ECALL AND NG-ECALL TECHNOLOGY, TRENDS AND CHALLENGE

Rohde & Schwarz Taiwan
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2024/01/17

ROHDE&SCHWARZ
Make ideas real

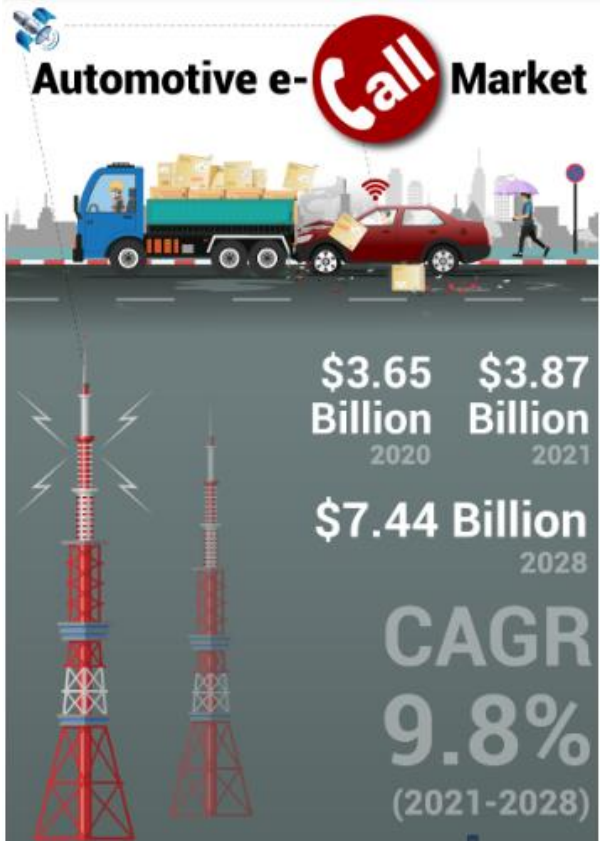
OUTLINE

- eCall & NG-eCall Technology Overview
- eCall & NG-eCall Regulations and Standards
- Solutions
- Q&A

ECALL & NG-ECALL TECHNOLOGY OVERVIEW

A feature for cars to improve traffic safety and save lives!

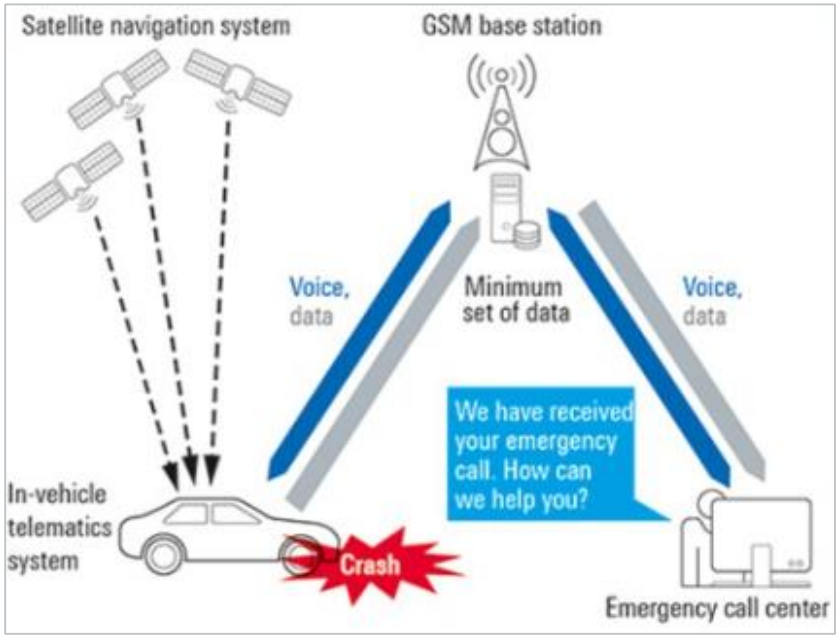
MARKET TRENDS AND FORECASTS



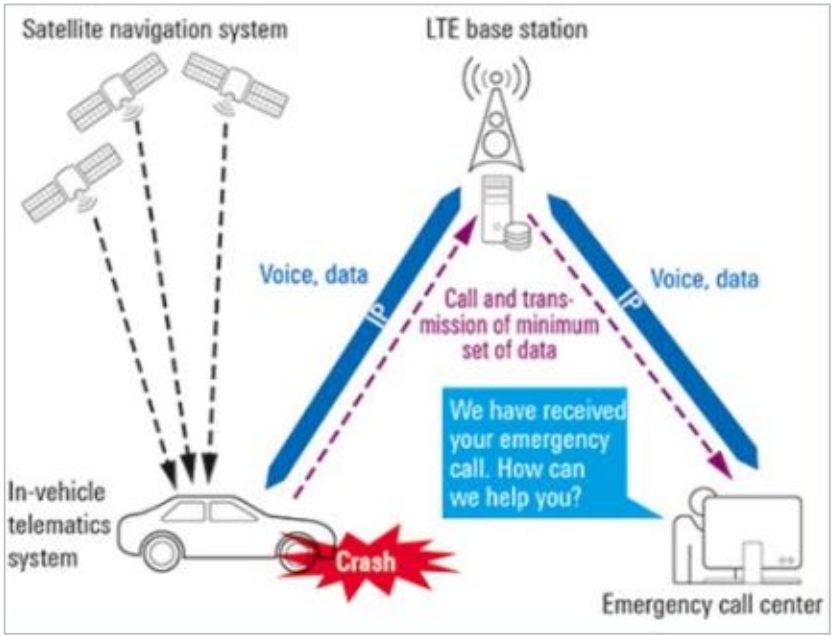
https://www.fortunebusinessinsights.com/automotive-ecall-market-102047

ECALL & NG-ECALL TECHNOLOGY OVERVIEW

Actual EU eCall System – in operation

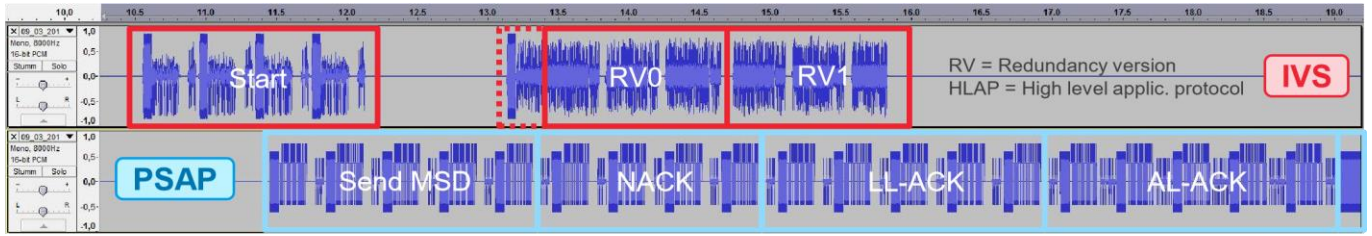


Next Generation eCall - the successor



MSD TRANSFER SEQUENCE: CALL FLOW PROCEDURE

2G



eCall signaling procedure:

Initiation: In the case of an accident, IVS establishes an automatic emergency call => start messages are sent continuously (max. 5x)

Send-MSD: PSAP receives emergency call and triggers MSD transmission (PULL mode), continuously sends start until it detects the first incoming sync frame.

