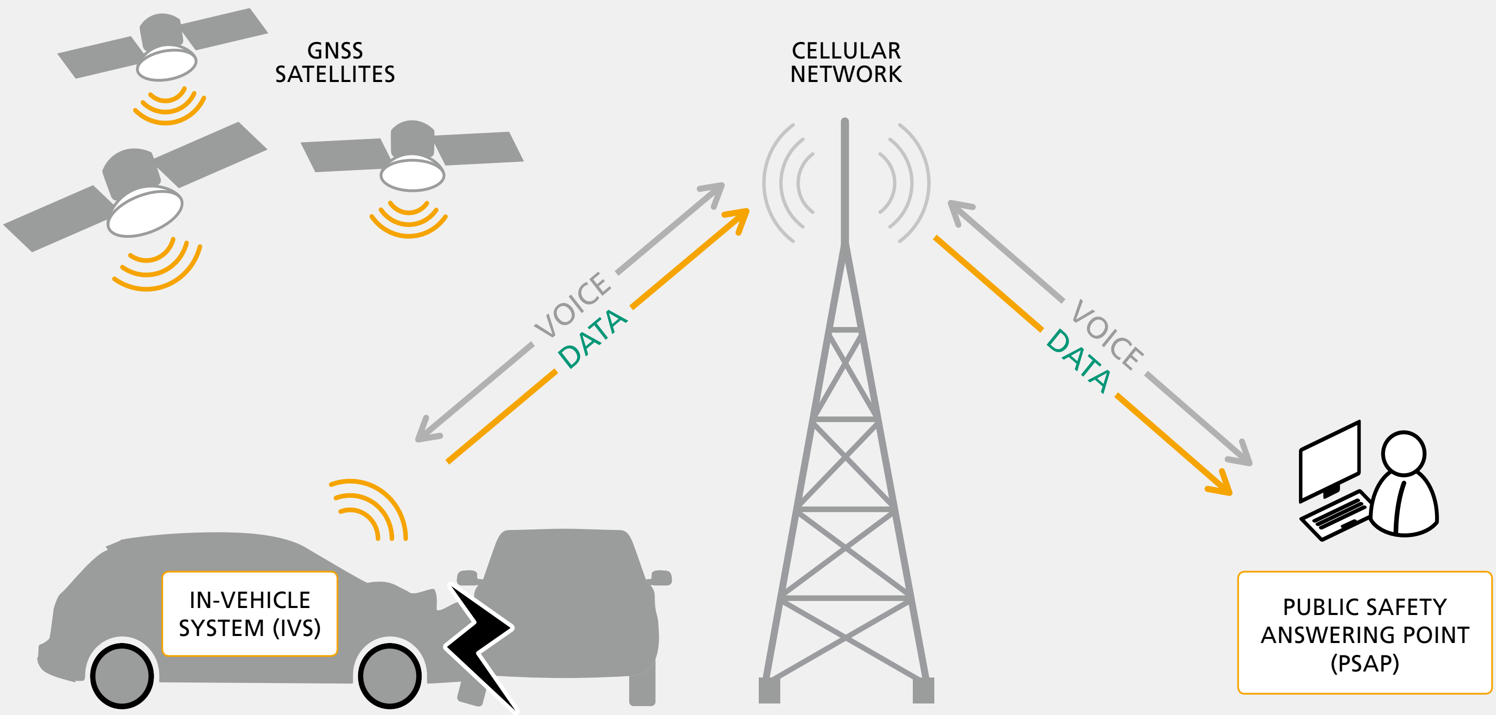
IZT S1000 / IZT S1010
Testing eCall Systems

- Ready for the 2018 eCall standards
- Preinstalled scenarios for various testing
- Self-defined scenarios for special tests
- eCall and Adjacent Band Compatibility testing in one device



OVERVIEW

The Innovationszentrum für Telekommunikationstechnik GmbH IZT enhanced the signal generator IZT S1000 / IZT S1010 for testing emergency call (eCall) systems. Now it is possible to test eCall systems with the IZT S1000 / IZT S1010 Signal Generator in combination with the GIPSIE® software which was developed in cooperation with TeleOrbit GmbH (www.teleorbit.eu) and TeleConsult Austria GmbH (www.tca.at). The solution offers a compact multi-channel high performance platform for complex and versatile testing in one device. The GNSS options from the GIPSIE® project enable simulations of eCall test scenarios with the IZT S1000 / IZT S1010 for testing eCall systems regarding the requirements of the European Union.

