FEDERAL AGENCY
ON TECHNICAL REGULATING AND METROLOGY

NATIONAL
STANDARD OF THE
RUSSIAN
FEDERATION

**GOST R
54620-2011**

**Global navigation satellite system**

# ROAD ACCIDENT EMERGENCY RESPONSE SYSTEM

**In-vehicle emergency call system/device
General technical requirements**

**Official Edition
English Version Approved by Interstandard**

**Moscow
Standartinform
2012**

## Foreword

The purposes and principles of standardization in the Russian Federation are established in the Federal law No. 184-ФЗ "On Technical Regulating", dated 27.12.2002, and the rules of application of national standards of the Russian Federation are established in GOST R 1.0-2012 "Standardization in the Russian Federation. Basic provisions"

**Details**

1 DEVELOPED by Open joint-stock company "Navigation IT Systems" ("NIS" OJSC) and Non-Profit Partnership "Promotion of Development and Use of Navigation Technologies"

2 SUBMITTED by Technical Committee for standardization TC 363 "Radio navigation"

3 APPROVED AND INTRODUCED by Decree No. 755-*cm*, dated 08.12.2011, of the Federal agency on technical regulating and metrology

4 This Standard takes into account basic provisions of the following world-wide documents and International Standards:

- UNECE Regulations establishing uniform procedures related to official approval of passenger vehicles of Categories M and N in regard to protection of drivers and passengers in collisions of various types, and in regard to electromagnetic compatibility;
- European National Standards of EN series on intelligent vehicle systems pertaining to safety in case of emergencies, as applicable to the European eCall system;
- Technical Specifications (TS) of European Telecommunications Standards Institute (ETSI) and of 3rd Generation Partnership Project (3GPP)) on data transmission systems and protocols as well as on wireless communication facilities based on 3G technologies, as applicable to the European eCall system.

5 INTRODUCED FOR THE FIRST TIME

*The information on amendments to this Standard is published in annually issued information index "National standards", and the text of amendments and corrections is published in monthly issued information indices "National standards". In case of revision (replacement) or cancellation of this Standard the corresponding notice will be published in monthly issued information index "National standards". The corresponding information, the notice and texts are also placed in the information system of general use — on official site of Federal Agency on Technical Regulating and Metrology in Internet*

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**(Amended Wording, Amendment No. 1)**

## Introduction

This Standard is one of the key standards a set entitled "Global Navigation Satellite System. Road Accident Emergency Response System."

The development of the ERA-GLONASS emergency response system is aimed to mitigate the consequences of road accidents and of other emergencies on the roads of the Russian Federation by reducing the response time of emergency services.

The in-vehicle emergency call system/device is a key ERA-GLONASS structural element intended to generate and transmit a minimum required set of data regarding the vehicle when the road accident occurs, and to ensure duplex voice communication with emergency services.

This Standard is interrelated with the following ones:

GOST R 54619-2011 Global navigation satellite system/device. Accident emergency response system. Protocols of data transmission from in-vehicle emergency call system to emergency response system infrastructure;

GOST R 54721-2011 Global navigation satellite system. Accident emergency response system. General base service description.

The ERA-GLONASS System is analogous to the European eCall system, and is harmonized with it for the purpose of process compatibility in regard to main functional properties (the use of in-band modem as the main data transmission tool, unified content and format of mandatory data transmitted in the minimum set of data, uniform procedures for initiation and termination of duplex voice communication with the persons present in the vehicle cabin, etc.).

**N A T I O N A L S T A N D A R D O F T H E R U S S I A N F E D E R A T I O N**

**Global navigation satellite system**

# ROAD ACCIDENT EMERGENCY RESPONSE SYSTEM

**In-vehicle emergency call system**
**General technical requirements**

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**Date of Introduction — 2012—09—01**

## 1 Scope

This Standard applies to in-vehicle emergency call systems/devices that constitute structural elements of the ERA-GLONASS emergency response system and are intended for installation on wheeled vehicles of Categories M and N in accordance with requirements of [19].

This Standard sets out general technical requirements for an in-vehicle emergency call system/device in relation to the provision of the base service by the ERA-GLONASS road accident emergency response system in accordance with GOST R 54721.

**(Amended Wording, Amendment No. 1).**

## 2 Normative references

The following standards are referred to in this Standard:

GOST R 22.0.05-94 Safety in emergencies. Technogenic emergencies. Terms and definitions

GOST R 50607-93 Electromagnetic compatibility of technical means. Electrical equipment for vehicles. Electrical disturbance from electrostatic discharges. Technical requirements and tests

GOST R 50905-96 Motor vehicles. Electronic equipment. General technical requirements

GOST R 52230-2004 Electrical equipment for vehicles and tractors. General specifications

GOST R 52456-2005 Global navigation satellite system and global position system. Individual receiver equipment for automobile transport. Technical requirements

GOST R 52928-2010 Global navigation satellite system. Terms and definitions

GOST R 54618-2011 Global navigation satellite system/device. Road accident emergency response system. Compliance test methods of in-vehicle emergency call system for electromagnetic compatibility, environmental and mechanical resistance requirements

GOST R 54619-2011 Global navigation satellite system/device. Accident emergency response system. Protocols of data transmission from in-vehicle emergency call system to emergency response system infrastructure

GOST R 54721-2011 Global navigation satellite system. Accident emergency response system. General base service description

GOST R ISO/IEC 8824-1-2001 Information technology. Abstract Syntax Notation One (ASN.1). Specification of basic notation

GOST R ISO/IEC 8825-93 Information technology. Open Systems Interconnection. Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).

GOST R ISO/IEC 8825-2-2003 Information technology. ASN.1 encoding rules. Part 2. Specification of packed encoding rules (PER)

GOST 12.1.044-89 Occupational safety standards system. Fire and explosion hazard of substances and materials. Nomenclature of indices and methods of their determination

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*Amendment No. 1 is inserted*

GOST 12.2.007.0-75 Occupation safety standards system. Electrical equipment. General safety requirements

GOST 14254-96 (IEC 529:1989) Degrees of protection provided by enclosures (IP code)

GOST 15150-69 Machines, instruments and other industrial products. Modifications for different climatic regions. Categories, operating, storage and transportation conditions as to environment climatic aspects influence

GOST 16019-2001 Equipment for land mobile radio communication. Requirements for mechanical and environmental resistance and test methods

GOST 28279-89 Electromagnetic compatibility of on-board radio equipment and electrical network in a vehicle. Limits and test methods

GOST 28751-90 Electrical equipment for vehicles. Electromagnetic compatibility. Electrical disturbance by conduction along supply lines. Technical requirements and tests

GOST 29157-91 Electromagnetic compatibility of technical means. Vehicle electrical equipment. Disturbances in control and signal lines on board vehicle. Requirements and test methods

GOST 30429-96 Electromagnetic compatibility of technical equipment. Man-made noise from equipment and apparatus used together with service receiver systems of civil application. Limits and test methods

GOST R 55530-2013 Global navigation satellite system. Road accident emergency response system. Functional test methods of in-vehicle emergency call system and data transfer protocols

GOST R 55532-2013 Global navigation satellite system. Road accident emergency response system. Test methods of in-vehicle emergency call system crash detection feature

GOST 30630.0.0-99 Environment stability test methods for machines, instruments and other industrial products. General requirements.

**(Amended Wording, Amendment No. 1).**

N o t e — When using this Standard it is recommended to check the validity of the above reference standards on the official Internet-site of Federal Agency on Technical Regulating and Metrology or in annually issued information index “National standards” published as of January 1of the current year. It may be also checked in the appropriate monthly issued information indices of the current year. If a reference standard is replaced or amended, then the replacing (amended) standard shall be followed by when using this Standard. If a reference standard is cancelled without a replacement, then the provision which refers to it shall be applied to the part which does not regard this reference.

## 3 Terms, definitions, designations and abbreviations

3.1 The terms as per GOST R 52928 as well as the following terms with their respective definitions are used for the purposes of this Standard:

3.1.1 **in-vehicle emergency call system/device;** (IVS): System/device installed on a wheeled vehicle of a relevant Category and used to evaluate vehicle location, speed and movement direction based on the signals generated by the GLONASS Global Navigation Satellite System (GNSS) either alone or in cooperation with other active GNSS, to transmit messages containing vehicle data in automatic (system) or manual (device) mode when a road accident or an accident of other type occurs, and to ensure duplex voice connection with emergency services over wireless mobile communication networks.

N o t e s :

1 In-vehicle emergency call systems are intended for Category M1 vehicles within the scope of UNECE Regulations [6] and [7], and for Category N1 vehicles within the scope of UNECE Regulation [7].

2 In-vehicle emergency call devices are intended for Category M1 vehicles outside the scope of UNECE Regulations [6] and [7], Category N1 vehicles outside the scope of UNECE Regulation [7], as well as for Category M2, M3, N2 and N3 vehicles.

3 The time frames for vehicle equipping with in-vehicle emergency call systems/devices are specified in [19].

4 In case of road accidents or accidents of other type, in-vehicle emergency call systems are capable of transmitting vehicle data messages in manual mode as well.

5 In case of road accidents or accidents of other type, an in-vehicle emergency call device may also be capable of transmitting vehicle data messages in automatic mode. The types of accidents to be detected automatically and the time frames for implementation of the function for automatic transmission of vehicle data in the device are established in [1] and [19].

**(Amended Wording, Amendment No. 1).**

3.1.2 **base service of ERA-GLONASS System:** result of ERA-GLONASS System operation that consists in generation and transmission of urgent messages on road accidents, in reception, processing and routing of those messages to the unified duty dispatching service of the System-112, and in ensuring that the duplex voice communication with the persons in the vehicle may be established (switched).

3.1.3 **road (traffic) accident (RTA):** event due to vehicle movement along the road or due vehicle presence on it resulting in deaths or injuries, in damages of vehicles, structures or cargoes, or in property damages of other kinds.

3.1.4 **automatic detector of RTA events:** device intended for identification of RTA events based on processing of data coming from a 3D acceleration sensor included in it, and for supplying external devices with data that are used to record the acceleration profile during the RTA and to assess the RTA severity.

N o t e — For vehicles of Categories M1 and N1, automatic detectors of RTA events may be included in the design of a standard vehicle system subject to the requirements established by the vehicle manufacturer.

3.1.5 **common number "112":** common telephone number for emergency service calls which is defined within the framework of the Russian Numbering System and Plan [15].

3.1.6 **potential damage index for RTA ($ASI_{15}$):** indicator of potential acceleration overload effects on the persons in the vehicle subjected to the RTA.

3.1.7 **configurable parameter:** parameter that affects the IVS operation algorithm and may be changed either in response to a command issued by System Operator or using a diagnostic interface developed by the vehicle manufacturer or the IVS manufacturer.

3.1.8 **minimum set of data (MSD):** set of data transmitted by the in-vehicle emergency call system in case of an RTA, including: location and movement parameters of the affected vehicle, RTA time, vehicle VIN-code and other information necessary for emergency response.

3.1.9 **operator of ERA-GLONASS emergency response system (System Operator):** legal entity carrying out activities related to ERA-GLONASS operation, in particular, processing of data stored in the ERA-GLONASS database.

3.1.10 **RTA severity assessment:** binary indicator used for formal assessment of RTA consequences possibly affecting life and health of people in the vehicle cabin depending on the accepted probability level of an event in question.

N o t e — This indicator may take the following values:

"0" — in case of low probability of harm caused by the RTA to life and health of people in the vehicle;

"1" — in case of high probability of harm caused by the RTA to life and health of people in the vehicle.

3.1.11 **RTA acceleration profile:** data array containing the records of acceleration values taken along the three axes of the vehicle (lengthwise, lateral and vertical) where the data are sampled at preset intervals before, during and after the RTA.

3.1.12 **road accident emergency response system (ERA-GLONASS System):** Automated geographically distributed Federal State Information System that uses the signals of the GLONASS Global Navigation Satellite System and of other active GNSS to provide for prompt collection of data related to road accidents or other emergencies on the roads of the Russian Federation as well as for processing, storage and transmission of such data to emergency services, and to enable access to the said data for the concerned governmental or local authorities, officials, legal and natural persons.

**(Amended Wording, Amendment No. 1).**

N o t e — The ERA-GLONASS System is analogous to the European eCall system, and is harmonized with it in regard to main functional properties (the use of in-band modem as the main data transmission tool, unified content and format of mandatory data transmitted in the MSD, uniform procedures for initiation and termination of duplex voice communication with the persons present in the vehicle cabin, etc.).

3.1.13 **System-112:** system providing for emergency service calls using the common number 112.

3.1.14 **in-band modem:** modem enabling data transmission during the established connection for voice communication.

3.1.15 **vehicle:** wheeled mechanical land-based device of Category M or N intended for transportation of people, cargoes or equipment loaded on it along the public automobile roads [1].

3.1.16 **narrow-band IVS:** IVS operating with narrow-band voice signal of standard quality (in the frequency range from 0.3 to 3.4 kHz at a sampling rate of at least 8 kHz).

3.1.17 **wide-band IVS:** IVS operating with wide-band voice signals of improved quality (in the frequency range from 0.15 to 7 kHz at a sampling rate of 16 kHz).

3.1.16 and 3.1.17 **(Amended Wording, Amendment No. 1).**

3.1.18 **emergency call:** operations performed by an in-vehicle emergency call system in order to make a telephone call of the common emergency number 112 from within the vehicle, using the identified emergency call indicator.