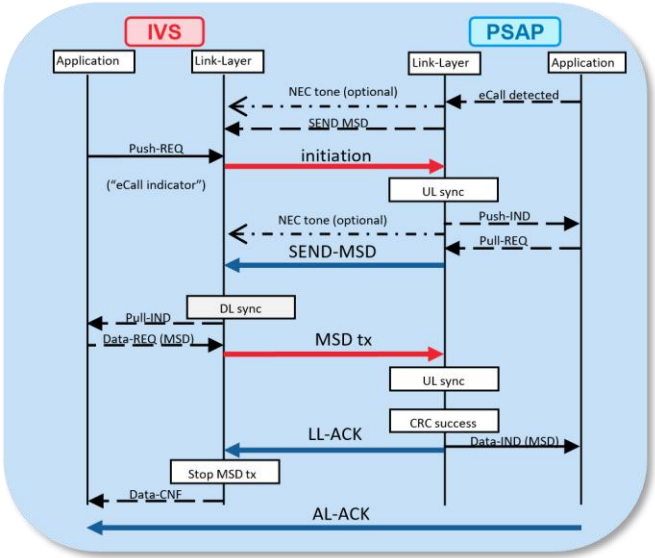
MSD-tx: IVS sends sync frame (dotted) after 3 successfully decoded START messages, MSD RV0 is sent, then MSD RV1 (since IVS first receives NACK, but discontinued after receiving LL-ACK)

NACK: PSAP detects uplink sync and continuously transmits NACK

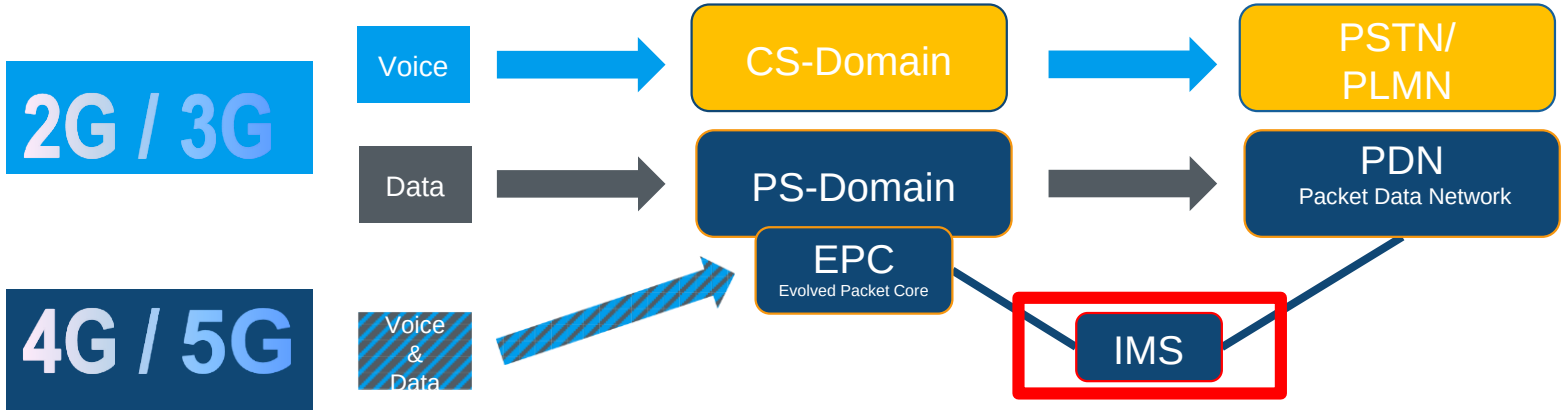
LL-ACK: PSAP tries to decode MSD after complete reception of RV0, and after each data part of subsequent RVs

AL-ACK: After CRC success, PSAP sends 3 ACK messages and then stops transmission => voice channel is un-muted.

Play tone: To test the voice channel in the R&S PSAP implementation a 1kHz sine tone is played.



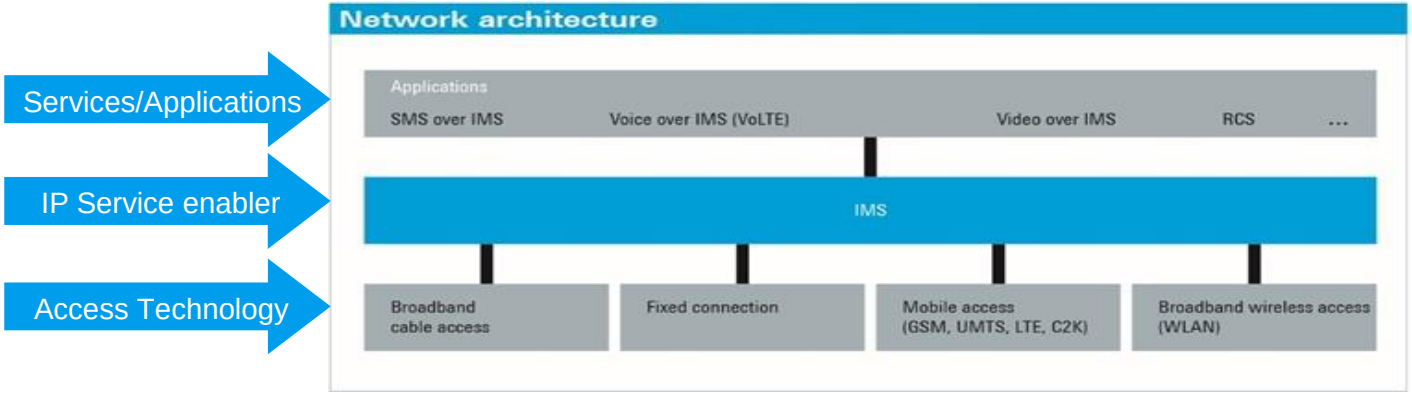
ALL IP-NETWORK INFRASTRUCTURE USING IMS AS SERVICE ENABLER



- 2G and 3G networks provide a CS domain for phone calls and PS domain for data communication ı 4G LTE has been designed as a **fully packet-oriented**, „all-IP“- based, multi-service system
- **This means: Networks from the 4th generation (LTE / LTE-A/ 5G) on use the internet protocol for all services**