FIGURE 1: THE IZT S1010 SIGNAL GENERATOR COMBINES IZT SIGNAL GENERATOR AND IZT MEMORY EXTENSION IN ONE DEVICE.

TECHNICAL BACKGROUND

The European Union has deployed the emergency Call (eCall) system supporting fast assistance in the event of a car accident. As a result, all new vehicles sold after the first quarter of 2018 in the European market, are obliged to have an in-vehicle system (IVS) supporting eCall. The eCall emergency information system uses the GSM mobile communications technology and the eCall sequence is executed in the following three steps as defined by the European Norm standard EN 16062.

Step 1: Issue Emergency Call

When the vehicle airbags are opened in a car accident or the emergency call button is pressed, the IVS makes an emergency call to the emergency call center known as the Public Safety Answering Point (PSAP).

Step 2: Transfer Minimum Set of Data (MSD)

When the IVS and PSAP start the communications, the IVS sends the MSD to the PSAP. The MSD contains detailed location data of the accident, the direction of travel before the accident, the time of the accident and the minimum amount of data required for the assistance, such as the vehicle type, number of passengers and much more.

Step 3: Confirm Status via Operator

When the MSD is sent, an operator at the PSAP can speak with the vehicle passengers to assess the emergency and dispatch emergency response vehicles.