3.2 The following designations and abbreviations are used in this Standard:

ASN.1 - Abstract Syntax Notation One;

DTMF - Dual-Tone Multi-Frequency (analogous signal used for dialling telephone numbers and for automatic voice response)

eCall - emergency Call (common European road accident emergency response system);

EDGE - Enhanced Data rates for GSM Evolution (digital wireless data transmission technology for mobile communications forming a superstructure over 2G and 2.5G GPRS-networks);

GNSS - Global Navigation Satellite System;

GPRS - General Packet Radio Service (service for packet data transmission in RF networks);

GPS - Global Positioning System (GNSS used in the United States of America);

GSM - Global System for Mobile communications (global digital standard for cellular mobile communications);

FIFO - First In First Out (order of data transmission and reception based on the principle where the first received data block is processed, serviced and transmitted for further processing before the next blocks);

HSDPA - High-Speed Downlink Packet Access (high-speed packet data transmission from a base station to a mobile device);

IMEI - International Mobile Equipment Identity;

IO - Input/Output;

IP - Internet Protocol;

LIFO - Last In First Out (order of data transmission and reception based on the principle where the last received data block is processed, serviced and transmitted for further processing before the previous blocks);

MMF2 - Machine to Machine Form Factor (conventional designation of standards defining the specifications of SIM-cards manufactured in a package);

NSC - navigation spacecraft;

PZ-90.11 - State Geocentric Coordinate System "Earth parameters as of the year 1990";

RLR - Receiving Loudness Rating (receive loudness indicator, volume equivalent for receiving);

RAIM - Receiver Autonomous Integrity Monitoring (carried out in regard to the processed navigation data in a satellite receiver);

SIM - Subscriber Identity Module (SIM-card);
SMS - Short Message System;
SW - software;
TCLw - Weighted Terminal Coupling Loss (i.e., weighted attenuation in electro-acoustic signal path);
TS - Technical Specification;
UIM - User Interface Module;
UMTS - Universal Mobile Telecommunications System (European version of the 3G cellular communication system)
VH - Vehicle;
VIN - Vehicle Identification Number;
WGS-84 - World Geodetic System dated 1984.
AGC — Automatic Gain Control;
AES - Advanced Encryption Standard (symmetric block encryption algorithm);
COMP128 - SIM-card protection algorithm;
CRC-32 - Cyclic Redundancy Check;
DES - Data Encryption Standard (symmetric encryption algorithm);
eUICC - Embedded Universal Integrated Circuit Card (built-in microprocessor card of extended standard);
GSM – Milenage – algorithms used for authentication and generation of session keys in wireless mobile communication networks;
LTE - Long Term Evolution (wireless mobile communication standard);
MD5 - Message Digest 5 (28-bit hashing algorithm);
OTA - Over The Air (framework for remote software updates);
PIN - Personal Identification Number;
SHA-1 - Secure Hash Algorithm-1 (cryptographic hashing algorithm, Version 1);
SLR - Sending Loudness Rating (transmit loudness indicator, volume equivalent for sending);
XOR - eXclusive OR.

**(Amended Wording, Amendment No. 1).**

## 4 General provisions

4.1 The requirements for IVS shall be applied in accordance with the vehicle category and the method that may be used to install such IVS on it.

4.2 The following vehicle categories are considered in this Standard [1]:

4.2.1 Category M – passenger vehicles with at least three wheels, including:

- motor cars, in particular:
  - Category M1 – passenger vehicles with at most eight seats not including the driver seat;
- buses, trolley buses, special purpose passenger vehicles and their chassis, in particular:
  - Category M2 – passenger vehicles with more than eight seats not including the driver seat, of the maximum weight not exceeding 5 tons;
  - Category M3 – passenger vehicles with more than eight seats not including the driver seat, of the maximum weight exceeding 5 tons.

4.2.2 Category N – cargo vehicles and their chassis, including:

- Category N1 – cargo vehicles of the maximum weight not exceeding 3.5 tons;
- Category N2 – cargo vehicles of the maximum weight in the range 3.5 to 12 tons;
- Category N1 – cargo vehicles of the maximum weight exceeding 12 tons.

4.3 The following approaches may be used for installation (configuration) of in-vehicle emergency call systems on vehicles:

- standard equipment configuration, where the IVS is installed in an assembly line of the vehicle manufacturer;

- auxiliary equipment configuration, where the IVS is installed either at a service (installation) station authorised to perform such activities in accordance with the established procedure, or on a site of the vehicle manufacturer or vendor, after the vehicle was produced (manufactured) in the main production facility.

4.4 The IVS parameter settings shall correspond to the ones detailed in Appendix A.

## 5 Components of in-vehicle emergency call system

5.1 An in-vehicle emergency call system shall include the following main components.

5.1.1 Navigation receiver for GLONASS and other operating global navigation satellite systems

5.1.2 GNSS antenna

5.1.3 GSM and UMTS communication module (modem)

5.1.4 Antenna for GSM and UMTS communication module

5.1.5 Built-in non-removable multi-profile SIM/e UICC circuit

5.1.6 In-band modem

5.1.7 Automatic detector of RTA events (only for vehicles of Categories M1 and N1)

5.1.8 If the system supports RTA acceleration profile recording and/or RTA severity assessment, all additional components required to record such profiles and/or make such assessments.

N o t e – The use of the information received from standard in-vehicle systems is permitted for automatic identification of RTA events, recording RTA acceleration profiles and/or RTA severity assessment.

5.1.9 User interface module with "Emergency call" and "Additional functions" buttons

N o t e – A user interface other than "Additional functions" button may be used provided that it complies with the requirements of 8.8

5.1.3 to 5.1.5 and 5.1.9 **(Amended Wording, Amendment No. 1).**

5.1.10 IVS status indicator

N o t e – The use of standard in-vehicle systems is permitted for implementation of "Emergency call" and "Additional functions" buttons and for IVS status display if the operational integrity of those systems is guaranteed under mechanical impacts listed in 13.3.1 and 13.3.2.

5.1.11 Internal non-volatile memory and RAM

5.1.12 Master microcontroller

N o t e – The master microcontroller may be combined with other modules (e.g., with the GSM/UMTS communication module or GNSS receiver).

5.1.13 Interface for access to diagnostic data intended for reading and clearing the contents of internal non-volatile memory of the device.

For standard in-vehicle systems, the interface for access to diagnostic data is defined by the vehicle manufacturer.

For in-vehicle systems installed as auxiliary equipment sets, the interface for access to diagnostic data is defined by the IVS manufacturer.

5.1.14 Power supply

5.1.15 A backup power supply for voice communication shall be provided for the case when no external power is available during emergency care activities in accordance with the requirements of 8.11.

This requirement does not apply to IVS installed in standard equipment configuration where the operating condition of the IVS within the vehicle is guaranteed without the use of any built-in backup battery under mechanical impacts listed in 13.3.1 and 13.3.2.

5.2 The requirements for IVS components are specified in Section 8.

5.3 An IVS supplied in auxiliary equipment configuration shall have at least two digital outputs ECALL_MODE_PIN and GARAGE_MODE_PIN rated for a current of up to 200 mA (switched to earth) and a maximum voltage in closed state of 36 V.

N o t e – Setting parameter names and values used here and below correspond to Appendix A.

## 6 Functions of in-vehicle emergency call system

6.1 An in-vehicle emergency call system/device shall support the following modes of generation and transmission of MSD messages when an RTA occurs:

- for vehicles of Categories M1 and N1 – automatic (using signals from sensors included in a given system or in other systems of the vehicle);
- for vehicles of Categories M and N – manual (when the "Emergency call" button is pressed).

N o t e – The categories of vehicles subject to equipping with in-vehicle emergency call systems/devices are specified in [19].

6.2 In-vehicle emergency call systems installed on vehicles of Categories M1 and N1 shall automatically detect road accidents that pose threats to health and life of people present in the vehicle compartment (cabin) when the accident takes place.

6.2.1 An in-vehicle emergency call system shall identify the following accident types: frontal collision, lateral collision, shock from behind (optionally), and turn-over.

N o t e – The requirement in regard to accident identification of "turn-over" types comes into force in accordance with time frames established in [19].

6.1, 6.2 and 6.2.1 **(Amended Wording, Amendment No. 1).**

6.2.2 For IVS installed in standard equipment configuration, the mechanism used to determine the accident instance is defined by the vehicle manufacturer.

6.2.3 For IVS installed in auxiliary equipment configuration, the condition where the potential damage index $ASI_{15}$ exceeds the ASI15_TRESHOLD value given in Appendix A is recommended as a system activation criterion.

The potential damage index $ASI_{15}$ is calculated using the following relations:

$$ASI_{15} = \{\frac{1}{t_2 - t_1}\int_{t1}^{t2} ASI(t)\,dt\}_{max} \quad (1)$$

$$ASI(t) = \sqrt{\left(\frac{\bar{a}_x}{\hat{a}_x}\right)^2 + \left(\frac{\bar{a}_y}{\hat{a}_y}\right)^2 + \left(\frac{\bar{a}_z}{\hat{a}_z}\right)^2} \quad (2)$$

$$\bar{a}_x(t) = \frac{1}{\delta}\int_{t}^{t+\delta} a_x\,dt \quad (3)$$

$$\bar{a}_y(t) = \frac{1}{\delta}\int_{t}^{t+\delta} a_y\,dt \quad (4)$$

$$\bar{a}_z(t) = \frac{1}{\delta}\int_{t}^{t+\delta} a_z\,dt \quad (5)$$

where $(t_2 - t_1)$ is the interval between recording of parameters used to assess potential damages; it is taken equal to 15 ms;

$ASI(t)$ is the current value of the potential damage index;

$a_x$, $a_y$, $a_z$ are the acceleration components of a vehicle point under question where the acceleration sensor is mounted, taken along the direction of three major axes of the vehicle (longitudinal – x, transversal – y, and vertical – z);

$\bar{a}_x$, $\bar{a}_y$, $\bar{a}_z$ are the acceleration components of a vehicle point under question where the acceleration sensor is mounted, taken along the direction of three major axes of the vehicle and averaged over a time interval of $\delta = 50$ ms;

$\hat{a}_x$, $\hat{a}_y$, $\hat{a}_z$ are the limits corresponding to a level such that the hazard for humans is negligible below it. When safety belts are used, the limiting safe accelerations are normally taken equal to âx = 12 g; ây = 9 g; âz = 10 g.

**(Amended Wording, Amendment No. 1).**

6.3 The MSD shall include last known vehicle location data as for the moment when the RTA was detected, in accordance with Appendix C.

6.4 If no reliable vehicle location data are available for the moment when the RTA was detected, then the "no reliable vehicle location data" attribute shall be included in the MSD in accordance with Appendix C. In this case, the MSD shall also include information on the expected last vehicle location for that moment. The method used to determine such location is specified by the IVS manufacturer.

6.5 The reliability attribute of vehicle location data shall be set in accordance with Appendix C. It shall have a value "reliable vehicle location data available" if the available location data correspond to the requirements stated in Appendix C.

6.6 The MSD shall include information on the direction of vehicle movement specified in according to Appendix C. Such information shall correspond to the actual direction, and shall not depend on possible spread of vehicle location values obtained from the GNSS receiver. The data filtering (smoothing) algorithm shall be selected by the IVS manufacturer and/or by the manufacturer of the GNSS receiver.

6.7 For IVS installed on vehicles of Categories M1 and N1, it shall be possible to disable automatic initiation of "Emergency call" mode using the ECALL_NO_AUTOMATIC_TRIGGERING setting for the IVS.

**6.8 Recording and transmission of RTA acceleration profiles (for vehicles of Categories M1 and N1 only)**

6.8.1 This function shall be implemented for IVS installed in auxiliary equipment configuration if the IVS does not support the RTA severity assessment function.

6.8.2 If an RTA event has been detected automatically, and the IVS supports the transmission of RTA acceleration profiles, then the 3D vehicle acceleration profile shall be recorded and transmitted to System Operator at the moments chosen as per Appendix A before, after and during the RTA event.

6.8.3 If an IVS supports the RTA acceleration profile recording and transmission function, then the vehicle acceleration 3D data array for an RTA shall be stored in a ring buffer, and shall correspond to a time interval CRASH_RECORD_TIME (not less than 250 ms) sampled with CRASH_RECORD_RESOLUTION (not exceeding 5 ms; preferably 1 ms) for the RTA duration, and to CRASH_PRE_RECORD_TIME (3,5 s) sampled with CRASH_PRE_RECORD_RESOLUTION (10 ms) for the RTA prehistory.

6.8.4 If an IVS supports the RTA acceleration profile recording and transmission function, then the vehicle acceleration shall be evaluated along the three axes in the following ranges, with an error not greater than 10% and a resolution not worse than specified below:

- lateral: from minus 24 G to plus 24 G (maximum permissible resolution of 0.1 G);
- lengthwise: from minus 24 G to plus 24 G (maximum permissible resolution of 0.1 G);
- vertical: from minus 24 G to plus 24 G (maximum permissible resolution of 0.1 G).

6.8.5 If an IVS supports the RTA acceleration profile recording and transmission function but the vehicle acceleration can not be determined within the accuracy and with the resolution stated in 6.8.4, then the acceleration profile shall not be recoded, and this fact shall be reflected in an applicable information message subject for transfer to System Operator.

6.8.6 The RTA acceleration profile shall be transferred using packet data transmission, and shall be stored in a non-volatile memory of the IVS whenever its radio transmission is not possible. The data source for the acceleration profile may be a 3D acceleration sensor or, equally, some other electronic unit or units installed in the vehicle, provided that the requirements for resistance to external influences specified in 13.3.1 and 13.3.2 hold for all IVS constituent parts (components) required for recording and transmission of the acceleration profile.

6.8.7 If an IVS supports the RTA acceleration profile recording and transmission function, then the acceleration profile shall always be recorded while the ignition is turned on, and for a configurable time interval defined by the IGNITION_OFF_FOLLOW_UP_TIME1 setting after it is turned off.