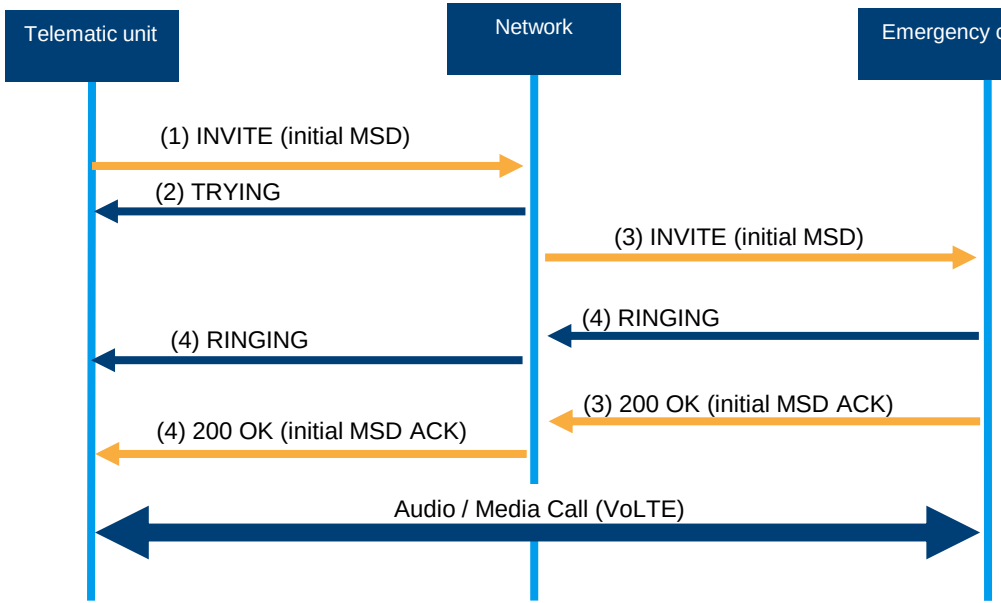
INTRODUCTION IMS – IP MULTIMEDIA SUBSYSTEM DEFINITION

- IMS is a global access-independent and standards-based IP connectivity and service control architecture that enables various types of multimedia services to end-users using common Internet-based protocols



- IMS is the enabler for VoLTE, SMS over IMS and new value adding services…
- … so a perfect base for the Next Generation eCall (NGeCall)

NGECALL: MSD TRANSFER IN SIP INVITE (CALL SETUP)



The IVS initiates a voice call (with included MSD content).

The IMS acknowledges that the SIP INVITE was received

IMS call signaling establishes the call.

The called PSAP is being rung.

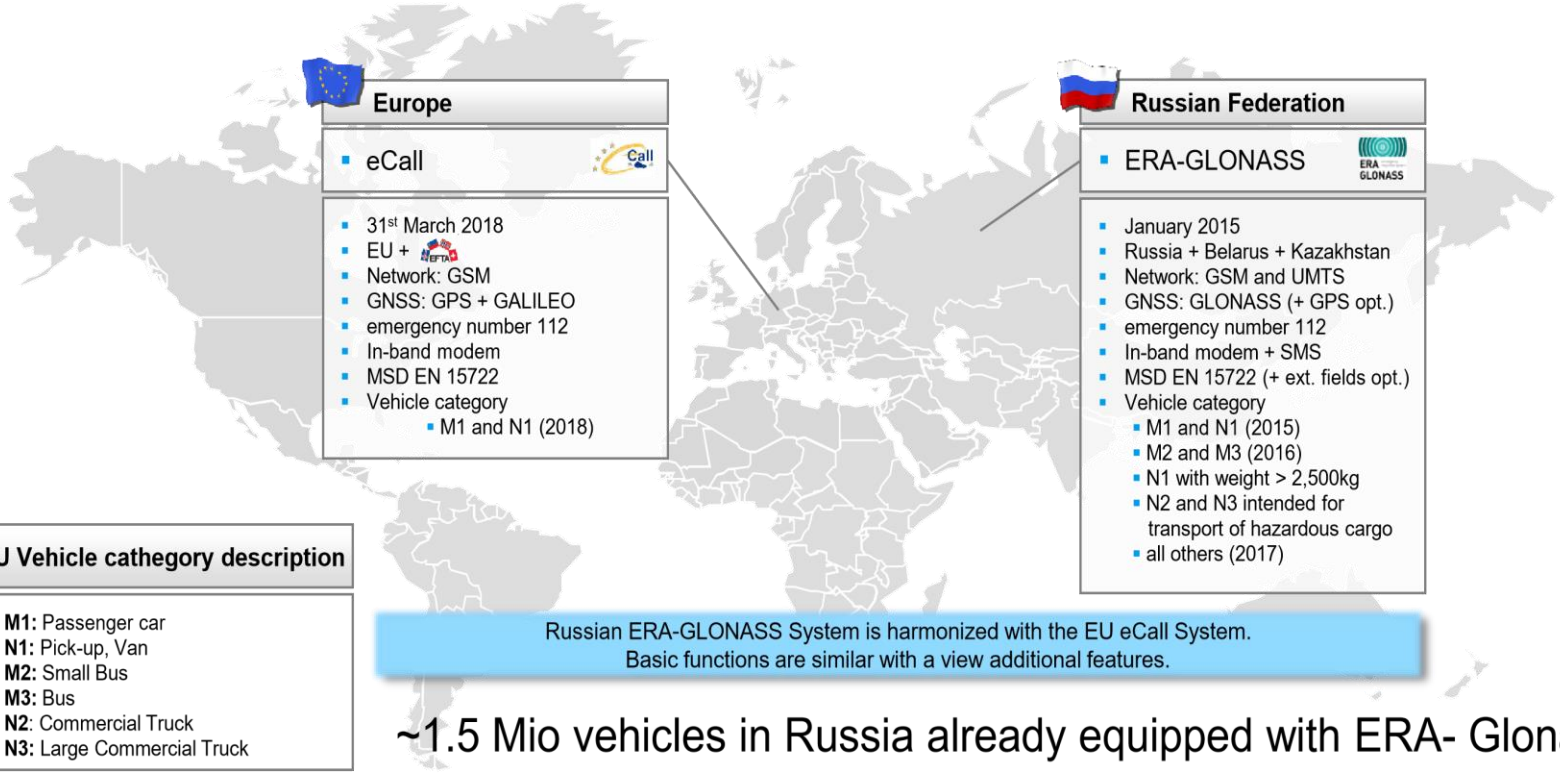
200 OK signals that the call has been answered and the MSD was received

Voice communication

Note: Prerequisites were fulfilled before!

ECALL & NG-ECALL REGULATIONS AND STANDARDS

Overview emergency call systems and details



Europe

- eCall

- 31st March 2018
- EU + EFTA
- Network: GSM
- GNSS: GPS + GALILEO
- emergency number 112
- In-band modem
- MSD EN 15722
- Vehicle category
  - M1 and N1 (2018)

Russian Federation

- ERA-GLONASS

- January 2015
- Russia + Belarus + Kazakhstan
- Network: GSM and UMTS
- GNSS: GLONASS (+ GPS opt.)
- emergency number 112
- In-band modem + SMS
- MSD EN 15722 (+ ext. fields opt.)
- Vehicle category
  - M1 and N1 (2015)
  - M2 and M3 (2016)
  - N1 with weight > 2,500kg
  - N2 and N3 intended for transport of hazardous cargo
  - all others (2017)

EU Vehicle cathegory description

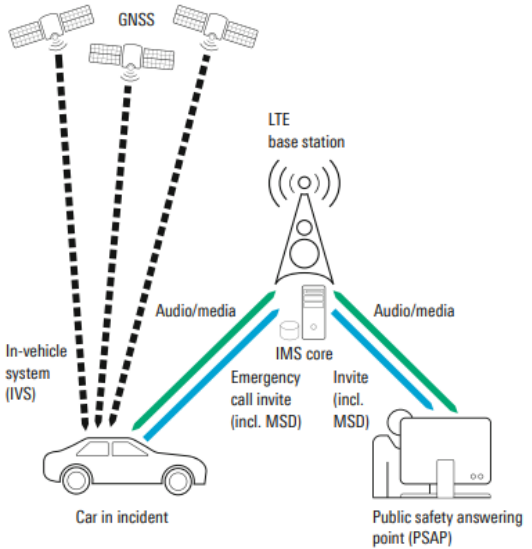
- **M1:** Passenger car
- **N1:** Pick-up, Van
- **M2:** Small Bus
- **M3:** Bus
- **N2**: Commercial Truck
- **N3:** Large Commercial Truck

Russian ERA-GLONASS System is harmonized with the EU eCall System.
Basic functions are similar with a view additional features.