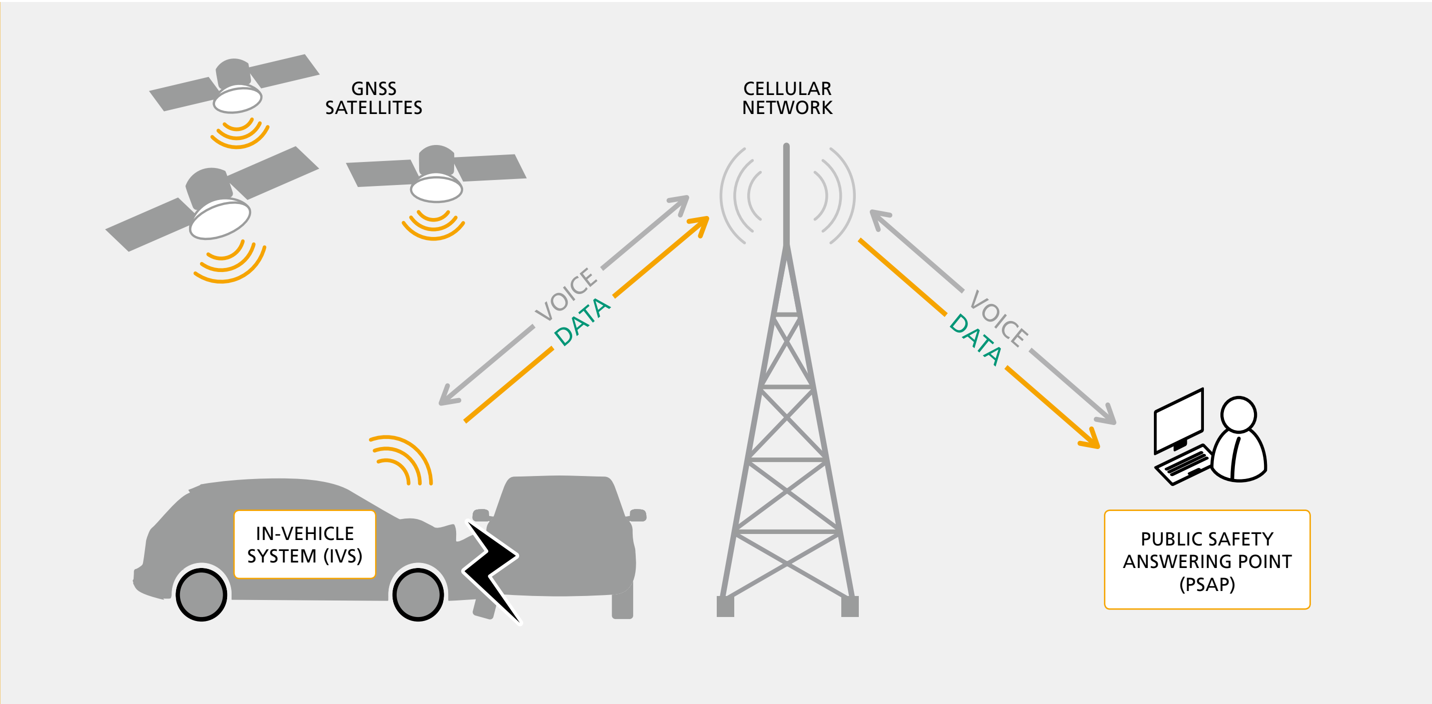


FIGURE 2: FUNCTIONALITY OF ECALL UNITS.

APPLICATION

The IZT Part

The IZT part in testing the eCall system is providing the GNSS standard conform test signals which are received from the IVS. These signals are produced for a laboratory use to ensure an economical testing procedure.

How IZT tests eCall

It is necessary to stimulate the IVS with standard conform GNSS signals in a laboratory to ensure repetitive and standard conform testing. The IZT S1000 / S1010 Signal Generator is using a GNSS software which was developed in cooperation with TeleOrbit and TeleConsult Austria. The result is a signal generator which is able to simulate various preinstalled scenarios to test the eCall systems. The test scenarios are defined by the European Union Commission and they are mandatory when testing an eCall system. You can find all details in the reference documents [1] and [2].

KEY FEATURES

There are different test scenarios which have to be passed by the eCall systems. In reference document [1] various test scenarios are described which must be fulfilled with the given performance requirements. These scenarios are a static open-sky scenario, a dynamic open-sky scenario and a dynamic urban canyon scenario which are described in the following sections.

The definition of open-sky according to [1] is depicted in Figure 3. In this Figure Zone A denotes the zone where signals are obstructed (or attenuated by 100dB).

The urban canyon is defined in [1] as depicted in Figure 4. In this scenario, signals from Zone A are again obstructed (or 100dB attenuated) and signals from Zone B or Zone C are partly obstructed, meaning an attenuation of 40dB.

Static open-sky

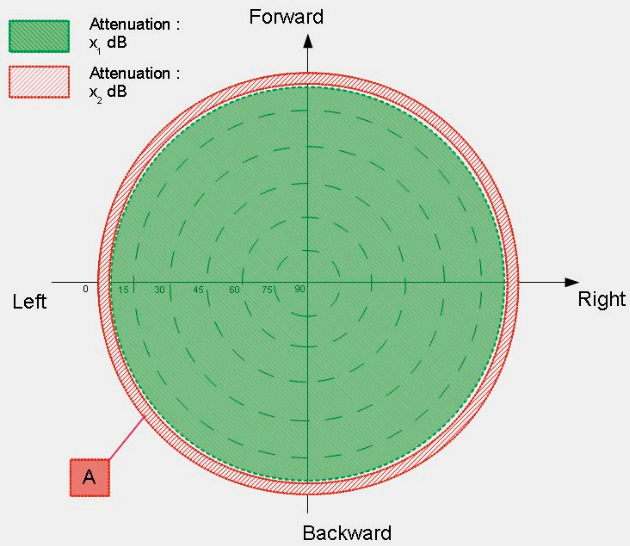
The static open-sky scenario is provided together with the GIPSIE® software. The main simulation parameters are provided in Table 1. Within the simulation, the obstruction mask as defined in Figure 3 is applied.