**6.9 Recording and transmission of vehicle motion path during RTA (only for vehicles of Categories M1 and N1 and only for IVS installed in the auxiliary equipment configuration)**

6.9.1 Once an RTA event is detected, the IVS shall collect the data on the event start time, geographical coordinates in coordinate systems stated in 8.1.6 and vehicle speed, and save the data in a ring buffer. The format of such data shall correspond to GOST R 54619.

**(Amended Wording, Amendment No. 1).**

6.9.2 The data regarding geographical coordinates shall cover a 10 s time interval after the RTA detection by the IVS and a prehistory 60 s long (up to the moment of RTA detection by the IVS), with a time resolution not worse than 5 s (including last 10 s of prehistory with time resolution not exceeding 1 s) and a limiting error of coordinate measurements not exceeding the one stated in 8.1.7.

**(Amended Wording, Amendment No. 1).**

6.9.3 While the ignition is on, the modulus of the vehicle speed vector shall be recorded in a ring buffer covering a 10 s time interval after the RTA detection by the IVS and a prehistory 20 s long (up to the moment of RTA detection by the IVS), with a time resolution not worse than 1 s and a limiting error of speed measurements not exceeding the one stated in 8.1.7.

N o t e – A GNSS receiver may be used to obtain the speed vector data.

6.9.4 If the accident time is detected automatically, the vehicle location and speed data shall be transferred to System Operator using packet data transmission, and shall be stored in a non-volatile memory of the IVS if their radio transmission is not possible.

**6.10 Recording and transmission of RTA severity assessment data (for vehicles of Categories M1 and N1 only)**

6.10.1 If an IVS supports the RTA severity assessment function, then the results of such assessment shall be sent to System Operator as additional MSD data in accordance with Appendix C.

6.10.2 The RTA severity may be assessed both from the IVS side, and from the System Operator side.

**6.11 General requirements on data recording and transmission (for vehicles of Categories M1 and N1 only)**

6.11.1 The RTA acceleration profile (if the RTA acceleration profile recording and transmission function is supported) and the vehicle movement path in case of RTA (if the RTA vehicle movement path recording and transmission function is supported) shall be transmitted upon the operator request if the RTA event has been detected in automatic mode.

6.11.2 The RTA severity assessment results (if the RTA severity assessment function is supported) shall be passed to System Operator automatically if the RTA event has been detected in automatic mode.

6.11.3 If the RTA acceleration profile recording and transmission function is supported, the RTA event has been detected in automatic mode, but the acceleration profile recording that describes the previous event of the exceeded acceleration threshold is not yet complete, the IVS shall record both acceleration profiles in parallel if the IVS memory size specified in 6.11.6 allows doing so.

6.11.4 If the RTA event has been detected in automatic mode, the acceleration profile recording that describes the previous event of the exceeded acceleration threshold is not yet complete whereas the IVS memory specified in 6.11.6 is full, then the said recording shall be completed, the recording request for a new acceleration profile shall be ignored, and an appropriate information message shall be transferred to System Operator.

6.11.5 If the RTA event has been detected in automatic mode but the transmission of information specified in 6.5, 6.8.3 and 6.9.1 has failed, then such information shall be stored in a non-volatile memory of the IVS in FIFO order and transferred to System Operator when the data transmission link is recovered.

6.11.6 A non-volatile memory of the IVS shall be capable of storing up to five data records described in 6.5, 6.8.3 and 6.9.1.

6.11.7 The MSD and RTA data specified in 6.5, 6.8.3 and 6.9.1 shall be stored in a non-volatile memory of the IVS.

6.11.8 A non-volatile memory of the IVS shall be capable of storing up to 100 MSD sets and up to 5 data sets specified in 6.11.7.

6.11.9 If a non-volatile memory of the IVS intended for storage of data specified in 6.11.8 is completely filled and one more set of data needs be stored, then each new set shall be recorded to that memory in FIFO order.

6.11.8 and 6.11.9 **(Amended Wording, Amendment No. 1).**

6.11.10 The IVS manufacturer shall provide hardware and software solutions suitable for reading and clearing non-volatile memory of the IVS.

The IVS manufacturer shall ensure a proper protection from unauthorised access to system procedures implemented for reading and clearing the contents of the IVS non-volatile memory.

6.12 An in-vehicle emergency call system installed in standard equipment configuration shall support activation of loudspeaker communication mode in the vehicle compartment (cabin) so that all other standard audio playback devices and systems in the vehicle will be muted during the emergency call.

6.13 When technically feasible, in-vehicle emergency call systems installed in auxiliary equipment configuration shall also support the loudspeaker communication mode detailed in 6.13.

6.14 An in-vehicle emergency call system shall enable audio input (using the microphone) and audio output in voice call mode.

6.15 An in-vehicle emergency call system shall support duplex loud voice communications.

**(Amended Wording, Amendment No. 1).**

6.16 An in-vehicle emergency call system/device shall be able to display its own health state and operating mode using an optical status indicator of a red colour that emits uninterrupted (non-blinking) light visible under a daylight as well, and is located within the line-of-sight region from the driver seat and the seat of a passenger next to the driver. When the ignition is started, the said indicator shall switch-on for a short time (from three to ten seconds), and when a fault occurs (or is already present) in the IVS, the indicator shall remain switched on until that fault is not corrected.

The optical indicator complying with the above requirements need not be available if the operational condition of the IVS may be verified using some other optical indicator at each ignition start, and a message on the device fault is output to the instrument set until the fault is not corrected while the ignition on.

6.17 An in-vehicle emergency call system/device shall provide for self-diagnostics.

N o t e – The format of health state data and the rules used to transmit them are established in GOST R 54619.

**(Subsequently Inserted, Amendment No. 1).**

6.17.1 An in-vehicle emergency call system shall activate its self-test function each time the ignition is turned on.

6.17.4 The information on IVS malfunctions that have been detected in each self-test shall be reported to a user by means of a status indicator or indicators (e.g., light alarm, display of appropriate icon or text message visible from the driver seat of the vehicle).

6.17.2, 6.17.3, and 6.17.5 **(Removed, Amendment No. 1)**.

6.17.6 Whenever technically feasible, the following checks during IVS self-tests shall be carried out:

- integrity of software image;
- operational condition of GSM/UMTS communication module interface;
- operational condition of GNSS receiver;
- integrity (dependability) of navigation and timing parameters of GNSS receiver (RAIM function);
- sufficient battery charge level;
- operational condition (correct connection) of external GNSS antenna (if installed);
- operational condition (correct connection) of external GSM/UMTS antenna (if installed);
- operational condition of automatic RTA detector (for vehicles of Categories M1 and N1 only);
- operational condition of UIM;
- proper connection of microphone;
- operational condition of microphone;
- operational condition of loudspeaker (loudspeakers).

N o t e – The technical feasibility of respective checks and the requirements for self-test procedures shall be defined by the vehicle manufacturer in case of standard in-vehicle systems, and by the IVS manufacturer in case of those installed in auxiliary equipment configuration.

6.18 For IVS installed in standard equipment configuration, the IVS interface for interaction with other vehicle systems shall defined by the vehicle manufacturer.

6.19 For IVS installed in auxiliary equipment configuration:

- IVS interface for interaction with vehicle safety systems or with its systems of other types shall be agreed with the vehicle manufacturer;
- IVS interaction with vehicle system may be not provided for (e.g., when an automatic RTA detector (auxiliary equipment) directly connected to the IVS is used).

## 7 Main operating modes of in-vehicle emergency call system

### 7.1 Types of operating modes

7.1.1 The IVS operating modes established in this Standard are related to provision of the base service of ERA-GLONASS road accident response system in accordance with GOST R 54721. This implies that the IVS communication module is not registered in a mobile operator's network until the RTA event is detected.

**(Amended Wording, Amendment No. 1).**

N o t e – If an IVS supports the provision of other services in addition to the base one (e.g., remote control of central vehicle locks, or guarding and tracing services), additional IVS operating modes may be introduced based on the requirements specified for that IVS. In this case, the procedure used for registration of the IVS communication module in a mobile operator's network may be changed.

7.1.2 For IVS installed in auxiliary equipment configuration, the following operating modes are established:

- OFF mode;
- Standby mode;
- ERA mode;
- Emergency Call mode;
- Test mode;
- Service Station mode;
- Software Downloading mode.

7.1.3 The state diagram of an in-vehicle emergency call system installed in auxiliary equipment configuration is shown in Figure 1.

N o t e – The software downloading mode is not included in Figure 1.

7.1.4 For IVS installed in standard equipment configuration, the following operating modes are established:

- OFF mode;
- ERA mode;
- Emergency Call mode;
- Test mode;
- Software Downloading mode.

7.1.5 The state diagram of an in-vehicle emergency call system installed in standard equipment configuration is shown in Figure 2.

N o t e – The Software Downloading mode is not included in Figure 2.

### 7.2 OFF mode

7.2.1 The in-vehicle emergency call system shall be in OFF mode when no external power is present, and the battery is discharged below the permitted level (or no backup battery is connected). The minimum permitted battery level shall be defined by the vehicle manufacturer or the IVS manufacturer.

7.2.2 An IVS shall be switched from OFF mode when the external power is connected.

7.2.3 The IVS switching to OFF mode from other states shall take place either when the backup battery is discharged below the permitted level as stated in 8.11, or when the power supply is turned off (if no backup battery is connected).

### 7.3 Standby mode

7.3.1 Standby mode shall be implemented for IVS installed in auxiliary equipment configuration.

For IVS installed in standard equipment configuration, this mode is optional (not mandatory).

7.3.2 Standby mode is intended for IVS transportation, and for repair or setup works with the system.

7.3.3 The in-vehicle emergency call system shall be in Standby mode if this system is not configured.

N o t e – In this Standard, IVS initialisation (configuration) mode is combined with Standby mode.

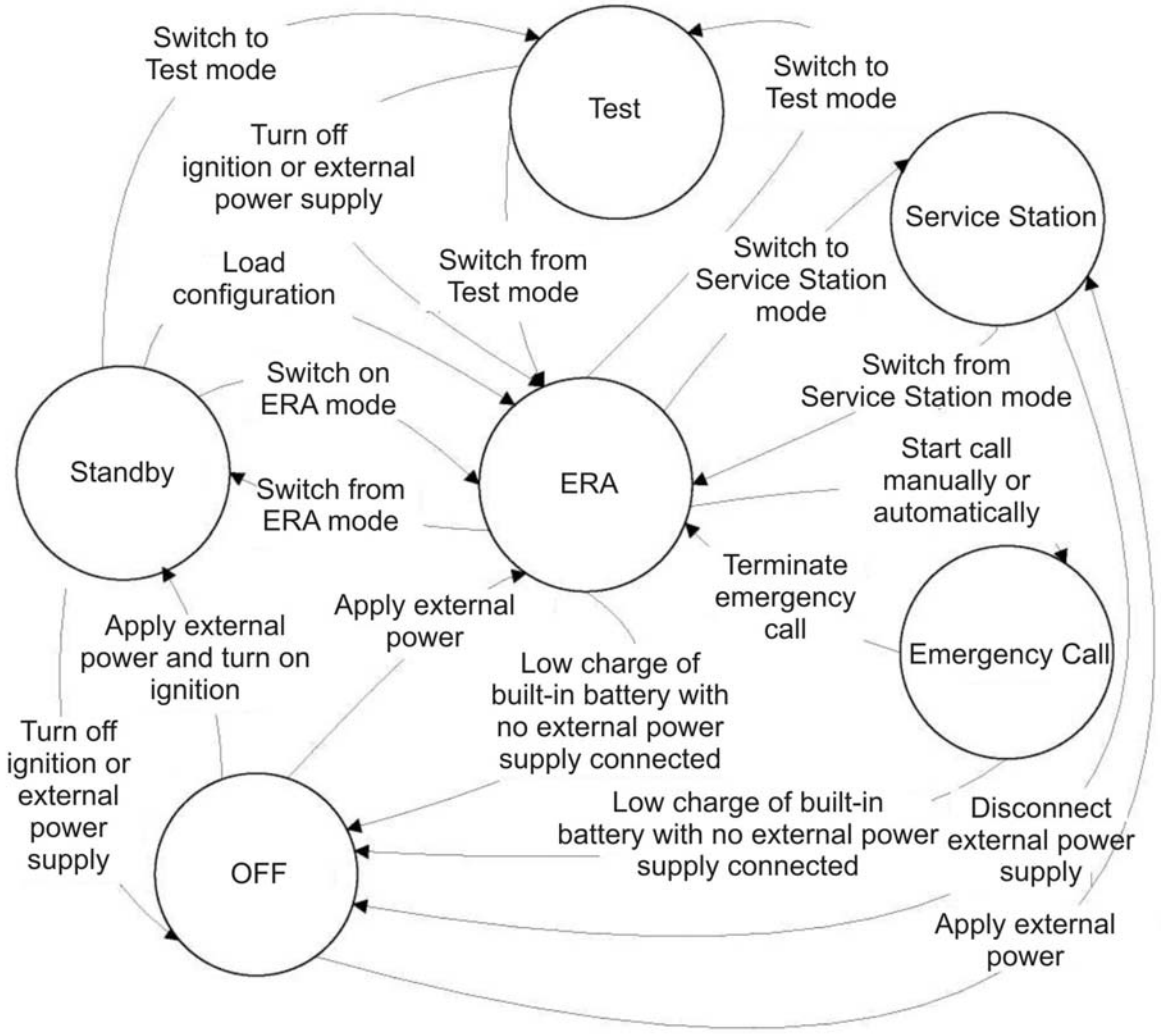



Figure 1 – State diagram of in-vehicle emergency call system in auxiliary equipment configuration

7.3.4 If the external power supply is connected and the ignition is turned on, the IVS shall register itself in the GSM/UMTS network either upon when the "Additional functions" button is pressed (for IVS installed in auxiliary equipment configuration), or by means of user interface implemented in the vehicle (for IVS installed in standard equipment configuration), and shall wait for configuration start command from System Operator. After the configuration start command is received (using ether SMS protocol or packet data transmission), the IVS shall:

- check availability of configuration setting for a given IVS;
- load configuration settings, if any, for the IVS in question;
- save the received configuration settings to non-volatile memory;
- switch to ERA mode.