~1.5 Mio vehicles in Russia already equipped with ERA- Glonass

ECALL CURRENT STATUS

NGeCall system



eCall systems – planned

	EU	UAE	KSA	China
Region / Country	Europe	United Arab Emirates	Kingdom of Saudi Arabia	China
Authority	Ministry of transportation Member States	Telecommunications Regulatory Authority(TRA)	Saudi Arabian Standards, Metrology and Quality Organization	samr.gov.cn
Regulation Standard	CEN TS 17240 ETSI xxx a.o.	UAE.Sxxx	SASOxxx	tbd
Mandate	ongoing - link	ongoing	ongoinig	ongoinig
Date	~2026/2027	not defined	not defined	~2026/2027
Technology	4G/5G IMS based eCall	4G/5G IMS based eCall	4G/5G IMS based eCall	4G / (5G) eCall

ECALL STANDARDS EVOLVE

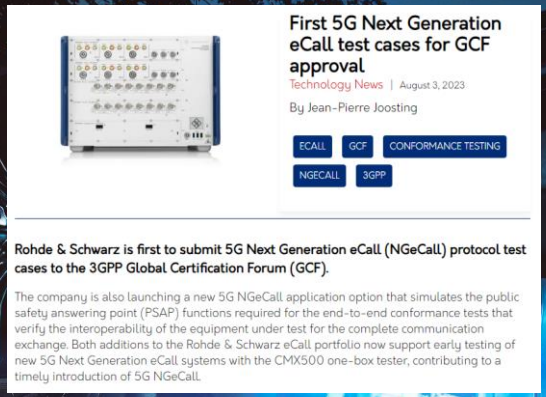
- Important NG eCall standards are defined in:
  - CEN TS 17240 – eCall end-to-end conformance tests for IMS packet-switched systems.
  - EN 15722:2020 Intelligent transport systems - ESafety - ECall minimum set of data

  - ETSI TS 134 229-1 – SIP protocol conformance tests
  - ETSI TS 134 229-5 – SIP/5G protocol conformance tests
  - ETSI TS 136 523-1 – LTE protocol conformance tests
  - ETSI TS 138 523-1 – 5G Protocol Conformance Tests
  - ETSI TS 126 269 – In-Band Modem Conformance Tests
  - ETSI TS 103 683 – Next Generation eCall HLAP interoperability tests

R&S IS THE FIRST TEST PLATFORM VENDOR TO VALIDATE 5G ECALL TCS (WI-537) ON GCF

See press release:

https://www.eenewseurope.com/en/first-5g-next-generation-ecall-test-cases-for-gcf-approval/



First 5G Next Generation eCall test cases for GCF approval

Technology News | August 3, 2023

By Jean-Pierre Joosting

ECALL GCF CONFORMANCE TESTING NGECALL 3GPP

Rohde & Schwarz is first to submit 5G Next Generation eCall (NGeCall) protocol test cases to the 3GPP Global Certification Forum (GCF).

The company is also launching a new 5G NGeCall application option that simulates the public safety answering point (PSAP) functions required for the end-to-end conformance tests that verify the interoperability of the equipment under test for the complete communication exchange. Both additions to the Rohde & Schwarz eCall portfolio now support early testing of new 5G Next Generation eCall systems with the CMX500 one-box tester, contributing to a timely introduction of 5G NGeCall.

Below TCs are validated and available in PCT5-KC625 23.24.1 release.

TC. Nbr	Description
11.1	eCall over IMS / Manual initiation / Normal registration / Emergency registration / Success / 200 OK with ACK / 5GS
11.2	eCall over IMS / Automatic initiation / Normal registration / Emergency registration / Success / 200 OK with ACK / 5GS
11.4 and 11.5 have been verified, but not validated due to their TTCN verification status. These TCs can still be run by customers	
11.4	eCall over IMS / Manual initiation / MSD transfer and 200 OK with ACK / SIP INFO request for MSD Update / Success / 5GS
11.5	eCall over IMS / Automatic initiation / MSD transfer and 200 OK with ACK / SIP INFO request for MSD Update / Success / 5GS

CERTIFICATION STATUS FOR CMW-KA09X VERSION 4.0.0

COMMISSION DELEGATED REGULATION (EU) 2017/79

of 12 September 2016

2.7.1.2. The dedicated PSAP test point during the test procedures shall be a PSAP simulator under the control of the technical service, compliant with the applicable EN standards and certified in accordance with EN 16454. It shall be equipped with an audio interface to allow voice communication tests.

CMW-KA094 Conformance Test Solution for eCall


CETECOM

CERTIFICATE of CONFORMITY

DRAFT

Version 4.0.0 - Certified by CETECOM

The Rohde & Schwarz solution for the EU-wide emergency call system complies with the standard CEN EN 16454:2015, which is a prerequisite for testing according to the COMMISSION DELEGATED REGULATION (EU) 2017/79.

CASE STUDY
EU NG ECALL - STATUS

European Commission

Legal Basis for NG eCall

Currently there is no legal basis (e.g. EU regulation) available for NG eCall approval

- In a NG eCall workshop in **March 2021** European Commission (EC) announced to provide an updated EU regulation in **April 2022** ← activities ongoing
  - updated EU regulation should contain an eCall adaptation towards LTE and 5G ← 5G was included
  - grace period of **2-3 years** expected before NG eCall becomes mandatory for new vehicle types ← 2-3 years lead time
  - EC presentation is available here: https://docbox.etsi.org/Workshop/2021/202103NGeCall_webinar/Gilles_Carabin_eCall_evolution.pdf

- In a NG eCall conference call in **March 2022** the EC informed about launch of a support study ← additional study
  - study should support the evolution of the EU eCall legal framework
  - study should contain recommendations to revise the EU regulations for eCall
  - online questionnaire was available until **July 2022**
  - study results should be available in **October 2022** ← Study results Dec 2022

Updated EU regulation(s) for NG eCall approval expected **earliest in 2023** ← EU decision earliest 2023

CETECOM eCall Services 39

CMW-KA09X PRODUCT STRUCTURE

(SOFTWARE OPTIONS)

eCall

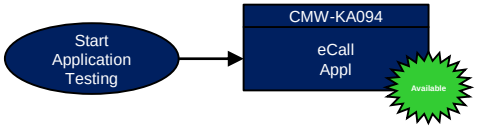
- Region: Europa
- Auf Basis von GSM/UMTS