The test procedure has to follow the specifications mentioned in [1] (especially Section 2.2 in Annex IV).

* SOURCE: EUROPEAN GNSS AGENCY (GSA)

TABLE 1: SIMULATION PARAMETERS FOR STATIC OPEN-SKY SCENARIO*

Simulated parameter	Value	User modification
Test duration	01:00 h	denied
Constellation update rate	1 Hz	denied
Location	Any specified land point between latitude range 80°N and 80°S in WGS-84 system	allowed within specified limits
Troposphere	Predefined simulator model	allowed (no disabling the model)
Ionosphere	Predefined simulator model	allowed (no disabling the model)
PDOP in test interval	$2.0 \leq PDOP \leq 2.5$	N/A (result of satellite visibility)
Simulated signals	■ Galileo E1 OS ■ GPS L1 C/A ■ SBAS L1 C/A (combined with GPS and Galileo)	denied
Signal strength	■ Galileo: -135 dBm ■ GPS: -138.5 dBm	N/A (according to ICD)
Number of simulated satellites	■ Galileo: ≥ 6 ■ GPS: ≥ 6 ■ SBAS: ≥ 2	denied

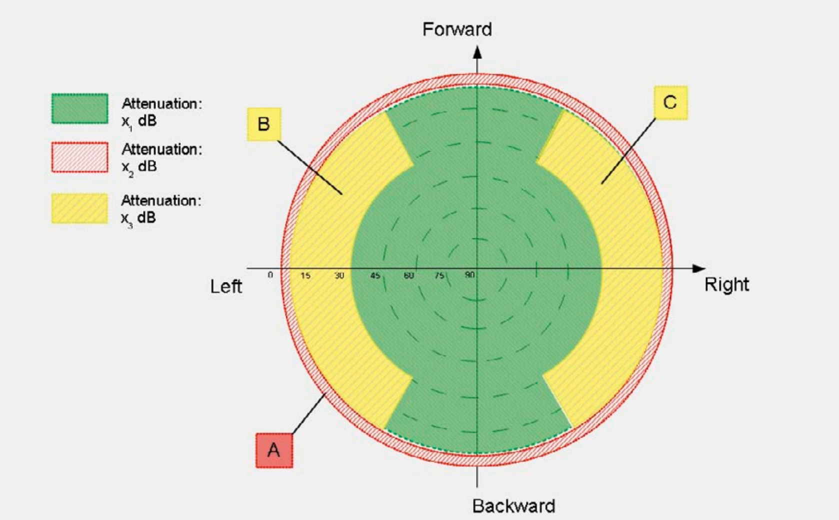


Zone	Elevation range	Azimuth range
A	0°–5°	0°–360°
Background	Area out of Zone A	Area out of Zone A

FIGURE 3: OPEN-SKY DEFINITION; © EUROPEAN GNSS AGENCY (GSA)

TABLE 2: SIMULATION PARAMETERS FOR DYNAMIC OPEN-SKY SCENARIO*

Simulated parameter	Value	User modification
Test duration	01:00 h	denied
Constellation update rate	1 Hz	denied
Location	Any specified land point between latitude range 80°N and 80°S in WGS-84 system	allowed within specified limits
Movement	Maneuvering movement: ■ speed:140 km/h ■ turning radius: 500 m ■ acceleration: 0.2 m/s2	allowed while maintaining specified parameters
Troposphere	Predefined simulator model	allowed (no disabling the model)
Ionosphere	Predefined simulator model	allowed (no disabling the model)
PDOP in test interval	$2.0 \leq PDOP \leq 2.5$	N/A (result of satellite visibility)
Simulated signals	Combined Galileo/GPS/SBAS	denied
Signal strength	■ Galileo: -135 dBm ■ GPS: -138.5 dBm	N/A (according to ICD)
Number of simulated satellites	■ Galileo: ≥ 6 ■ GPS: ≥ 6 ■ SBAS: ≥ 2	denied