7.3.5 If the configuration start command was not received, or the received command was ignored, the IVS shall remain in Standby mode until either the respective (preset) timeout expires, or the vehicle ignition is turned off, or the external power is disconnected.

7.3.6 If any critical problem related to IVS operation (e.g., unrecoverable software fault) is found in Standby mode, the IVS shall be restarted, and shall return to Standby mode.

7.3.7 While the IVS is in Standby mode, all other IVS functions (e.g., support of additional services) shall be disabled.

7.3.8 The method used to switch the IVS from standby to Test mode is defined by the IVS manufacturer.

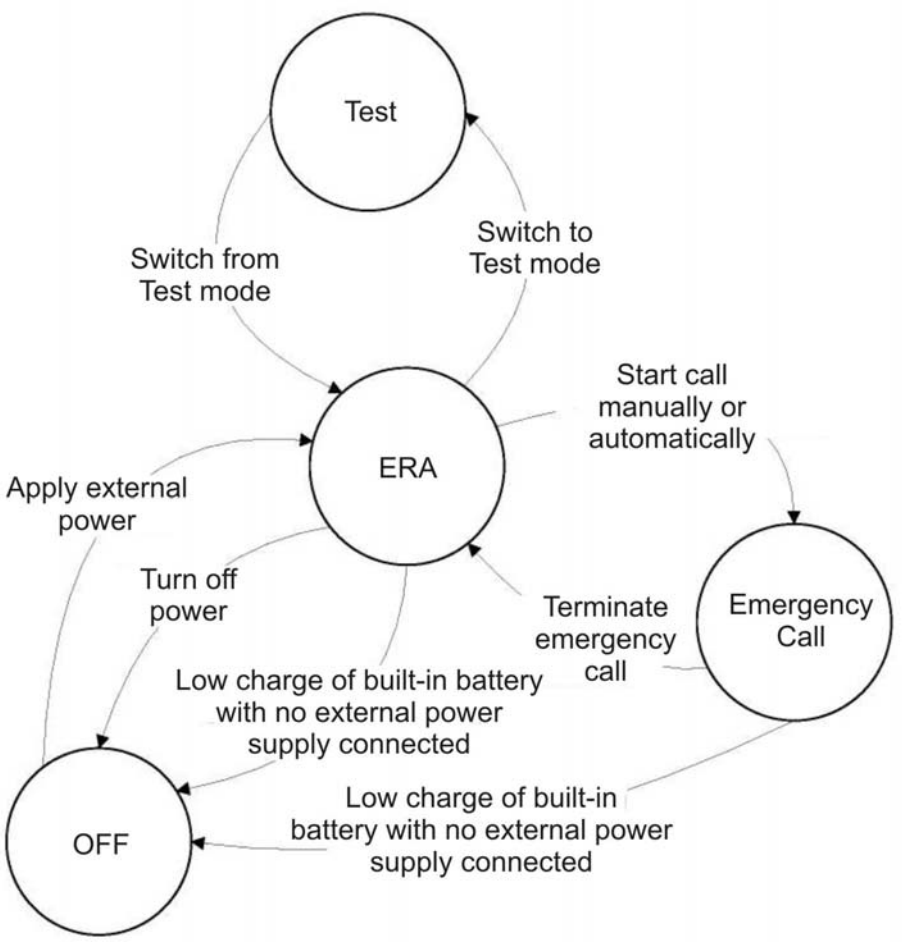



Figure 2 – State diagram of in-vehicle emergency call system in standard equipment configuration

The IVS testing techniques used when the IVS is switched from standby to Test mode, as well as the methods used to report test results, shall be defined by the IVS manufacturer.

The specification of IVS configuration procedure is presented in GOST R 54619.

**7.4 ERA mode**

This mode is used to track and record vehicle parameters, to detect RTA events in automatic mode (for vehicles of Categories M1 and N1 only) and to respond to user's control actions.

**7.5 Emergency Call mode**

7.5.1 Emergency Call mode is intended for starting emergency calls from the IVS side in order to establish IVS voice communication with, and send MSD to, System Operator. After the emergency call, the IVS remains registered in the Operator's network for a time interval defined by the respective setting (Appendix A).

The time from the moment when the accident occurs to the moment when the IVS voice communication with System Operator is initialised shall not exceed 20 s.

**(Amended Wording, Amendment No. 1).**

Should the telephone connection break, the IVS shall restore it taking into account the following requirements:

7.5.1.1 If the disconnection occurs before an AL-ACK acknowledgement as per GOST R 54619 is received by the IVS, and before a 20 s delay assigned for MSD transmission using the in-band modem as per Table 7 expires, the IVS shall re-establish the telephone connection, and shall initiate the MSD retransmission using the in-band modem.

7.5.1.2 If the disconnection occurs after an AL-ACK acknowledgement as per GOST R 54619 is received by the IVS, or after a 20 s delay assigned for MSD transmission using the in-band modem as per Table 7 expires, the IVS shall re-establish the telephone connection, but shall not initiate the MSD retransmission using the in-band modem.

**7.5.2 Signals used to initiate Emergency Call mode (for vehicles of Categories M1 and N1 only)**

7.5.2.1 For IVS installed in auxiliary equipment configuration, a signal source used to initiate Emergency Call mode shall be configurable, and one or two signals shall be selected from the below options:

- signal from acceleration sensor (CRASH_SIGNAL_INTERNAL);
- emergency signal coming from an on-board vehicle system (CRASH_SIGNAL_EXTERNAL).

7.5.2.2 For IVS installed in standard equipment configuration, a signal source used to initiate Emergency Call mode shall be selected by the vehicle manufacturer.

**7.5.3 General requirements for implementation of IVS Emergency Call mode**

7.5.3.1 For IVS installed in auxiliary equipment configuration, the emergency call shall be initiated automatically (for vehicles of Categories M1 and N1 only) when:

- ignition is on, conditions defined in 6.2.3 are satisfied, and the CRASH_SIGNAL_INTERNAL parameter is set to TRUE;
- ignition is off, IGNITION_OFF_FOLLOW_UP_TIME2 interval (configurable value) is expired after ignition turn-off, conditions defined in 6.2.3 are satisfied, and the CRASH_SIGNAL_INTERNAL parameter is set to TRUE;
- on-board vehicle system reports an RTA, ignition is on, and the CRASH_SIGNAL_EXTERNAL parameter is set to TRUE.

7.5.3.2 For IVS installed in standard equipment configuration (for vehicles of Categories M1 and N1 only), the emergency call shall be initiated automatically when the ignition is turned on if an RTA alarm is received from the on-board vehicle system.

7.5.3.3 For IVS installed in auxiliary equipment configuration, an emergency call shall be initiated when SOS_BUTTON_TIME interval (configurable value) expires after the "Emergency call" button press (see 8.8.1.1), regardless of the ignition line state.

7.5.3.4 For IVS installed in standard equipment configuration, the emergency call shall be initiated when a time interval stated by the vehicle manufacturer expires after the "Emergency call" button press, with the ignition turned on for a time interval exceeding the value specified by the vehicle manufacturer.

**(Amended Wording, Amendment No. 1).**

7.5.3.5 While the common emergency number 112 is being dialled in Emergency Call mode, the IVS shall notify the persons present in the vehicle cabin on such dialling, either using the IVS status indicator (see 8.8.2), or by playback of a relevant sound signal or voice message.

7.5.3.6 While the MSD is being transmitted in Emergency Call mode, the IVS shall report that to the persons present in the vehicle cabin, either using the IVS status indicator, or by playback of a relevant sound signal or voice message.

7.5.3.7 Once the MSD has been transmitted before the voice channel connection, the IVS shall notify the persons present in the vehicle compartment (cabin) that the voice channel connection is being established, by playback of a relevant sound signal or voice message.

7.5.3.8 Once the voice channel connection has been established, the IVS shall report that to the persons present in the vehicle compartment (cabin) using the IVS status indicator.

7.5.3.9 The loudspeaker communication in the vehicle compartment (cabin) for the IVS in Emergency Call mode shall correspond to the requirements established in Section 10, and shall provide for duplex voice communication with System Operator in all typical operating conditions of the vehicle (including but not limited the following noise scenarios: operation in silence, operation under ambient traffic acoustic noise, vehicle parking, vehicle moving, windows closed, windows opened).

7.5.3.10 Right after the loudspeaker communication in Emergency Call mode is started, the rated receiving loudness level shall be set in the vehicle regardless of the initial position of the IVS volume control and regardless of the previous status of the automatic gain control (if present).

The rated receiving loudness level (constant for systems with no volume controls and initial for systems with manual or automatic gain controls) described by the receiving loudness rating $RLR_{nom}$ shall ensure that the duplex voice communication with System Operator is reliable in all typical operating conditions of the vehicle, including those where interfering acoustic noises are present in the vehicle compartment (cabin).

The required $RLR_{nom}$ value shall be specified by the manufacturer based on the requirement that the receiving loudness level must be sufficient for reliable duplex loudspeaker communication with the acoustic receiving signal-to-noise ratio (SNR) not less than 6 dB in "normal" noise situations [The latter depend on the vehicle category (type) and on the noise scenario. If the requirements to noise types and levels are not specified by the vehicle manufacturer, the minimum sound pressure level of background noises in the vehicle compartment shall be taken equal to minus 24 dbPa(A)].

The selected $RLR_{nom}$ value shall be in the range from (minus $6 \pm 4$) dB to ($2 \pm 4$) dB. The recommended $RLR_{nom}$ value is (minus $6 \pm 4$) дБ.

7.5.3.11 If a manual or automatic volume control is available for Emergency Call mode, the IVS user or the IVS itself shall not be able to decrease the receiving loudness level below a smallest value sufficient for duplex loudspeaker communication at an SNR of at least 0 dB in "typical" noise situations [The latter depend on the vehicle category (type) and on the noise scenario. If the requirements to noise types and levels are not specified by the vehicle manufacturer, the minimum sound pressure level of background noises in the vehicle compartment shall be taken equal to minus 24 dbPa(A)].

The minimum receiving loudness level is defined by either the IVS manufacturer or the vehicle manufacturer, and described by the maximum receiving loudness rating $RLR_{max}$.

The selected $RLR_{max}$ value shall be in the range from ($0 \pm 4$) dB to ($8 \pm 4$) dB. The recommended $RLR_{max}$ value is ($2 \pm 4$) dB.

7.5.3.12 In Emergency Call mode, the use of a microphone for loudspeaker communication in the vehicle compartment (cabin) shall be of top priority, and neither the IVS users nor the IVS itself shall be able to disable the microphone.

In other IVS operating modes where the microphone may be disabled (using "mute" function), the microphone shall be switched to transmission automatically as soon as Emergency Call mode is entered, regardless on its initial status, and the IVS shall forcibly mute all other sound-reproducing equipment installed in the vehicle compartment (cabin) (excluding equipment for special communication).

7.5.3.9 to 7.5.3.12 **(Amended Wording, Amendment No. 1).**

7.5.3.13 After Emergency Call mode is left, the IVS shall remain registered in the GSM/UMTS network for a time interval determined by the NAD_DEREGISTRATION_TIME setting.

7.5.3.14 Emergency Call mode and all IVS functions related to support of the ERA-GLONASS base service shall be accessible if emergency calls have been enabled, and the IVS configuration has been completed.

7.5.3.15 Emergency Call mode and all IVS functions related to support of the ERA-GLONASS base service (excluding configuration and setup functions) shall be inaccessible if emergency calls have been disabled or the IVS configuration has not been completed.

7.5.3.14 and 7.5.3.15 **(Amended Wording, Amendment No. 1).**

7.5.3.16 Emergency Call mode shall be switched to ERA mode when the voice call is terminated, and to OFF mode when the minimum backup battery level is reached (if the backup battery is in use).

7.5.3.17 After Emergency Call mode is left, the IVS shall remain registered in the network for a time interval determined by the NAD_DEREGISTRATION_TIME setting.

7.5.3.18 Switching from Emergency Call mode to Test mode, Service Station mode or Software Downloading mode shall not be possible.

7.5.3.19 to 7.5.3.23 **(Removed, Amendment No. 1)**.

7.5.3.24 If the emergency call can not be made, the IVS user shall be notified using the method specified in 8.9.3.

7.5.3.25 For IVS installed in auxiliary equipment configuration, the ECALL_MODE_PIN hardware output line shall be activated by the in-vehicle system whenever it is in Emergency Call mode.

The requirements for hardware output lines are stated in 5.3.

7.5.3.26 For IVS installed in auxiliary equipment configuration, the ECALL_MODE_PIN hardware output line shall be reset by the in-vehicle system if it is switched to any mode rather than Emergency Call.

7.5.3.27 As soon as the emergency call session is over, the IVS shall answer all incoming calls automatically during not less than 20 min.

**(Amended Wording, Amendment No. 1).**

7.5.3.28 As regards the use of GSM/UMTS mobile networks, the IVS operation shall meet the requirements of [11],[12].

7.5.3.29 The bit 6 and bit 7 values of the Service Category element shall be set in accordance with 9.1.2 and Table 6 based on the emergency call activation method (manual or automatic).

7.5.3.30 The dialling duration value for initiation of emergency calls shall be configurable using the ECALL_DIAL_DURATION setting.