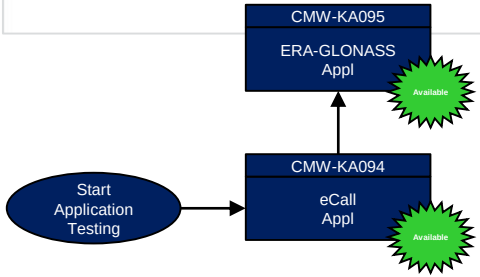
ERA GLONASS

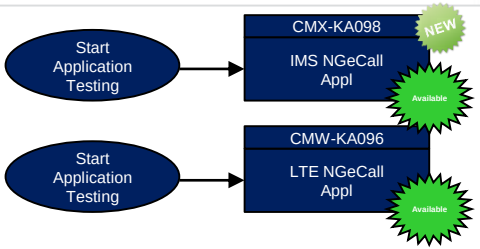
- Region: Russische Föderation
- Auf Basis von GSM/UMTS

NG eCall

- Region: Europa
- Auf Basis von 4G LTE und 5G NR







CMX500 NGeCALL – MILESTONE PLANNING
APPLICATION TEST SOLUTOION

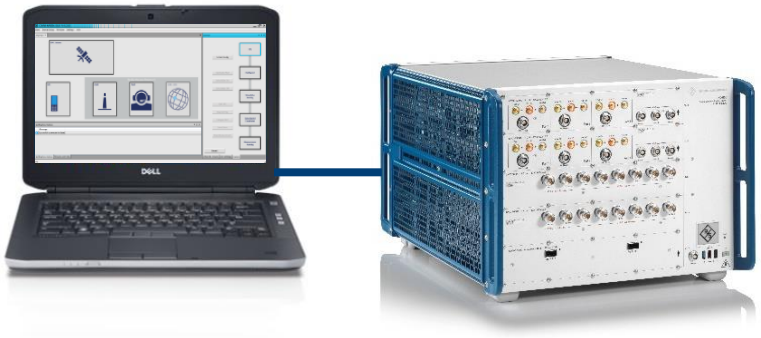
NGeCall 5G

CMX-KA098 (beta)
- 5G cell configuration and CMXremote
- IMS MSD transmission via SIP invite support
- MSD decoding according to CEN EN 15722:2020
- Enables VoNR Voice Communication for NGeCall

NGeCall 4G

Part of CMX-KA098
- 4G cell configuration and CMXremote
- IMS MSD transmission via SIP invite support
- MSD decoding according to CEN EN 15722:2020
- Enables VoLTE Voice Communication for NGeCall

…



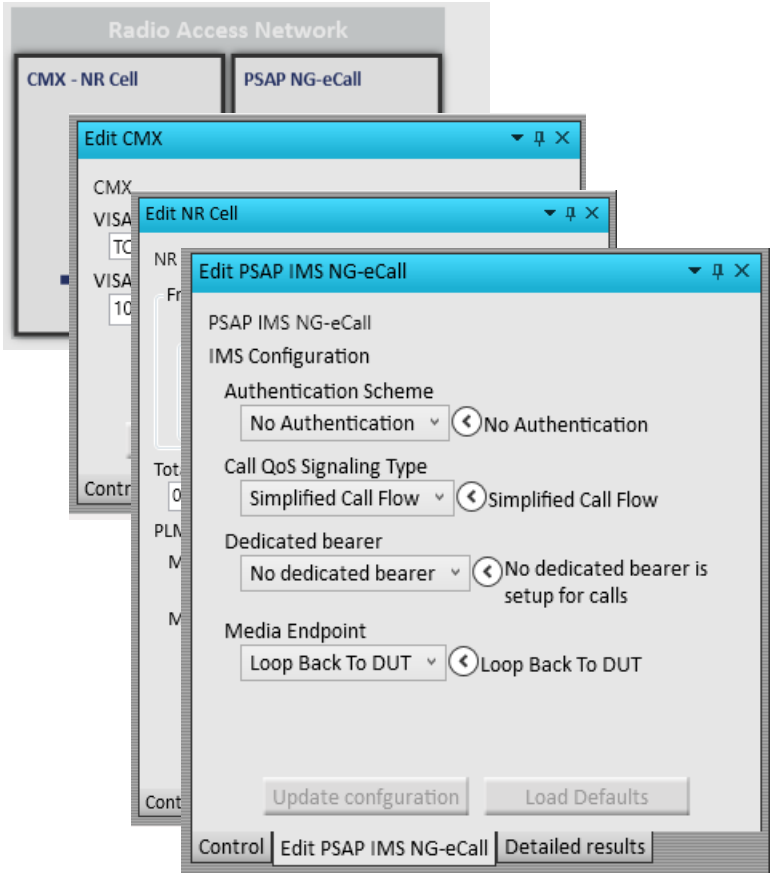
Q1/2023

June 2023

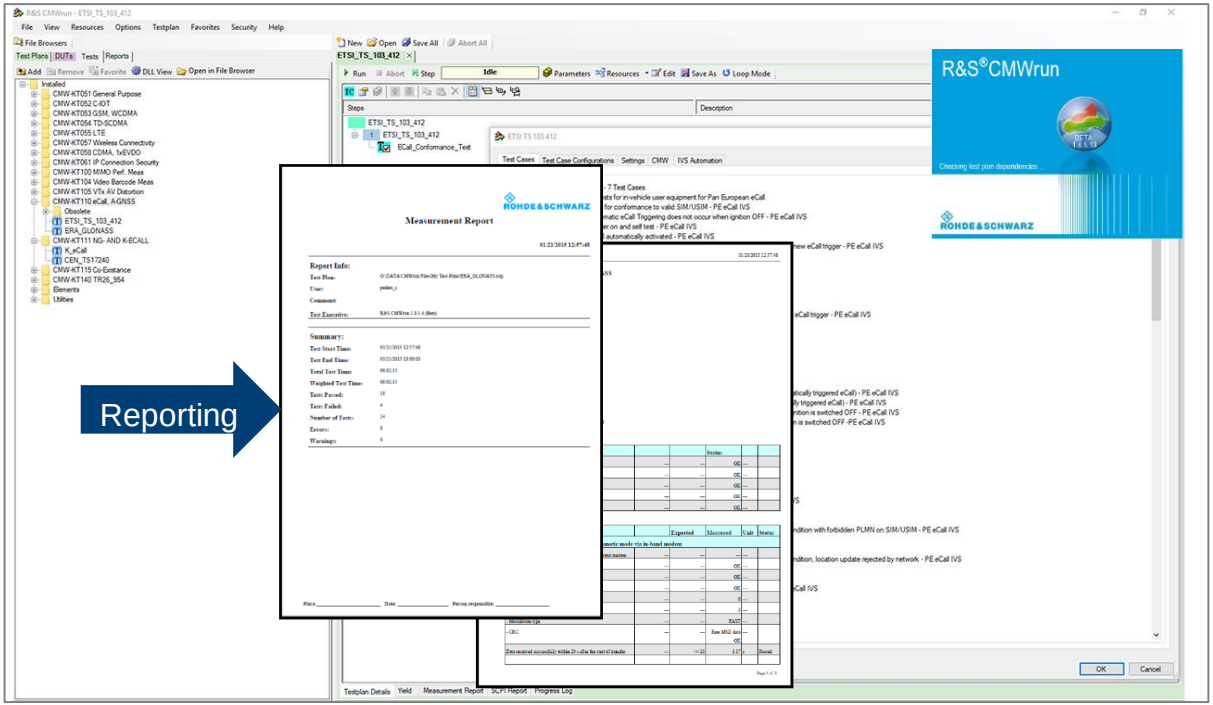
5G NGECALL – CMX-KA098 PSAP EMULATOR WITH CMX500