Zone	Elevation range	Azimuth range
A	0°–5°	0°–360°
B	5°–30°	210°–330°
C	5°–30°	30°–150°
Background	Area out of Zone A, B, C	Area out of Zone A, B, C

FIGURE 4: URBAN CANYON DEFINITION; © GSA

Dynamic open-sky

The dynamic open-sky scenario is provided together with the GIPSIE® software. The main simulation parameters are provided in Table 2. Within the simulation, the obstruction mask as defined in Figure 3 is applied.

The test procedure has to follow the specifications mentioned in [1] (especially Section 2.2 in Annex IV).

Dynamic urban canyon

The dynamic urban canyon scenario is provided together with the GIPSIE® software. The main simulation parameters are provided in Table 3. Within the simulation, the obstruction mask as defined in Figure 4 is applied.

The test procedure has to follow the specifications mentioned in [1] (especially Section 2.2 in Annex IV).

Positioning accuracy in dynamic mode

The positioning accuracy performance of the IVS need also to be tested in open-sky conditions. The test procedure is specified in section 2.2.3 of Annex VI of the reference document [1]. Under the given test conditions, the maximum overall horizontal position error with a 95 % confidence level must be below 15 meters.

An example of a vehicle trajectory meeting the requirements above is shown in Figure 5. The shown trajectory consists of two turns along an elongated oval aligned in the North/South direction. The trajectory is split into four sectors, with the last one ending with a sudden 2G deceleration event.

The pre-installed scenario includes this trajectory to fulfil the test requirements. Other scenarios can also be installed which could differ significantly from this example while still being suitable for testing eCall systems.

* SOURCE: EUROPEAN GNSS AGENCY (GSA)

TABLE 3: SIMULATION PARAMETERS FOR DYNAMIC URBAN CANYON SCENARIO*

Simulated parameter	Value	User modification
Test duration	01:00 h	denied
Constellation update rate	1 Hz	denied
Location	Any specified land point between latitude range 80°N and 80°S in WGS-84 system	allowed within specified limits
Movement	Maneuvering movement: ■ speed:140 km/h ■ turning radius: 500 m ■ acceleration: 0.2 m/s2	allowed while maintaining specified parameters
Troposphere	Predefined simulator model	allowed (no disabling the model)
Ionosphere	Predefined simulator model	allowed (no disabling the model)
PDOP in test interval	3.5 ≤ PDOP ≤ 4.0	N/A (result of satellite visibility)
Simulated signals	Combined Galileo/GPS/SBAS	denied
Signal strength	■ Galileo: -135 dBm ■ GPS: -138.5 dBm	N/A (according to ICD)
Number of simulated satellites	■ Galileo: ≥ 6 ■ GPS: ≥ 6 ■ SBAS: ≥ 2	denied