7.5.3.31 The number of dialling attempts for automatic initiation of emergency calls shall be defined by the ECALL_AUTO_DIAL_ATTEMPTS setting.

7.5.3.32 The number of dialling attempts for manual initiation of emergency calls shall be defined by the ECALL_MANUAL_DIAL_ATTEMPTS setting which may not be set to 0.

7.5.3.33 If the emergency call has been initiated manually, the ECALL_MANUAL_CANCANCEL parameter set to TRUE and the connection with System Operator has not been established yet, the call shall be terminated:

- when the "Additional functions" button is pressed (for IVS installed in auxiliary equipment configuration);
- by means of respective user interface implemented for the vehicle (for IVS installed in standard equipment configuration).

7.5.3.34 Each IVS shall allow System Operator to initiate an emergency call by sending an SMS to the IVS address within a time interval the IVS remains registered in the network after it initiated the emergency call. The emergency call attribute (manual or automatic call) shall be set in System Operator's request. Such calls shall be enabled only after the emergency call initiated by the IVS side is over and the IVS remains registered in the network waiting for the response call that may possibly come from the side of System Operator.

7.5.3.35 If the attempt to send the MSD using the in-band modem fails, the IVS shall send it to the operator by SMS transmission to the configurable ECALL_SMS_FALLBACK_NUMBER.

7.5.3.36 Upon the relevant command from System Operator, the IVS shall send its current MSD to him by SMS transmission In such cases, an SMS from System Operator may be received both during the emergency call and after it until the IVS remains registered in the network.

A current MSD shall include the same data as those obtained after the RTA was identified or the call was initialised manually, albeit with updated location (see Appendix B, MSD fields "Vehicle Location", "Recent Vehicle Location n-1" and "Recent Vehicle Location n-2") and driving direction (MSD field "Vehicle Direction") determined for the vehicle state as for the moment when the command from System Operator was received. Given this, the MessageIdentifier shall be incremented by 1 for each subsequent request, and shall be reset to its initial value if a new call from the vehicle is initialised.

The IVS shall send SMS messages to the configurable ECALL_SMS_FALLBACK_NUMBER. Such sending shall be enabled only after the emergency call initiated by the IVS side is over, for a time interval the IVS remains registered in the network waiting for the response call that may possibly come from the side of System Operator.

**(Amended Wording, Amendment No. 1).**

7.5.3.37 Whenever the connection in Emergency Call mode breaks, the IVS shall re-establish it.

7.5.3.38 After the voice communication with System Operator is established (if an external power supply is available), the following DTMF tones shall be output to the telephone line:

- corresponding to symbol "1" – after the first press of the "Emergency call" button;
- corresponding to symbol "1" – after the second press of the "Emergency call" button;
- corresponding to symbol "2" – after the third press of the "Emergency call" button.

The DTMF tone duration shall be 1 s.

Any subsequent presses of the "Emergency call" button during the voice session shall be ignored.

**(Amended Wording, Amendment No. 1).**

7.5.3.39 If an event of vehicle ignition turning off is detected during the emergency call session, the emergency call shall proceed regardless of the ignition line state of the vehicle until it is terminated from the side of System Operator.

7.5.3.40 The dialup in Emergency Call mode shall start no later than 1 s after the registration in the ERA-GLONASS Operator network upon identification of the RTA event or confirmation of the manual activation of the "Emergency call" button.

**(Amended Wording, Amendment No. 1).**

7.5.4 After the RTA event occurrence, the IVS shall ensure correct operation in accordance with the requirements of 13.2.2 and 13.2.3.

**7.6 Test mode**

7.6.1 This mode is intended for checks of IVS operation.

N o t e – The IVS functionality in test mode may be verified in various IVS tests in production, during the IVS conformity assurance to the requirements of [19] and of this Standard, during maintenance of the vehicle in dealers' centres of vehicle manufacturers, or during state technical inspections of the IVS.

**(Amended Wording, Amendment No. 1).**

7.6.2 An IVS may only be switched to Test mode if the action required for such switching is taken on the vehicle side, an external power source is available, no vehicle movement has occurred for the last minute, and the ignition is turned on.

The vehicle manufacturer may specify one or several additional requirements for switching to Test mode in case of standard IVS.

7.6.3 The IVS shall be switched from Test to ERA mode either after the testing session is complete, or when a turning-off event is detected for the ignition or external power.

7.6.4 The message exchange between the IVS and System Operator shall be initiated by calling the ECALL_TEST_NUMBER using the in-band modem.

7.6.5 For an IVS installed in auxiliary equipment configuration, switching to Test from ERA mode shall be performed by pressing the "Additional functions" button.

7.6.6 For an IVS installed in standard equipment configuration, switching to Test to ERA mode shall be performed through the user interface implemented for the vehicle.

The instruction on transition to Test mode with the help of the user interface shall be included in the user manual for the vehicle.

7.6.7 If the IVS is not used for provision of telematic services other than the emergency response service and has been registered in a network by pressing the "Additional functions" button (for IVS installed in auxiliary equipment configuration) or through the user interface implemented for the vehicle (for IVS installed in standard equipment configuration), and the testing procedure has been started, then the IVS shall de-register in the network after the testing procedure terminates.

7.6.8 If the IVS is used for provision of telematic services other than the emergency response service and has been registered in a network by pressing the "Additional functions" button (for IVS installed in auxiliary equipment configuration) or through the user interface implemented for the vehicle (for IVS installed in standard equipment configuration), and the testing procedure has been started, then the IVS behaviour after the completion of the testing procedure shall be defined by:

- IVS manufacturer (for IVS installed in auxiliary equipment configuration);
- vehicle manufacturer (for IVS installed in standard equipment configuration).

7.6.9 If the IVS is not used for provision of telematic services other than the emergency response service and has been registered in a network by pressing the "Additional functions" button (for IVS installed in auxiliary equipment configuration) or through the user interface implemented for the vehicle (for IVS installed in standard equipment configuration), then the successive registration in the network for the specified IVS modifications shall be possible only after a time interval set for the TEST_REGISTRATION_PERIOD parameter expires.

If the TEST_REGISTRATION_PERIOD value is set to "0", no time constraints are imposed on the successive registration of the IVS in the network.

7.6.10 If the IVS is used for provision of telematic services other than the emergency response service and has been registered in a network by pressing the "Additional functions" button (for IVS installed in auxiliary equipment configuration) or through the user interface implemented for the vehicle (for IVS installed in standard equipment configuration), then the rules of successive registration in the network for the specified IVS modifications shall be established by the IVS manufacturer or by the vehicle manufacturer, correspondingly.

7.6.11 If a distance of vehicle movement becomes greater than TEST_MODE_END_DISTANCE while the ignition is turned on, Test mode shall terminate automatically. The distance measurement error in this case shall not exceed 45 m.

If coordinates of the Test mode activation point have not been evaluated, Test mode shall be switched off at the stated distance from a point where the vehicle coordinates were determined for the first time after the ignition had been turned on.

N o t e – If movement data can not be obtained from a GNSS receiver, other methods are permitted for evaluation of the distance covered by the vehicle.

7.6.12 The following tests shall be carried out in Test mode:

- Test of microphone(s) connection(s) and of sending signal loudness level. For example, the IVS may reproduce a voice prompt of a rated level asking the tester at the standard driver's location to pronounce a phrase of a certain length, record the sound clip in its internal memory, and then play it back requesting the tester to press the respective button(s) so as to confirm that the sound clip has been reproduced correctly and at a loudness level sufficient for legible perception of voice;
- Test of loudspeaker(s) connection(s) and of receiving signal loudness level. For example, the IVS may reproduce a voice prompt of a rated level in left and right speakers and ask the tester at the standard driver's location to press the respective button(s) so as to confirm that the sound clip has been reproduced correctly and at a loudness level sufficient for legible perception of the operator's voice in noise conditions existing in the vehicle compartment (cabin);
- Ignition turn on/turn off test for IVS installed in auxiliary equipment configuration. For example, the IVS plays a voice message prompting the tester to turn off and on the vehicle ignition, or the IVS makes a decision if the logics used to evaluate the vehicle ignition line state is operating correctly, based on the ignition state change data received before (e.g., in case that the vehicle ignition line state has changed during a given time interval);
- Extended test of user interface module. For example, the IVS plays a voice message prompting the tester to press the buttons in a certain order. In addition, it plays a voice message prompting him to confirm that the IVS status indicators operate as required;
- Redundant battery test, if testing of the redundant battery state is feasible (the test scope is defined by either the vehicle manufacturer or the IVS manufacturer);
- Functional test of automatic detector (identification mechanism) of RTA events (for vehicles of Categories M1 and N1 only). This test is mandatory for the specified vehicle Category.

N o t e – If a standard in-vehicle system is used as a data source for RTA events, it is permitted to use those performance data of the automatic detector (identification mechanism) of RTA events that have been obtained earlier for a time interval passed after the ignition had been turned on (e.g., the RTA detector status data obtained during the diagnostic check of standard in-vehicle systems that is started when the ignition is turned on).

- Additional checks performed during the self-tests described in 6.17.6.

**(Amended Wording, Amendment No. 1).**

7.6.13 After the IVS tests are complete, their results shall be send to System Operator by calling ECALL_TEST_NUMBER using the in-band modem.

The minimum set of data including IVS test results shall be presented in a test result format complying with that of Appendix C.

7.6.14 The minimum set of data including IVS test results shall be transmitted with the "Test call" attribute set in accordance with Appendix C.

7.6.15 The IVS shall be switched from Test mode:

- after the MSD with IVS test results are transmitted to System Operator;
- when the external power is disconnected;
- when the vehicle (with its ignition off) moves away from the test mode activation point beyond the distance equal to the sum of the value of the configurable setup parameter TEST_MODE_END_DISTANCE and the value three times greater than the error in evaluation of vehicle location in plan as per 8.1.7.

N o t e – Additional requirements for switching from Test mode may be stated in case of standard IVS.

**(Amended Wording, Amendment No. 1).**

7.6.16 Before the IVS is switched from Test mode, it shall report the test results to the tester with the help of the IVS status indicator, or by playing the respective voice message.

The displayed test results shall include information on the test success status, i.e., whether the IVS is in operational condition or not.

**7.7 Service Station mode**

7.7.1 This mode is used to disable all IVS functions while the vehicle is in a Service Centre.

7.7.2 Service Station mode shall be implemented for IVS installed in auxiliary equipment configuration, and is not mandatory for standard in-vehicle systems.

7.7.3 When the IVS is switched to Service Station mode, it shall set the hardware output line GARAGE_MODE_PIN.

When the IVS is switched from Service Station mode, it shall reset the hardware output line GARAGE_MODE_PIN.

7.7.4 All IVS functions related to provision of the ERA-GLONASS base service and to IVS testing shall be disabled when the IVS is in Service Station mode.

7.7.5 Service Station mode shall be exited automatically when the vehicle moves beyond the distance equal to the sum of the GARAGE_MODE_END_DISTANCE parameter value (which is configurable) and the value three times greater than the error in evaluation of vehicle location in plan as per 8.1.7.

If coordinates of the Service Station mode activation point have not been evaluated, this mode shall be switched off at the stated distance from a point where the vehicle coordinates were determined for the first time after the ignition had been turned on.

The distance measurement error shall not exceed 45 m.

N o t e s

1 When the IVS is in Service Station mode, all IVS modules (components) shall be in a switched-off state while the ignition is on.

2 The conditions of IVS transition to Service Station mode are defined by the IVS manufacturer.

3 The conditions of IVS transition from Service Station mode when the ignition is turned on are determined basing on the information received from the navigation module of the IVS.

**(Amended Wording, Amendment No. 1).**

**7.8 Software Downloading mode**

7.8.1 The Software Downloading mode is intended for IVS software updates.

7.8.2 The Software Downloading mode is mandatory.

7.8.3 For IVS installed in auxiliary equipment configuration, the Software Downloading mode using packet data transfer in accordance with the requirements 7.8.4 – 7.8.11 shall be supported.

For IVS installed in standard equipment configuration, the requirements for implementation of the Software Downloading mode shall be defined by the vehicle manufacturer.

**(Amended Wording, Amendment No. 1).**

7.8.4 If the IVS is in ERA or Service Station mode with external power connected, and a System Operator's command for activation of Software Downloading mode arrives, then the IVS shall switch to the said mode and establish the connection with System Operator for the purpose of packet data transmission.

The System Operator's command may be received after any emergency call is complete or after the IVS test terminates, in a time period defined by the POST_TEST_REGISTRATION_TIME setting.

7.8.5 If the IVS is not in ERA or Service Station mode or its external power is not present when it receives System Operator's command for activation of Software Downloading mode arrives, then the IVS shall ignore that command and remain in the mode active before it.

7.8.6 The IVS operation in Software Downloading mode shall correspond to the parameters of the mode active before its switching to Software Downloading mode.

7.8.7 In Software Downloading mode, the IVS shall download software images to IVS RAM using the data exchange protocol established in GOST R 54619.

7.8.8 If the ignition is off after the software downloading is complete, the IVS shall perform the software image update in non-volatile memory followed by a self-test cycle.

7.8.9 If the ignition is on after the software downloading is complete, the IVS shall update the software image update in non-volatile memory, and perform a self-test cycle after the ignition is turned off.

7.8.10 The software image integrity in the IVS non-volatile memory and the protection means against the loss of such integrity shall be ensured in order to make provisions for the following situations:

- errors in communication link between IVS and System Operator;
- broken connection between IVS and System Operator;
- disconnection of external power during software image update in IVS non-volatile memory.

7.8.11 If the IVS is in Software Downloading mode when an emergency call is due, the said mode shall be interrupted, and the downloaded data ignored.