5G PSAP enabler for NG eCall

- New Option **CMX-KA098** 5G NG eCall for CMW PC!
- Same software environment for all eCall variants (runs on a PC)
- Same look & feel like NG eCall or legacy eCall with CMW
- Controls CMX500 for 5G easy swap to CMW for legacy
- Enables VoNR Voice Communication - ++



CMX-KA098 5G NGeCall PSAP 1222.6639.02



- Simplifies conformance tests for eCall and ERA-GLONASS & LTE NGeCall
- "ready to use" test plans for automated testing
- Test creation, parameterization, execution, analysis and test reporting with pass/fail indication in a single tool
- Following conformance test specifications are supported:
  - eCall (CEN , ETSI)
  - ERA-GLONASS (GOST(R))
  - NGeCall (CEN)
  - GNSS (EU2017/79 /UNECE 2016/07 / GOST 33471
- Available Options:
  - R&S®CMW-KT110, KT111
  - SMBV-K360, SMBV-K361

The ability to verify compliance with standards at an early design stage makes it possible to take corrective action and optimize an IVS module in a timely manner.

R&S ECALL / ERA-GLONASS / NGECALL PSAP EMULATOR CMW-KA094/095/96

R&S®CMW-KA094/095/096

Key Features:

- PSAP simulation for eCall (KA094) and ERA-GLONASS (KA095) over GSM and UMTS and NGeCall over LTE (KA096) testing
- Measure MSD transmission time & time since call establishment etc.
- MSD decoding
  according to CEN EN 15722:2020 and GOST R 54620/ GOST 33467 for every redundancy version and for every uplink data part
- Optional recording of un-decoded signal from IVS
- Optional audio connection to CMW-Z50 or external audio analyzer
- Details on PUSH and SYNC indications
  Timing, Count
- Optional fixed position GPS/GLONASS simulation with SMBV or SMW100A
- ERA-GLONASS SMS Protocol support
- NGeCall over LTE and IMS support
  - Rel.14 NGeCall Flag indication
  - MSD transmission in SIP invite etc.

Benefits of using the Rohde & Schwarz PSAP simulator

- Controlled environment without influence of network operator
- Reproducible test conditions and results
- Possibility to test real ecall with emergency number 112 ← *high risk in live network*

R&S 5G NGECALL
PSAP EMULATOR CMX-KA098

R&S®CMX-KA098

Key Features:

- PSAP simulation for 5G NGeCall (KA098)
- With remote control of R&S CMX500
- With remote control of SMBV or SMW100A for GNSS positioning
- Measure MSD transmission etc.
- MSD decoding
  according to CEN EN 15722:2020
- Optional recording IP Communication in PCAP from/to IVS<->PSAP
- Optional audio connection (loopback mode)
- Optional fixed or moving position GPS/GLONASS simulation with SMBV or SMW100A
- NGeCall over 5G and IMS support
  - MSD transmission in SIP invite etc.
  - Position evaluation
  - …

Benefits of using the Rohde & Schwarz PSAP simulator

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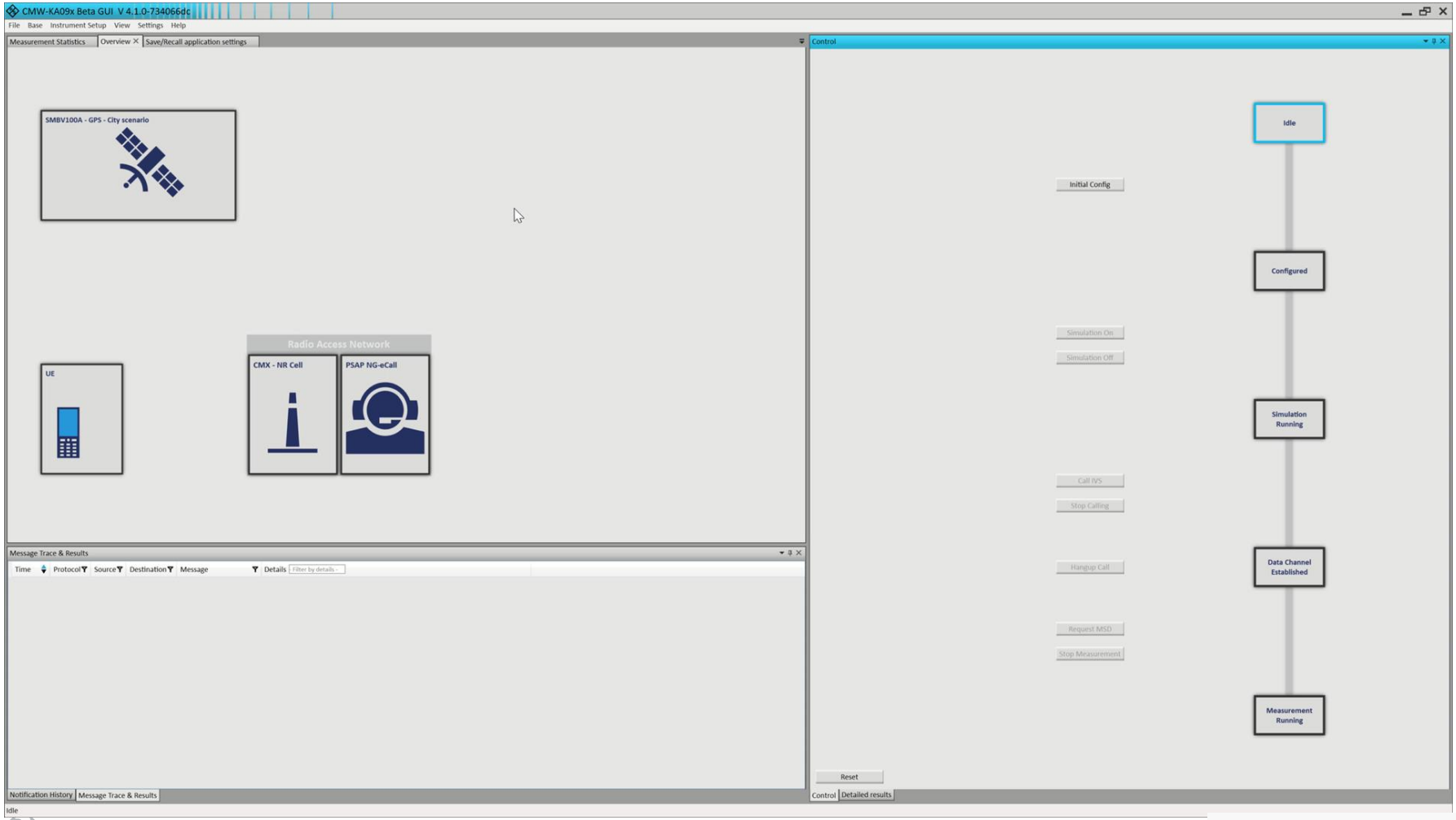
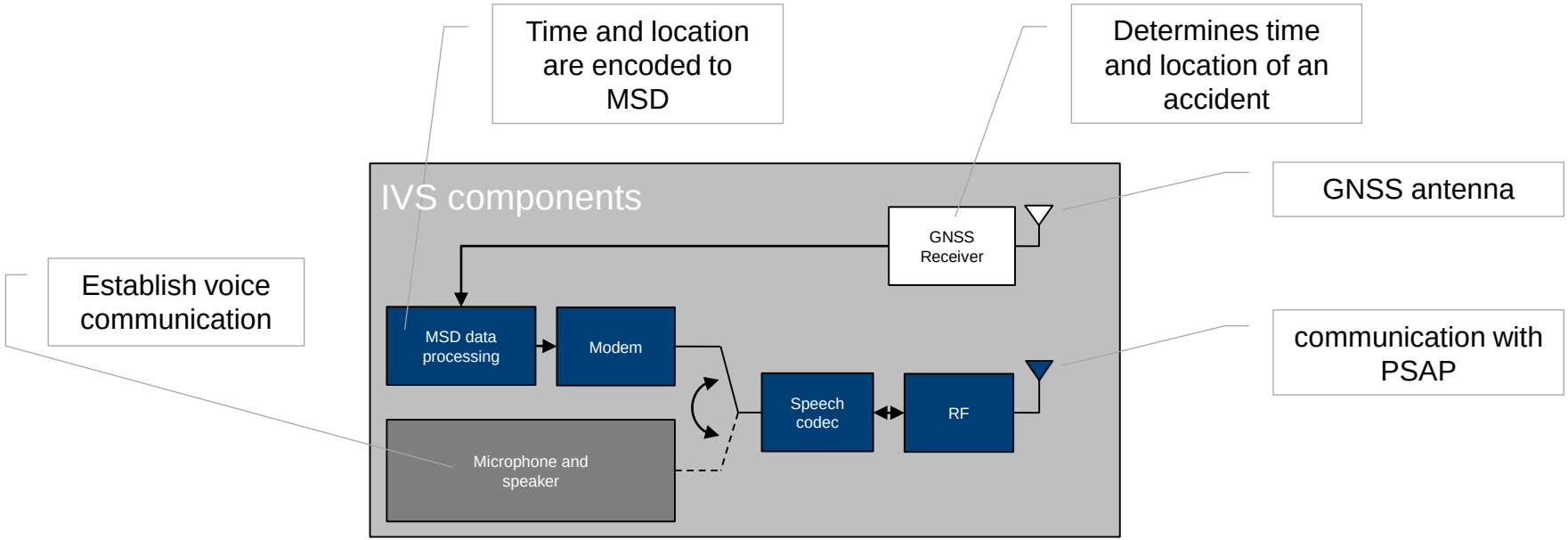


