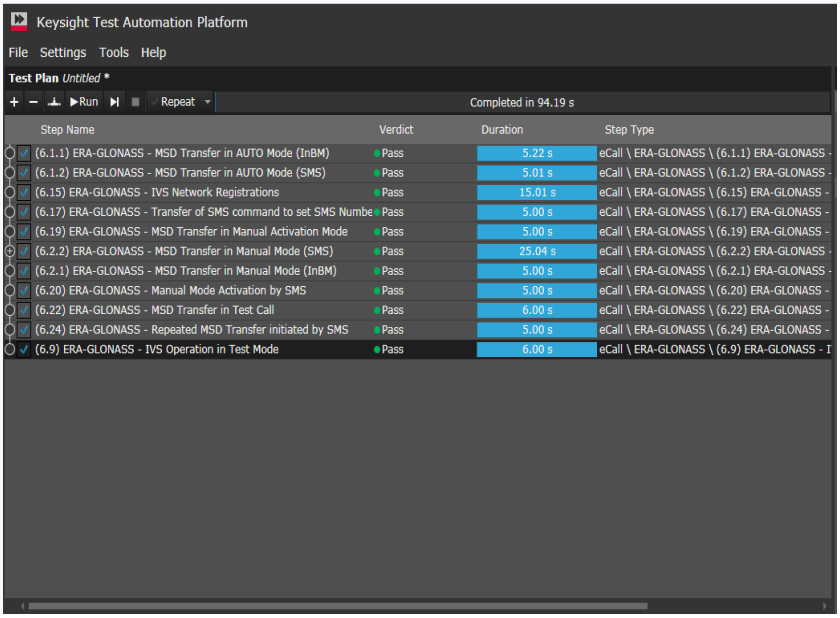
Test Automation Platform (TAP)

TAP is a generic test automation platform where test sequences/plans can be created based on test steps. Non-programmers can construct and configure test plans consisting of test steps. Simple flow operations such as If, While, Loop are supported. Execution speed is key and analysis tool for visualizing and optimizing test-flow is available in TAP. Test Steps, Instruments and DUT Drivers, Result storage are all provided as plugins.

The e-Call/ERA-GLONASS test automation is built around TAP as plugins, the same as applications built around the OS. TAP will take the plugins and run the test cases in the plugins and publish the results in a form of either .txt, .CSV or in graphing format.

For more TAP information:
www.keysight.com/find/tap





Supported Test Cases

The following tables list the supported eCall and ERA_GLONASS test cases. The test cases are documented in DOC-ETSI_TS 103 412 V1.1.1 for eCall and GOST_R_55530 for ERA_GLONASS.

Table 1. Supported eCall test cases

Test Cases	Description
HLAP CTP 1.1.2.1	e-Call automatically activated
HLAP CTP 1.1.2.2	Automatically triggered e-Call in progress was not disconnected upon a new e-Call trigger
HLAP CTP 1.1.3.1	e-Call manually activated
HLAP CTP 1.1.3.2	Manually triggered e-Call in progress was not disconnected upon a new eCall trigger
HLAP CTP 1.1.4.1	Test e-Call activated
HLAP CTP 1.1.5.1	Network registration
HLAP CTP 1.1.6.1	Mute IVS and vehicle audio
HLAP CTP 1.1.7.1	Set-up TS12 call with e-Call identifier (flag) set to 'automatic'
HLAP CTP 1.1.8.1	Set-up TS12 call with e-Call identifier (flag) set to 'manual'
HLAP CTP 1.1.9.1	Test for set-up TS11 call to test number
HLAP CTP 1.1.10.1	e-Call is attempted when no networks are available (limited service condition)
HLAP CTP 1.1.10.2	Re-dial attempt completed within 2 minutes after e-Call is dropped
HLAP CTP 1.1.10.3	Duration of e-Call Initiation signal
HLAP CTP 1.1.11.1	Send MSD with indicator set to 'Automatically Initiated e-Call' (AleC)
HLAP CTP 1.1.12.1	Send MSD with indicator set to 'Manually Initiated e-Call' (MleC)
HLAP CTP 1.1.13.1	Send MSD with indicator set to 'Test Call'
HLAP CTP 1.1.14.1	Verify MSD transfer
HLAP CTP 1.1.14.2	Un-mute IVS audio when AL-ACK received
HLAP CTP 1.1.15.1	Establish voice link to PSAP
HLAP CTP 1.1.15.2	MSD transfer request while e-Call conversation in progress
HLAP CTP 1.1.15.3	Call continuation when SEND MSD request not received (T5 expired)
HLAP CTP 1.1.15.4	Call continuation when AL-ACK not received (T6 expired)
HLAP CTP 1.1.15.5	MSD is transferred continuously until T7 expires and IVS reconnects loudspeaker and microphone on its expiry
HLAP CTP 1.1.16.1	Clear down call automatically
HLAP CTP 1.1.17.1	Call-back allowed by IVS
HLAP CTP 1.1.17.2	Call-back answered by IVS
HLAP CTP 1.1.17.3	MSD transfer occurs upon PSAP request during call-back
HLAP CTP 1.1.1.2	IVS does not perform registration after power-up
HLAP CTP 1.1.10.4	Verify that PLMN registration procedure is executed upon initiating an e-Call

Supported Test Cases (continued)

The following tables list the supported eCall and ERA_GLONASS test cases. The test cases are documented in DOC-ETSI_TS 103 412 V1.1.1 for eCall and GOST_R_55530 for ERA_GLONASS.

Table 2. Supported test cases for ERA-GLONASS

Test Cases	Description
ERA 6.1.1	MSD Transfer in AUTO mode (InBm)
ERA 6.1.2	MSD Transfer in AUTO mode (SMS)
ERA 6.2.1	MSD Transfer in MANUAL mode (InBm)
ERA 6.2.2	MSD Transfer in MANUAL mode (SMS)
ERA 6.3	MSD Vehicle Location Check
ERA 6.4	MSD Expected Last Know Vehicle Location Checks
ERA 6.5	MSD Valid Location Data
ERA 6.6	MSD Contains Direction Data
ERA 6.9	IVS Operation in Test Mode
ERA 6.15	IVS Network Registrations
ERA 6.17	eSMS Command for Setting IVS SMS Number
ERA 6.19	RSMS Command for Initiation of Emergency Call
ERA 6.20	SMS Command for MSD re-transmission

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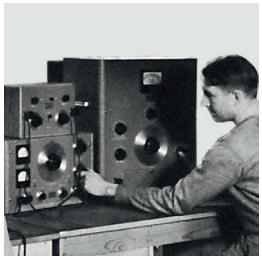

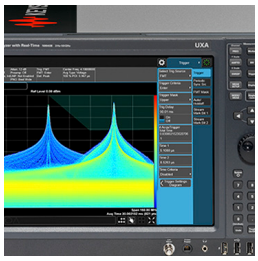

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