If the software downloading is interrupted by an emergency call, the IVS shall, once that call is complete, send the appropriate data message to System Operator and switch to ERA mode.

## 8 Requirements for components of in-vehicle emergency call system

### 8.1 Navigation receiver (navigation module)

8.1.1 A navigation receiver included in the IVS equipment set may be either built-in into IVS, or external to it (i.e., embedded in other electronic unit installed on the vehicle).

8.1.2 A navigation module included in the IVS equipment set shall be capable of receiving and processing the standard precision signals in L1 range of the GNSS GLONASS System in order to determine the vehicle location coordinates and speed vector components.

8.1.3 A navigation module included in the IVS equipment set may receive and process signals from other GNSS systems (e.g., GPS) to determine the vehicle location coordinates and speed vector components.

8.1.4 A navigation module included in the IVS equipment set shall receive and process the signals of all supported GNSS with the same priority, and use the RAIM function to find those satellites whose data may not be used in calculations of navigation characteristics.

N o t e – When the navigation receiver type is selected for inclusion to the IVS set, preference shall be given to receivers where the planned frequency and content change of GLONASS signals is taken into account.

8.1.5 A GNSS receiver included in the IVS equipment set shall enable evaluation of navigation parameters using the signals received from the GLONASS System only.

8.1.6 A GNSS receiver included in the IVS equipment set shall enable evaluation of navigation parameters either in PZ-90.02 or in WGS-84 coordinate systems. The use of PZ-90.02 is preferable.

**(Amended Wording, Amendment No. 1).**

8.1.7 The limiting errors (with a confidence probability 0.95) shall not exceed:

- planimetric coordinates: 15 m;
- height: 20 m;
- speed vector: 0.1 m/s.

The above accuracy requirements shall be ensured:

- in speed range from 0 to 250 km/h;
- in linear acceleration range from 0 to 2 G;
- under short-time vertical acceleration from 0 to 5 G.
- for values of space geometric factor not exceeding 4;
- under disturbances of zero level or of a level governed by EMC requirements listed in 13.3.

8.1.8 The minimum update interval of navigation data shall not exceed 1 s.

8.1.9 The signal tracking recovery time for the operational NSC constellation after the signals are lost for a time of up to 60 s shall not exceed 5 s from the moment when the NSC visibility is restored.

8.1.10 The time from the moment when the ignition is turned on to the moment when the first navigation solution is received by the GNSS receiver shall not exceed 60 s.

8.1.11 A GNSS receiver included in the IVS equipment set shall provide for:

- search (detection) of GNSS signal at a level of useful signals at antenna input (antenna amplifier input) equal to minus 163 dBW;
- GNSS signal tracking and navigation solution output at a level of useful signals at antenna input (antenna amplifier input) equal to minus 188 dBW.

8.1.12 If a GNSS receiver allows changing the output rate of navigation data, the target output rate shall be set using the GNSS_DATA_RATE parameter by selecting its value from the range specified in Appendix A.

8.1.13 If a GNSS receiver does not allow changing the output rate of navigation data, the rate supported by the receiver shall be within the value range specified for the GNSS_DATA_RATE parameter in accordance with Appendix A.

8.1.14 The minimum elevation angle (cut-off angle) of navigation spacecrafts shall be set using the GNSS_MIN_ELEVATION parameter by selecting its value from the range specified in Appendix A. The default value of this parameter is taken equal to 5 degrees.

8.1.15 The execution of the following functions shall be provided for in GNSS receiver test mode:

- management of GNSS receiver settings using the software of the receiver developer;
- output of navigation and timing data in NMEA-0183 format [5];
- output of autonomous integrity (reliability) monitoring results for navigation definitions, and exclusion of unreliable measurements (RAIM function).

N o t e – The test mode of GNSS receivers is used when the IVS conformity is assessed in part of requirements for GNSS receivers. Such tests assume the use of navigation and timing data in NMEA-0183 format.

8.1.16 For IVS installed in auxiliary equipment configuration, the GNSS receiver shall be powered off after a time interval defined by the GNSS_POWER_OFF_TIME parameter expires from the moment the ignition is turned off.

8.1.17 The navigation module shall ensure conformity to its functional requirements at a useful signal level equal to minus 161 dBW and under exposure to harmonic interferences of the following threshold power levels at the antenna input:

- as per Table 1: for operation using GLONASS signals of standard precision;
- as per Table 2: for operation using GPS signals.

T a b l e 1 – Threshold values of harmonic interference for operation using GLONASS signals of standard precision

| Frequency, MHz | Threshold values of interference level, dBW |
|---|---|
| $F < 1540$ | Minus 15 |
| $1540 < F \leq 1562$ | From minus 15 to minus 50 |
| $1562 < F \leq 1583$ | From minus 50 to minus 90 |
| $1583 < F \leq 1593$ | From minus 90 to minus 140 |
| $1593 < F \leq 1609$ | Minus 140 |
| $1609 < F \leq 1613$ | From minus 140 to minus 80 |

| | |
|---|---|
| 1613 < F ≤ 1626 | From minus 80 to minus 60 |
| 1626 < F ≤ 1670 | From minus 60 to minus 15 |
| F > 1670 | Minus 15 |

Table 2 – Threshold values of harmonic interference for operation using GPS signals

| Frequency, MHz | Threshold values of interference level, dBW |
|---|---|
| F < 1525 | Minus 15 |
| 1525 < F ≤ 1565 | From minus 50 to minus 140 |
| 1565 < F ≤ 1585 | Minus 140 |
| 1585 < F ≤ 1610 | From minus 140 to minus 60 |
| 1610 < F ≤ 1626 | From minus 60 to minus 50 |
| 1626 < F ≤ 1670 | From minus 50 to minus 15 |
| F > 1670 | Minus 15 |

8.1.18 A navigation module shall ensure tracking of GNSS GLONASS and GPS signals when the antenna input is exposed to impulse interferences of parameters listed in Table 3 that are generated in the frequency range of the received GNSS GLONASS and GPS signals of useful signal power level equal to minus 161 dBW.

Table 3 – Impulse interference parameters

| Parameter name | Parameter value |
|---|---|
| Threshold interference level (peak impulse power), dBW | Minus 10 |
| Pulse duration, ms | ≤ 1 |
| Pulse duty ratio | ≥ 10 |

**8.2 GNSS antenna**

8.2.1 Each in-vehicle emergency call system shall be equipped with an external and/or internal antenna used to receive GNSS signals that ensures the required signal reception quality after the IVS is installed on the vehicle.

8.2.2 For IVS in auxiliary equipment configuration, the requirements for external GNSS antennas shall be specified by the IVS manufacturer.

For IVS in standard equipment configuration, the requirements for external GNSS antennas shall be specified by the vehicle manufacturer.

**8.3 GSM/UMTS communication module (modem)**

8.3.1 Each communication module shall operate in two GSM ranges, GSM900 (P-GSM and E-GSM) and GSM1800, support packet data transmission, and provide for control transfer when the range is switched.

**(Amended Wording, Amendment No. 1).**

8.3.2 An GSM 900/1800 communication module shall meet the requirements stated in [10].

8.3.3 Each communication module shall operate in two UMTS ranges, UMTS900 and UMTS2000, with support packet data transmission, and provide for control transfer when the range is switched.

8.3.4 An UMTS 900/2000 communication module shall meet the requirements stated in [11] and [12].

**8.4 Antenna for GSM and UMTS communication module**

8.4.1 Each antenna for the GSM/UMTS communication module shall provide for reliable communication over wireless mobile communication networks of GSM 900, GSM 1800, UMTS 900 and UMTS 2000 standards in any position of the vehicle.

/N o t e – A GSM/UMTS antenna may be external and/or internal with respect to the IVS.

**(Amended Wording, Amendment No. 1).**

8.4.2 At least one antenna (either internal or external) intended for data exchange between the IVS and System Operator shall remain operational after a road accident, in accordance with the requirements established in 13.3.2 and 13.3.3.

8.4.3 For IVS in auxiliary equipment configuration, the requirements for installation of external GSM and UMTS antennas are specified by the IVS manufacturer.

8.4.4 For IVS in standard equipment configuration, the requirements for installation of external GSM and UMTS antennas are specified by the vehicle manufacturer.

**8.5 Built-in SIM chip**

8.5.1 A built-in SIM/USIM chip shall be designed as an MFF2 package conforming to [17], and shall meet the requirements of GOST 18725.

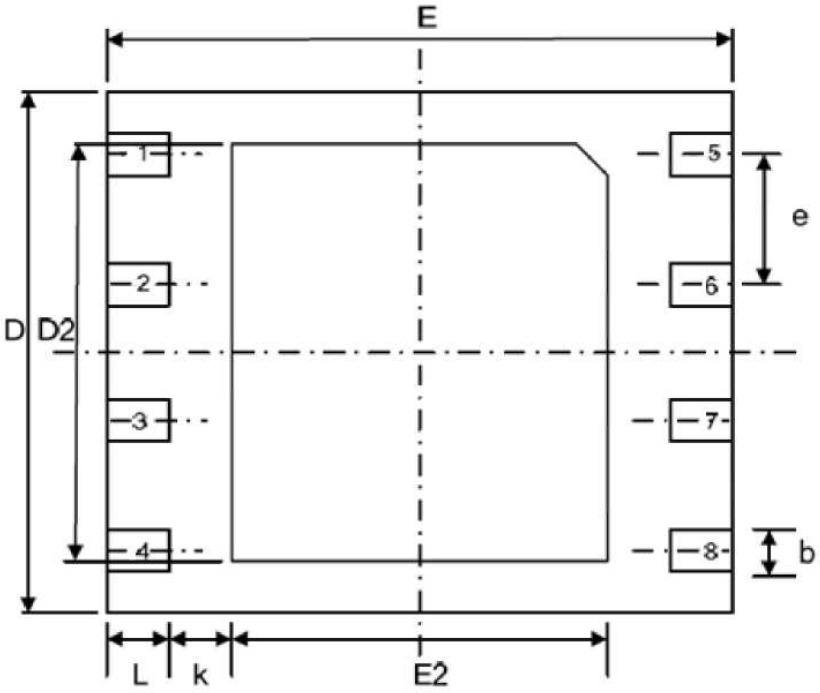



Figure 3 – MFF2 form-factor, bottom view

T a b l e 4 – Specification of contacts

| Item | Description | Size, mm |
|---|---|---|
| E | Horizontal size of package body | 6.00 ± 0.15 |
| D | Vertical size of package body | 5.00 ± 0.15 |
| L | Length of signal contact | 0.60 ± 0.15 |
| b | Width of signal contact | 0.40 ± 0.10 |
| E2 | Horizontal size of heat contact | 3.30 ± 0.15 |
| D2 | Vertical size of heat contact | 3.90 ± 0.15 |
| k | Gap between signal and heat contacts | 0.80 ± 0.10 |
| e | Distance between centrelines of signal contacts | 1.27 |

8.5.2 The SIM/eUICC card shall support operation in wireless mobile communication networks of GSM-900/GSM-1800/UMTS standards.

8.5.3 The guaranteed service life of the SIM/eUICC card shall be at least 10 years (i.e., access to data saved on the card shall be possible during this period).

8.5.4 The SIM/eUICC card shall remain operational in the range of ambient temperatures from minus 40°C to plus 105°C.

8.5.5 The number of read/write cycles before failure shall not be less than 500000 per logical sector.

8.5.6 The SIM/eUICC card shall not itself contain any software or firmware (counters, algorithms or scenarios) that artificially decrease its service life.

8.5.7 The total memory capacity of the SIM/eUICC card shall be at least 64 kB.

8.5.8 The SIM/eUICC card shall be rated for d.c. supply voltages in the range 1.62 to 3.3 V in accordance with the requirements of [17].

8.5.9 The SIM/eUICC card shall include an initialised System Operator profile required for operation with the ERA-GLONASS system, and its internal rewritable card memory shall have a free space sufficient for recording one or several additional profiles for operators of wireless mobile communication networks.

8.5.10 The SIM/eUICC card shall support the following functions of remote software updating:

- OTA downloading of profile data;
- OTA profile initialization and activation;
- OTA operator profile control (switching).

8.5.11 The time required for switching from the System Operator profile to the operator profile of a wireless mobile communication network shall not exceed 3 s.

N o t e – The switching time of the SIM/eUICC card is not taken into account in this requirement.

8.5.12 PIN-code requests shall be deactivated on each SIM/eUICC card.

8.5.13 The SIM/eUICC shall support the following algorithms:

- authentication (COMP128 V1, V2 и V3; GSM-Milenage, Milenage; XOR; AES);
- cryptographic (CRC-32; DES, 3DES; MD5; SHA-1).

8.5.14 In the System Operator profile of the SIM/eUICC card, no such priority criteria shall be included for operators of wireless mobile communication networks that could enable switching the user on a single side to wireless mobile communication networks.

8.5.1 to 8.5.14 **(Amended Wording, Amendment No. 1).**

**8.6 In-band modem**

8.6.1 Each in-band modem shall ensure the MSD transmission within the frame of the established voice connection between the IVS and System Operator.

8.6.2 Each in-band modem shall correspond to the requirements presented in [2].

**8.7 Automatic detector of RTA events (for vehicles of Categories M1 and N1 only)**

8.7.1 For IVS installed in auxiliary equipment configuration, automatic detectors of RTA events, unless installed inside the IVS unit, shall be secured to vehicle elements in a way ensuring that they may be used to measure accelerations of up to 24 G.

A detector shall remain secured and operational under exposure to acceleration of up to 75 G at a point of its fastening for a time interval of duration from 1 to 5 ms.

8.7.2 For IVS installed in auxiliary equipment configuration, automatic detectors of RTA events intended for installation inside the IVS unit shall be delivered with a fastening device (devices) ensuring that the detector may be used to measure accelerations of up to 24 G.