ECALL DOCUMENATION

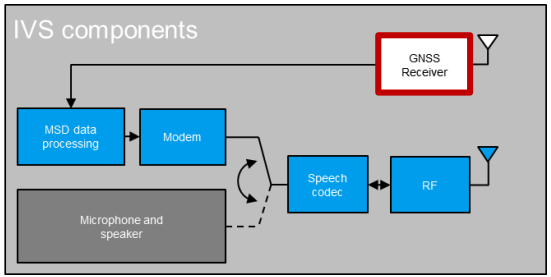
#	Title	Type	Website
1	Automotive eCall Website	Website	R&S Website Link
2	Pioneer in NG eCall testing	eGuide	R&S Website Link
3	Verification of next generation eCall functionality in an IVS	App Card	R&S Website Link
4	NEXT GENERATION ECALL CONFORMANCE TESTING	App Note	R&S Website Link
5	eCall infographic	Graphic	R&S Website Link
6	Test your eCall and ERA-Glonass system modules	App card	R&S Website Link
7	ERA-GLONASS Conformance and Performance Testing	App Note	R&S Website Link
8	GNSS Performance Testing for eCall Modules	App card	R&S Website Link
9	Webinar: eCall and its challenges	Webinar	R&S Website Link
10	EU COMMISSION DELEGATED REGULATION 2017/79	Other	EU Website

ECALL/ERAGLONASS IVS
BASIC FUNCTIONALITY



TESTING THE IVS‘S GNSS RECEIVER
TEST COVERAGE OF CONFORMANCE/PERFORMANCE TESTS

GNSS conformance testing

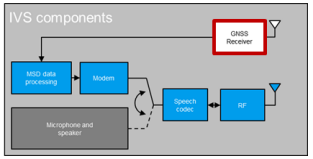


GNSS performance testing

- Evaluation of GNSS-based vehicle position in MSD
- Check if valid position information is present
- No position accuracy checks

- Evaluation of several GNSS receiver performance parameters, including
  - Position accuracy
  - Time to first fix (TTFF)
  - Receiver sensitivity
  - Reacquisition time

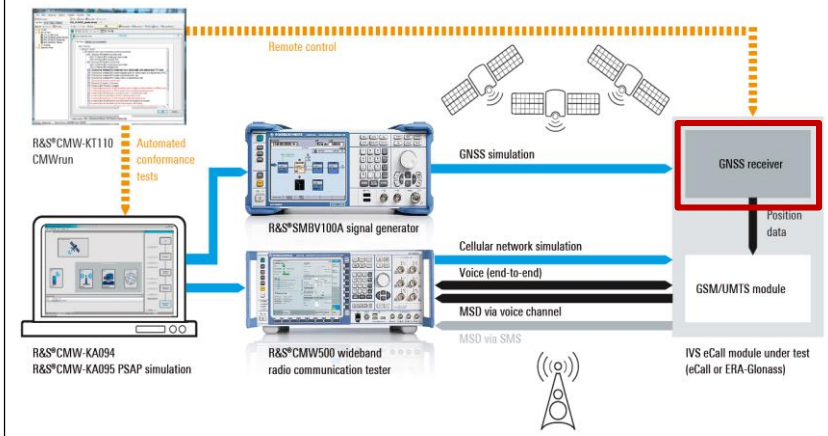
TESTING THE IVS'S GNSS RECEIVER
CONFORMANCE VS. PERFORMANCE TESTING



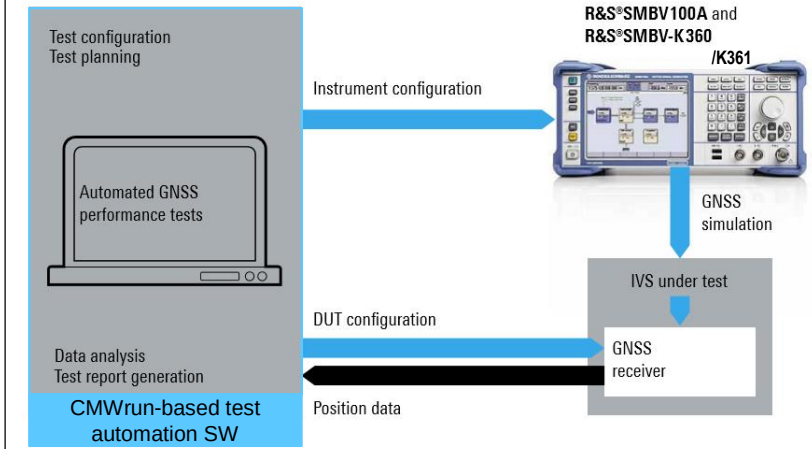
GNSS conformance testing

GNSS performance testing

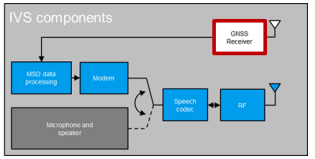
R&S test solution(s)