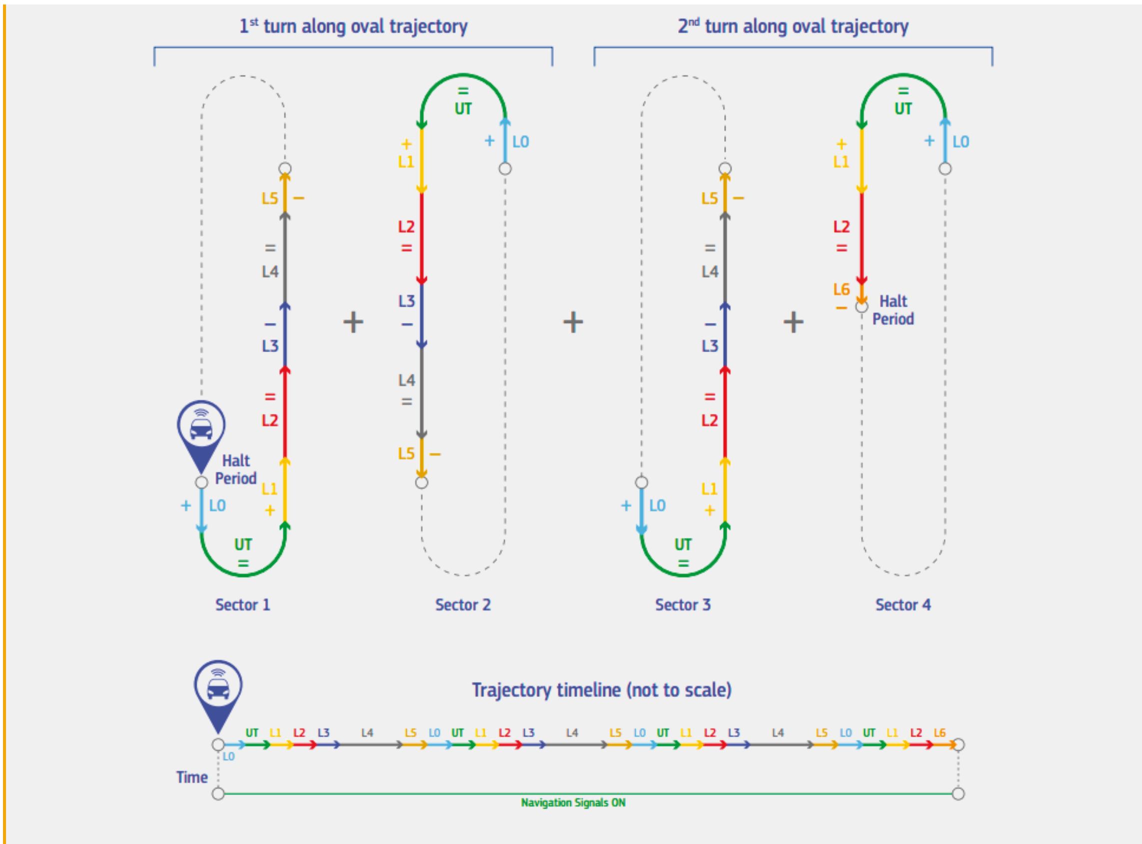


FIGURE 5: SKETCH OF A POSSIBLE OPEN-SKY VEHICLE TRAJECTORY TO BE USED IN THE DYNAMIC SCENARIO SPECIFI ED IN SECTION 2.2.3 OF ANNEX VI [1], AND THE ASSOCIATED TIMELINE INDICATING THE TIME SERIES OF ALL THE TRAJECTORY SECTORS INVOLVED; © GSA/JRC

Movement in urban canyons

The positioning accuracy performance of the IVS also needs to be tested in an urban canyon characterized by shadow areas and intermittent signal reception. The test procedure is specified in section 2.2.4 of Annex VI of the reference document [1]. There are four main differences with respect to the previous dynamic scenario in open-sky conditions:

- Higher Position Dilution of Precision (PDOP) range (3.5 to 4.0)
- The vehicle is driving in an urban canyon (specified in section 2.2.4.2 of Annex VI of the reference document [1])
- Simulation of interrupted navigation signals for 300 and 600 seconds (this simulates long tunnels) shown in Figure 6

Under these test conditions, the maximum overall horizontal position error with a 95 % confidence level must be below 40 meters.