8.7.2.1 An IVS unit shall remain secured and operational under exposure to acceleration of up to 75 G at a point of its fastening for a time interval of duration from 1 to 5 ms.

**(Amended Wording, Amendment No. 1)**

8.7.2.2 **(Removed, Amendment No. 1)**

8.7.3 For IVS installed in auxiliary equipment configuration, any automatic or manual adjustment (calibration) procedure possibly required after the IVS installation for the automatic detector of RTA events shall be included in the installation and setup task list for the IVS.

8.7.4 For IVS installed in auxiliary equipment configuration, any existing restrictions on the arrangement of the IVS or the automatic detector of RTA events inside the vehicle shall be reflected in the documentation for the IVS and specified in the IVS installation manual.

8.7.5 For IVS installed in auxiliary equipment configuration, the procedure used to check proper installation of the automatic detector of RTA events and operational condition of the IVS shall be developed by the IVS supplier and specified in the IVS installation manual. If necessary, the IVS supplier shall provide a tool (tools) used to check proper installation of the automatic detector of RTA events.

8.7.6 When the ignition is turned on, the IVS shall continuously test the correct in-service operation of the automatic detector of RTA events, and report any detector malfunctions whenever they are found.

8.7.6.1 For systems installed in standard equipment configuration, the requirements to testing of the automatic detector of RTA events are defined by the vehicle manufacturer.

8.7.6.2 For systems installed in auxiliary equipment configuration, the requirements to testing of the automatic detector of RTA events are defined by the IVS manufacturer.

**8.8 User interface module**

8.8.1 IVS control buttons

8.8.1.1 A user interface module shall have the "Emergency call" button.

8.8.1.2 For IVS installed in auxiliary equipment configuration, an UIM shall have the "Additional functions" button.

N o t e – The use of other buttons displayed on a touch screen installed in the vehicle is permitted if their functionality is not impaired in the conditions specified in 13.3.

8.8.1.3 For IVS installed in standard equipment configuration, device controls used implemented for the vehicle shall allow the user to start the test mode.

8.8.1.4 If the IVS is in ERA mode, then pressing the "Emergency call" button shall start the emergency call with manual activation attribute as specified in 7.5.3.29.

8.8.1.5 If the IVS installed in auxiliary equipment configuration is in ERA mode, then pressing the "Additional functions" button shall start Test mode as specified in 7.6.

8.8.1.6 If the IVS installed in standard equipment configuration is in ERA mode, and the command for Test mode activation is selected with the help of the user interface, then the said mode shall be started in accordance with 7.6.

8.8.1.7 If the IVS installed in auxiliary equipment configuration is in "Emergency call" mode (automatic activation), then pressing the "Additional function" button shall be ignored.

8.8.1.8 If the IVS installed in standard equipment configuration is in ERA mode, the emergency call has been activated manually whereas the connection to System Operator has not yet been established, then the termination of the emergency call shall be enabled by the user interface implemented in the vehicle.

8.8.1.9 If the IVS is in OFF or Service Station mode, any press of the "Emergency call" button shall be ignored.

8.8.1.10 If the IVS is in OFF or Service Station mode, the response to presses of the "Additional function" button is defined:

- by the IVS manufacturer (for IVS installed in auxiliary equipment configuration);
- by the vehicle manufacturer (for IVS installed in standard equipment configuration).

8.8.1.11 If the IVS is in Test mode, pressing the "Emergency call" button shall start the test call to a dedicated number as specified in 7.6.4 и 7.6.13.

**(Amended Wording, Amendment No. 1)**

8.8.1.12 If the IVS installed in auxiliary equipment configuration is in Test mode, the IVS response to presses of the "Additional function" button is defined by the IVS manufacturer.

8.8.1.13 If the IVS installed in auxiliary equipment configuration is in Standby mode, then any press of the "Emergency call" button shall be ignored.

8.8.1.14 The "Emergency call" button shall be protected from its inadvertent pressing.

For IVS installed in auxiliary equipment configuration, such built-in protection, as well as the interface for interaction between the IVS and the UIM, is defined by the IVS manufacturer.

For IVS installed in standard equipment configuration, such built-in protection, as well as the interface for interaction between the IVS and the UIM, is defined by the vehicle manufacturer.

8.8.1.15 The "Emergency call" button shall remain mounted and operational during the tests of compliance to the requirements established in 13.3.2.

8.8.1.16 The "Emergency call" button shall be installed in a place within direct visibility from the seats of the driver and the passenger next to him, who are considered as male persons of 50-percentile representation level (if the vehicle design provides for a seated passenger next to the driver), and this button shall be readily accessible by them without the need to disconnect their safety belts.

8.8.1.14 and 8.8.1.17 **(Amended Wording, Amendment No. 1)**

8.8.1.17 **(Removed, Amendment No. 1)**

8.8.1.18 If the "Emergency call" button is implemented as a touch screen button, it shall be accessible after at most one pass from one screen to another, and the requirements of 8.11.3 shall be met.

8.8.1.19 The "Emergency call" button shall be equipped with backlighting.

**(Subsequently Inserted, Amendment No. 1).**

8.8.2 The user interface module shall have an indicator or indicators for visual display of the IVS status.

N o t e – The use of standard in-vehicle systems is permitted for indication of the IVS status provided that the functionality of such systems is not compromised under the mechanical impacts listed in 13.3.

**8.9 Status of the optical indicator of in-vehicle emergency call system**

8.9.1 An IVS status of the optical indicator(s) shall remain secured and operational during the tests of compliance to the requirements established in 13.3.2.

8.9.2 The in-vehicle emergency call system shall display its health status and the operating mode using an optical status indicator of a red colour that emits uninterrupted (non-blinking) light visible under a daylight as well, is located within the line-of-sight region from the driver seat and the seat of a passenger next to the driver, and meets the criteria established in 8.8.1.16. When the ignition is started, the said indicator shall switch-on for a short time (from three to ten seconds), and when a fault occurs (or is already present) in the IVS, the indicator shall remain switched on until that fault is not corrected.

N o t e – The optical indicator complying with the above requirements need not be available if the operational condition of the IVS may be verified using some other optical indicator at each ignition start, and a message on the device fault is output to the instrument set until the fault is not corrected while the ignition on.

**(Amended Wording, Amendment No. 1).**

8.9.3 The following IVS status conditions shall be displayed using the status of the optical indicator:

- failure;
- inability to make emergency calls (to be reported only when an emergency call is attempted);
- dialling in Emergency Call mode;
- MSD transmission in Emergency Call mode;
- voice connection in Emergency Call mode;
- test mode;
- Service Station mode (for systems installed in auxiliary equipment configuration only);

8.9.4 For IVS installed in standard equipment configuration, the status of the optical indicator(s) and their interface with the IVS are implemented as specified by the vehicle manufacturer.

8.9.5 For IVS installed in auxiliary equipment configuration, the status of the optical indicator(s) and their interface with the IVS are implemented as specified by the IVS manufacturer.

8.9.3 to 8.9.5 **(Amended Wording, Amendment No. 1).**

**8.10 Internal non-volatile memory and internal RAM**

8.10.1 Each in-vehicle emergency call system shall be equipped with internal non-volatile memory for storage of MSD messages.

8.10.2 The internal memory shall be capable of storing at least 100 messages contain MSD sets.

8.10.3 to 8.10.8 **(Removed, Amendment No. 1).**

Table 5 **(Removed, Amendment No. 1)**.

8.10.9 Prior to initialisation of the emergency call and transmission of the MSD using an in-band modem, the IVS shall save the respective MSD message in its internal non-volatile memory.

8.10.10 to 8.10.15 **(Removed, Amendment No. 1)**.

8.10.16 A message shall be removed from the IVS internal memory after the successful reception of that message is acknowledged from the System Operator side (in case it was send using an in-band modem), or after the successful transmission of the SMS-message containing the MSD.

8.10.17 **(Removed, Amendment No. 1)**.

8.10.18 If a message could not be send to System Operator, its transmission shall be suspended for a time interval equal to INT_MEM_TRANSMIT_INTERVAL.

8.10.19 If the message transmission has been suspended in accordance with the requirements stated in 8.10.18, and the time interval INT_MEM_TRANSMIT_INTERVAL has expired, then the repeated transmission of that message shall be attempted using SMS.

8.10.20 If the number of message transmission attempts has exceeded the value set for the INT_MEM_TRANSMIT_ATTEMPTS parameter, all further attempts shall be terminated.

**(Amended Wording, Amendment No. 1).**

8.10.21 The internal memory contents shall survive after the IVS is turned off.

8.10.22 The IVS implementation shall support reading and clearing its internal non-volatile memory contents using a diagnostic interface. A data exchange interface used to read and clear the contents of the IVS internal non-volatile memory by means of the said diagnostic interface is designed:

- by the IVS manufacturer – for systems implemented in auxiliary equipment configuration;
- by the vehicle manufacturer – for systems implemented in standard equipment configuration.

**8.11 Backup battery and power supply**

8.11.1 If no external (on-board) power source is available for IVS installed in auxiliary equipment configuration, the backup battery shall be used as a power supply.

8.11.2 If the use of the standard vehicle battery can not ensure the IVS operation in tests against the requirements stated in 13.3, and no external power is available, then the IVS manufactured in standard equipment configuration shall use the backup battery as a power supply.

N o t e – For IVS installed in standard equipment configuration, the IVS need not be switched to the backup battery each time the standard battery supply fails: it shall be done only when an accident event must be identified.

8.11.3 After an RTA event is detected in case of IVS installed in auxiliary equipment configuration or in case of standard systems designed to make use of backup batteries, the backup battery shall provide for the IVS registration in a network, for transmission of messages required in Emergency Call mode, for 1 h of the IVS idle time waiting for the response call, and for 10 min of voice communications at the sound volume specified in 7.5.3.9.

The conformity to the above requirements shall be checked after the backup battery has been charging for 24 h. The backup battery charging, and the test of system operation time under its power supply from the backup battery, shall be carried out at a constant ambient temperature of 20° C. No requirements for the power supply of external sensors are specified in the latter test (for example, in regard to the automatic detector of RTA events).

The backup battery shall ensure the IVS operation when used as a power source in case that no external power supply is available, and shall be operational in the temperature range from minus 20°C to plus 85°C. The service life of the backup battery in permitted vehicle operating conditions at a temperature from minus 20° C to plus 85° C shall be stated in the IVS user manual.

**(Amended Wording, Amendment No. 1).**

8.11.4 If an external power is available when the minimum permitted level of the backup battery charge is reached, the IVS shall inform the user that the minimum permitted level of the backup battery charge is reached, either using the IVS status indicator or playing an audio tone/voice prompt regarding that.

8.11.5 The built-in power supply of the IVS shall be capable of starting the IVS once an external power becomes available after the backup battery is discharged.

8.11.6 For those IVS that are installed in auxiliary equipment configuration and make use of a backup battery, the charging of such battery shall take place in any IVS modes where the ignition is on.

8.11.7 For those IVS that are installed in standard equipment configuration, and make use of a backup battery, the rules used to charge such battery are specified by the vehicle manufacturer.

8.11.8 If a backup battery is used, its charging conditions shall be specified by either the IVS manufacturer or the vehicle manufacturer, and such specification shall ensure that the main battery will not discharge prematurely.

8.11.9 The service life of backup batteries and the recommended procedures of their replacement shall be presented in the IVS documentation.

N o t e – For standard in-vehicle systems, an authorised Service Centre is assumed to perform the replacement of backup batteries after the expiration of their service life.

8.11.10 If a non-rechargeable backup battery is used, then the procedure of its replacement after the expiration of its service life shall be detailed in the IVS documentation. In addition, visual or audible warnings shall be provided for the case when such replacement is necessary.

N o t e – Common IVS fault indication may be used in case that the battery replacement is necessary.

8.11.4, 8.11.8 and 8.11.10 **(Amended Wording, Amendment No. 1).**

## 9 Requirements for data transmission interfaces and data transmission formats

### 9.1 General requirements for data transmission

9.1.1 In Emergency Call mode, the MSD transmission between the vehicle and the System Operator of the ERA GLONASS System shall be carried out in the voice channel using the in-band modem. If the MSD transmission in the voice channel breaks, the IVS shall use the redundant channel to transmit the MSD by means of the SMS mechanism.

**(Amended Wording, Amendment No. 1).**

9.1.2 When the data are transmitted in Emergency Call mode, the IVS shall set the bit 6 and bit 7 values in the Service Category element (which initiate either automatic or manual emergency calls) in accordance with Figure 4 and with the bit pattern detailed in Table 6.

The remaining bits of the Service Category element shall be set to 0.

9.1.3 The minimum set of data transmitted using the in-band modem shall have a structure described in Appendix C.

| Bit number | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|
| Byte 1 | | Data element identifier | | | | | | |
| Byte 2 | Length of Service Category element | | | | | | | |
| Byte 3 | 0 | Value of Service Category element | | | | | | |
| | reserved | | | | | | | |

Figure 4 – Service Category element

T a b l e 6 – Bit values of Service Category element

| Bit number | Meaning |
|---|---|
| 1 | Police |
| 2 | Medical service |
| 3 | Fire service |
| 4 | Maritime help service |
| 5 | Mountain help service |
| 6 | Manual call |
| 7 | Automatic call |
| 8 | Reserved (0 by default) |

9.1.4 The MSD transmission using the IVS in-band modem shall meet the requirements of [2].

9.1.5 The requirements on the contents and formats of data and commands transmitted between the IVS and System Operator are specified in Table 7.

9.1.6 Should the data transmission fail in the voice channel using the in-band modem, the IVS shall ensure the voice communication with emergency services, and the data transmission using the SMS mechanism in parallel with the voice communication.