R&S test solution(s)



TESTING THE IVS‘S GNSS RECEIVER
APPLICABLE STANDARDS



eraGlonass

GOST-R

(55534)
33471

eCall

EU

2017/79

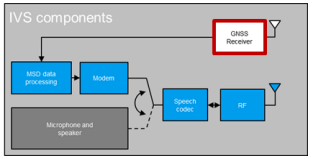
eCall

UNECE

2016/07

Difference between EU and UNECE standard:
UNECE adds GLONASS test cases

TESTING THE IVS'S GNSS RECEIVER
TEST CASES FOR ERAGLONASS MODULES (GOST-R 33471)



5.1	Availability of position/velocity for GLONASS L1
5.2	Availability of position/velocity for GPS L1
5.3	Availability of position/velocity for combined GPS/GLO L1 processing
5.4	Verify NMEA transmission from DUT
5.5	Functional RAIM test
5.6	Use of different reference systems (PZ-90/WGS-84)
5.7	Location accuracy (static receiver)
5.8	Location accuracy (moving receiver)
5.9	Minimum update rate of NMEA stream
5.10	Reacquisition time
5.11	Time-to-first fix (TTFF) under cold start conditions
5.12	Tracking and acquisition sensitivity
5.13	Change update rate of NMEA stream
5.14	Check cutoff angle settings for navigation satellites
5.15	Check power-off time of navigation module (GNSS navigation receiver)

Make sure position and velocity data are transmitted from IVS and no data is getting lost

Make sure GNSS receiver can provide position data in different formats and under different conditions

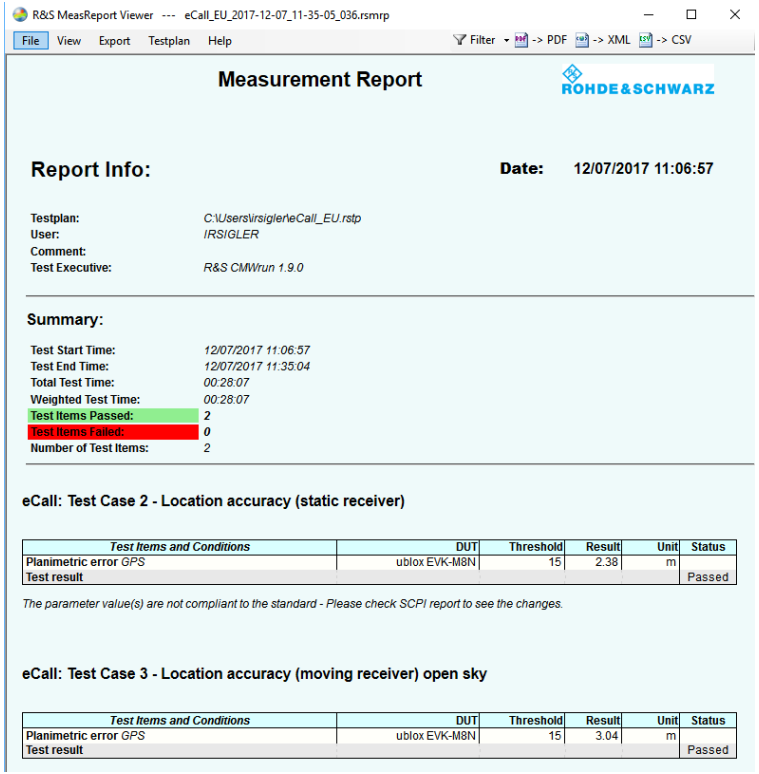
Standard receiver tests

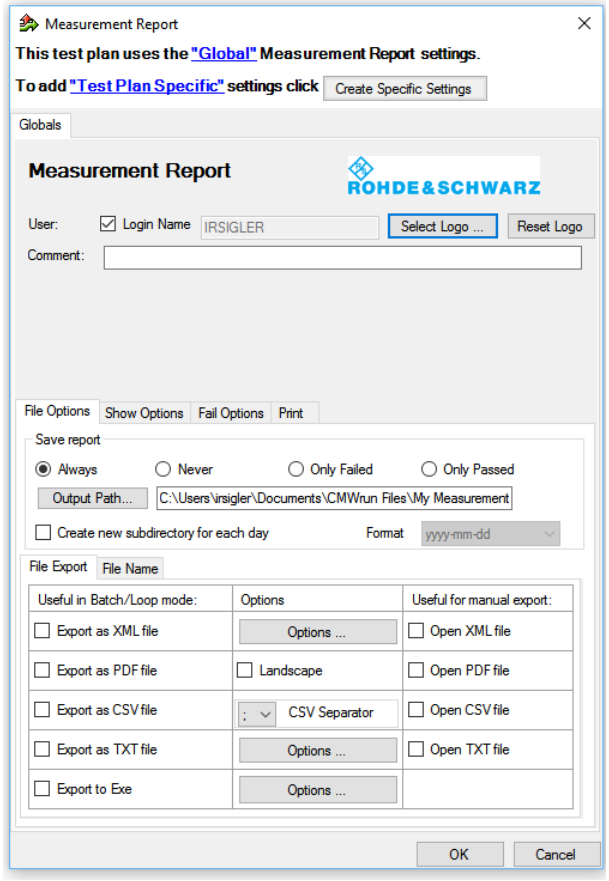
Make sure the receiver excludes faulty observations from the position solution

TEST AUTOMATION WITH CMWRUN

KEY FEATURES

- Generation of test reports





ECALL CURRENT STATUS

eCall / ERA Glonass E2E Conformance

EN 16454:2015 / GOST 33467

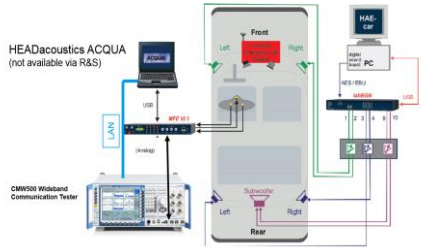
GNSS performance

EU2017/79 Annex VI , UN-R 144, GOST 33471

4G NGeCall E2E Conformance

CEN/TS 17240:2018

eCall audio quality

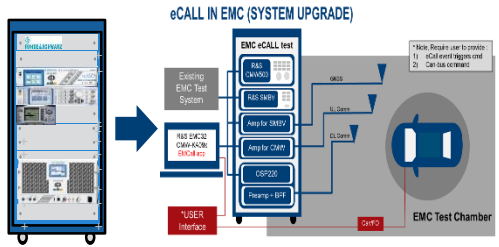


GOST R 55531 / GOST 33468 / ITU-T P.1140

Your benefit!

- Scalable
- Precise & Repeatable
- Performance optimized

EMC testing



(awaiting UN ECE R10 Rev. 7 standard completion)

THANK YOU