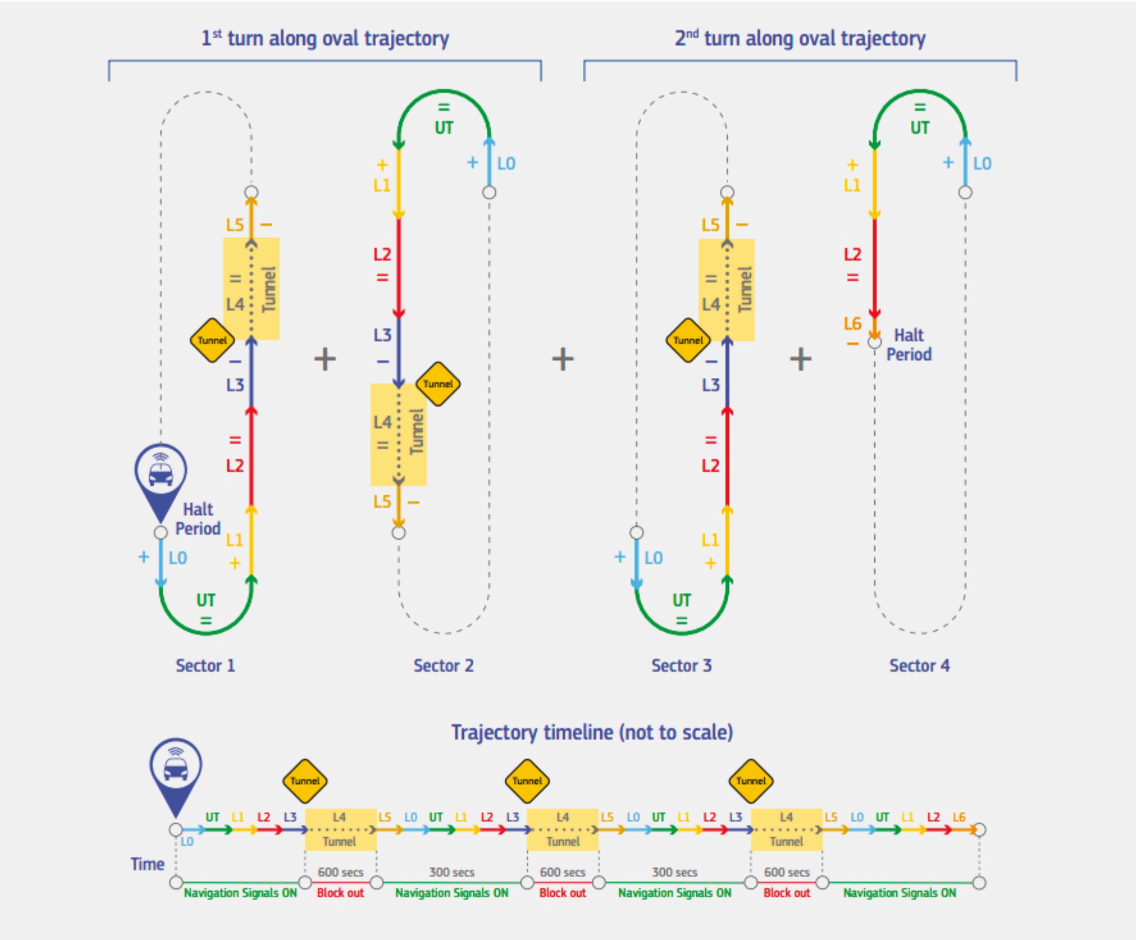


FIGURE 6: SKETCH OF A POSSIBLE OPEN SKY VEHICLE TRAJECTORY TO BE USED IN THE DYNAMIC SCENARIO SPECIFED IN SECTION 2.2.4 OF ANNEX VI [1], INCLUDING THREE INTERVALS WITH A COMPLETE OUTAGE OF NAVIGATION SIGNALS, AND THE ASSOCIATED TIMELINE INDICATING THE TIME SERIES OF ALL THE TRAJECTORY SECTORS INVOLVED; © GSA/JRC

REQUIRED HARDWARE AND SOFTWARE OPTIONS

IZT S1000 / IZT S1010 Signal Generator		
Hardware options	**IZT S1010-CHS***	Chassis and all digital hardware
	IZT S1010-SDD*	Solid state data disk for IZT S1010-CHS3
	IZT S1000-RF3	RF output 9 kHz – 3 GHz
	IZT S1000-RFS3	RF synthesizer 3 GHz
	IZT S1000-ESU	eCall support on request
Software options	**IZT S1000-GNSS3**	SCS (Satellite Constellation Simulator) software licence for GPS L1 + EGNOS L1 + Galileo E1 based on GIPSIE® SCS including IFS (Intermediate Frequency Simulator)
	IZT S1000-GUI	Graphical user interface
	IZT S1000-110 (4x)	One virtual signal generator VSG (up to 31 VSGs are possible)
	IZT S1000-120	Streaming input (high-speed LAN streaming, 2 Gbit ports for streaming data)
	IZT S1000-305	Power level profiles

*The two options IZT S1010-CHS and IZT S1010-SDD can be replaced with the IZT S1000-CHS and the IZT S1000 Memory Extension

YOUR BENEFITS

The predefined test scenarios delivered with GIPSIE® are to be understood as baseline scenario definitions that provide a starting point for eCall testing. Of course, the scenarios can be extended to match the user needs or represent even more stringent test conditions as long as it is ensured that the given minimum test conditions defined in [1] are applied.

Additionally it is possible to provide scenarios with interfering signals and supply requirements for test cases to evaluate how the receiver performs under interference conditions, namely jamming and spoofing signals. Within GIPSIE® it is possible to simulate such interfering signals in many different scenarios (for instance single or multiple jamming and/or spoofing signals with a high dynamic range).

In addition to the new eCall regulations there is a new standard to safeguard GNSS reliant devices from the impacts of adjacent band interference. This standard was created by the European Telecommunications Standards Institute (ETSI) and it ensures that any new or altered GNSS product launched in the EU can withstand a level of adjacent band interference and continue to operate without interruption. These systems also need to be tested. The IZT S1000 / IZT S1010 is able to test them without any additional equipment. Thus, it saves costs.

CONCLUSION

IZT delivers a device that prepares customers in the automotive industry and their suppliers for current and future regulations and standards regarding eCall and adjacent band interference.

The IZT S1000 / IZT S1010 with the GIPSIE® software combines two test devices in one and delivers absolutely high performance.

REFERENCES

[1] European Union: COMMISSION DELEGATED REGULATION (EU) 2017/79; September 12, 2017.
http://data.europa.eu/eli/reg_del/2017/79/oj

[2] European GSA: Implementaton guidelines for On-Board Unit manufacturers, test soluton vendors and technical centres.
https://www.gsa.europa.eu/system/files/reports/egnos_galileo_ecall_conformance_testing_.pdf

REV.1.0 12/2018

About IZT The Innovationszentrum fuer Telekommunikationstechnik GmbH IZT specializes in the most advanced digital signal processing and field programmable gate array (FPGA) designs in combination with high frequency and microwave technology.

The product portfolio includes equipment for signal generation, receivers for signal monitoring and recording, transmitters for digital broadcast, digital radio systems, and channel simulators. IZT offers powerful platforms and customized solutions for high signal bandwidth and real-time signal processing applications. The product and project business is managed from the principal office located in Erlangen/Germany. IZT distributes its products worldwide together with its international strategic partners.The IZT quality management system is ISO 9001:2000 certified.

Quality Management ISO 9001:2008
▶ Voluntary participation in regular monitoring
DEKRA Certification
DEKRA certified

IZT
Innovationszentrum
Telekommunikationstechnik

INNOVATIONSZENTRUM FÜR TELEKOMMUNIKATIONSTECHNIK GMBH IZT AM WEICHSELGARTEN 5 · 91058 ERLANGEN, GERMANY
GENERAL MANAGER: RAINER PERTHOLD · TEL: +49 (0)9131 9162-0 · FAX: -190 · SALES@IZT-LABS.DE · WWW.IZT-LABS.DE