9.1.7 A single SMS shall be sent in the case described in 9.1.6. The criterion of successful SMS transfer shall be the absence of information at the IVS side in regard to any error(s) that may have occurred during such transfer.

9.1.8 If the information on any error(s) during the SMS transfer is available at the IVS side in the case described in 9.1.6, the message containing the MSD shall be saved into the IVS internal memory in accordance with 8.10.

**9.2 Contents of messages sent between in-vehicle emergency call system and System Operator**

9.2.1 The message exchange between the IVS and System Operator is carried out in the following directions:

- from IVS to System Operator: for transmission of telematic messages (e.g., RTA acceleration profile data, if the IVS supports the respective function);
- from System Operator to IVS:

1) for transmission of control commands (e.g., requests to repeat the "Emergency call");

2) for transmission of IVS configuration parameters;

3) for transmission of data intended for software updates, if the IVS supports the completion of such updates using packet data transmission.

The message transfer protocol used for message transmission between the IVS and System Operator shall correspond to GOST R 54619.

9.2.2 and 9.2.2.1 to 9.2.2.7 **(Removed, Amendment No. 1)**.

9.2.3 For systems manufactured in auxiliary equipment configurations, settings shall be configurable at System Operator's discretion by selecting either SMS mechanisms or packet data transmission as long as the system remains registered in the network after the emergency call and after transmission of test results.

For systems manufactured in standard equipment configuration, the requirements for remote configuration management shall be defined by the vehicle manufacturer.

Т а б л е 7 – Requirements for contents and formats of data and commands

| Data and commands | Sending party | Receiving party | Data transmission method | Remarks |
|---|---|---|---|---|
| MSD with RTA data | IVS | System Operator | In-band modem | Main method of RTA data transmission in the ERA-GLONASS System. |
| Command for transmission of MSD with RTA data using the in-band modem | System Operator | IVS | In-band modem | |
| Command for transmission of MSD with RTA data using SMS | System Operator | IVS | SMS | Redundant method of data transmission in the ERA-GLONASS System. MSD sets are send in SMS messages automatically from the IVS side in case of failed attempts of their transmission using the In-band modem or in case of System Operator requests[4]. |
| MSD with RTA data | IVS | System Operator | SMS | |
| Acceleration profile during RTA[1]; RTA severity assessment[2]; vehicle motion path during RTA | IVS | System Operator | Packet data transmission | Format and rules of data/command transmission shall be as per GOST R 54619 |
| IVS configuration parameters[5] | System Operator | IVS | Packet data transmission, SMS | |
| Updated software versions[3] | System Operator | IVS | Packet data transmission | |
| Command for repeated emergency call | System Operator | IVS | SMS | |
| MSD with IVS test results | IVS | System Operator | In-band modem | Data transmission format is defined in Appendix C |
| Command for network de-registration | System operator | IVS | SMS | Data/command format and transmission rules shall comply with GOST R 54619 |

1) The transmission of RTA acceleration profiles is mandatory for systems installed in auxiliary equipment configuration, if the system does not provide RTA severity assessment data. The transmission of RTA acceleration profiles is not mandatory for standard in-vehicle systems.

2) For standard in-vehicle systems, RTA severity assessment data are transmitted only where technically feasible.

3) The implementation of Software Downloading mode is not mandatory for standard in-vehicle systems. This mode may be supported as agreed between the vehicle manufacturer and System Operator.

4) When the data are transmitted in the voice channel using the in-band modem, the transmission shall be considered to fail if no acknowledgment of correct data transfer is received at the IVS side within 20 s after the start of data transmission.

5) The IVS remote configuration management function is not mandatory for standard in-vehicle systems. This function may be supported as agreed between the vehicle manufacturer and System Operator.

**9.3 Modes used for registration of in-vehicle emergency call systems/devices in System Operator network**

9.3.1 If the IVS only supports the base service as per GOST R 54721, then it shall register in the Operator network in ERA and Passive modes (see Section 7) in accordance with the requirements for "Emergency Call Only" mode ("eCall only mobile station") as stated in [20 (subsection 10.7)]:

- with vehicle ignition on;
- with vehicle ignition off for the time period IGNITION_OFF_FOLLOW_UP_TIME2 after its switching off (for IVS installed in auxiliary equipment configuration).

9.3.2 If the IVS supports the base service as per GOST R 54721 as well as additional services, then the IVS behaviour as regards the network registration is specified by:

- IVS manufacturer (for IVS installed in auxiliary equipment configuration);
- vehicle manufacturer (for IVS installed in standard equipment configuration).

9.3.3 If the IVS supports the base service as per GOST R 54721 as well as additional services, and the requirements for provisions of additional services do not provide for network registration in specific conditions, then the IVS registration in the System Operator network shall be carried out in accordance with the requirements of 9.3.1.

9.3.4 Regardless of the network registration status prior to "Emergency call" mode (see Section 7), the IVS shall immediately register in the System Operator network when switching to such mode.

9.3.5 After leaving "Emergency call" mode, the IVS shall remain registered in the System Operator network until the period specified by the NAD_DEREGISTRATION_TIME setup parameter expires, or until a network de-registration command is received.

9.2.3 to 9.3.5 **(Amended Wording, Amendment No. 1).**

## 10 Requirements for quality of loudspeaker communication in vehicle cabin

10.1 After the IVS is installed and configured in the vehicle compartment (cabin), the loudspeaker communication shall correspond to the minimum performance type for duplex communication as specified in Table 8, and shall conform to the minimum requirements listed in Appendix H.

10.2 The recommendations for selection of vehicle electro-acoustic elements that ensure the required sound quality are presented in Appendix I.

10.1 and 10.2 **(Amended Wording, Amendment No. 1).**

10.3 The need for automatic gain control algorithms to be used for receiving (sending) soundness level management shall be considered by the IVS manufacturer (for in-vehicle systems manufactured in auxiliary equipment configuration), or by the vehicle manufacturer (for in-vehicle systems manufactured in standard equipment configuration).

If any AGC algorithms are implemented in the IVS for receiving (sending), then such algorithms shall meet the minimum requirements of Appendix J in order to ensure the proper quality of loudspeaker communication.

**(Amended Wording, Amendment No. 1).**

Т а б л е 8 – Minimum performance of duplex communication

| IVS type | Speaker and microphones in use | Receiving loudness level | Minimum performance type for duplex communication of IVS |
|---|---|---|---|
| IVS in standard equipment configuration | Defined by vehicle manufacturer | Nominal receiving loudness rating, RLR = $RLR_{nom}$ | 2a |
| | | Maximum receiving loudness rating, RLR= $RLR_{min}$ | 2b |
| IVS in auxiliary equipment configuration | Built-in (front) vehicle speakers and microphone as defined by IVS manufacturer | Nominal receiving loudness rating, RLR = $RLR_{nom}$ | 2a |
| | | Maximum receiving loudness rating, RLR= $RLR_{min}$ | 2b |
| | Additional speaker or microphone as defined by IVS manufacturer | Nominal receiving loudness rating, RLR = $RLR_{nom}$ | 2a |
| | | Maximum receiving loudness rating, RLR= $RLR_{min}$ | 2b |

N o t e s

1 The nominal receiving loudness level $RLR_{nom}$ is specified by IVS or vehicle manufacturer in accordance with 7.5.3.10, and shall be within the range from (minus 6±4) dB to (2±4) dB. The recommended $RLR_{nom}$ value is (minus 6±4) dB.

2 The minimum receiving loudness level $RLR_{min}$ is specified by IVS or vehicle manufacturer in accordance with H.4 (Appendix H), and shall be within the range from (minus 18±4) dB to (minus 10±4) dB. The recommended $RLR_{min}$ value is (minus 13±4) dB.

3 For IVS in standard equipment configuration of vehicles that pass their type approval until January 1, 2017, the use of the minimum performance type 2b for duplex communication is permitted at the nominal receiving loudness rating.

Т а б л е 9 – Minimum performance of wide-band IVS

| IVS type | Loudspeakers in use | Volume level of incoming signals | Minimum performance type |
|---|---|---|---|
| IVS installed in standard equipment configuration | Defined by vehicle manufacturer | Nominal (the RLR parameter shall be equal to (2 ± 2) dB) | 2a |
| | | High (the RLR parameter shall be equal to minus (13 ± 2) dB) | 2b |
| IVS installed in auxiliary equipment configuration | Built-in (front) vehicle loudspeakers | Nominal (the RLR parameter shall be equal to (2 ± 2) dB) | 2a |
| | | High (the RLR parameter shall be equal to minus (13 ± 2) dB) | 2b |
| | Additional installed loudspeaker | Nominal (the RLR parameter shall be equal to (2 ± 2) dB) | 2b |
| | Additional installed loudspeaker | High (the RLR parameter shall be equal to minus (13 ± 2) dB) | 2c |

N o t e – If the required volume level of incoming signals RLR equal to minus (13 ± 2) dB may not be achieved for the IVS, the performance shall be measured at the maximum possible volume level.

Table 10 – Maximum permitted signal attenuation

In decibels

| Performance type | | | | |
|---|---|---|---|---|
| Full duplex | Partial duplex | | | No duplex |
| 1 | 2a | 2b | 2c | 3 |
| ≤ 5 | ≤ 8 | ≤ 11 | ≤ 13 | > 13 |

10.4 The switchover time required to remove the attenuation introduced by the non-linear processor in outgoing and incoming directions shall be within the limits specified in [3] and [4] for narrow-band and wide-band IVS, correspondingly.

10.5 An IVS shall enable the automatic gain control of outgoing signals for the purpose of compensation of low signal levels that may occur in an RTA (for example, when the driver speaks in the direction different from the microphone pattern). The gain increase by 6 dB shall be achieved within no more than 200 ms. The tests shall be performed under the noise leading to SNR levels less than 15 dB. No erroneous gain shall be observed when the signal is not present (only when the noise is applied).

10.6 An IVS shall enable the automatic gain control of incoming voice signals by up to 15 dB depending on the noise level in the vehicle compartment (cabin). The gain increase by 6 dB shall take place not later than 2 s after the respective change in the noise level.

10.7 The signal delay in outgoing and incoming directions (the sum of signal delays in such directions) shall be within the limits stated in [3] and [4] for narrow-band and wide-band IVS, correspondingly.

10.8 The echo attenuation (TCLw) shall be by 50 dB in ambient silence conditions, or by a greater value at the rated volume level. At the maximum volume level, the attenuation TCLw shall exceed 50 dB.

## 11 Requirements for electric power supply and for energy consumption

11.1 An IVS shall be powered from the on-board vehicle power supply system rated for a voltage of either 12 V or 24 V, or it shall support both 12 V and 24 V voltages at the same time, as per GOST R 52230.

An IVS shall remain operational under variations of the (mean) working power supply voltage in the range from minus 10% to plus 25% of its nominal value.

11.2 An IVS shall remain operational after the nominal power supply voltage of reverse polarity is applied for 5 minutes.

11.3 An IVS shall ensure protection of external electric circuits from their shortening on power supply terminals.

11.4 When powered from a 12 V (24 V) power supply source, the (peak) energy consumption of IVS in auxiliary equipment configuration shall not exceed the following values depending on the IVS operating mode:

11.4.1 In Emergency Call mode when the GSM network is in use, the current consumption shall not exceed 1500 mA at 12 V (or 1200 mA at 24 V) if an external loudspeaker rated for 8 Ohm/5 W is connected (and if the backup battery charging rate is not taken into account).

Note – The external loudspeaker specifications (i.e., 8 Ohm and 5 W) are given as a reference for the purpose of evaluating the conditions where the declared current consumption shall be ensured. The specifications of the actual loudspeaker used in the product may differ from the specified ones.

11.4.2 In ERA mode with the ignition turned off after the emergency call is complete and the IVS waiting for the response call from System Operator (with the automatic detector of RTA events turned on for vehicles of Categories M1 and N1 only, the GNSS receiver off, the GSM/UMTS module on, and the IVS registered in a network but not transmitting any data or voice), the current consumption shall not exceed 10 mA.

11.4.3 In ERA mode, within a time interval defined by the IGMTION_OFF_FOLLOW_UP_TIME1 setting after the ignition turning-off (with the automatic detector of RTA events turned on for vehicles of Categories M1 and N1 only, the GNSS receiver off, and the GSM/UMTS module off), the current consumption shall not exceed 1 mA.

11.4.4 In ERA mode, after a time interval defined by the IGMTION_OFF_FOLLOW_UP_TIME1 setting expires since the ignition turning-off (with the automatic detector of RTA events turned off for vehicles of Categories M1 and N1 only, the GNSS receiver off, and the GSM/UMTS module off), the current consumption shall not exceed 100 μA.

11.5 The requirements on energy consumption for IVS manufactured in standard equipment configuration shall be specified by the vehicle manufacturer.

## 12 Diagram for connection of in-vehicle emergency call system to on-board audio system

12.1 The diagram used to connect IVS in auxiliary equipment configuration to on-board audio systems of vehicles shall be specified by the IVS manufacturer, and shall be agreed with the vehicle manufacturer when required.

The recommended (example) diagram used for IVS connection to the on-board audio system is shown in Appendix D.

12.2 The diagram used to connect IVS in standard equipment configuration to on-board audio systems of vehicles shall be specified by the vehicle manufacturer.

## 13 Requirements for resistance to external conditions

**13.1 General requirements for resistance to external conditions**

13.1.1 An in-vehicle system/device shall meet the requirements for resistance to external conditions stated in 13.2 – 13.4 and the requirements established in [19 (Appendix 10, clause 118)]

13.1.2 and 13.1.3 **(Removed, Amendment No. 1)**.

**13.2 Requirements for resistance to climatic factors**

13.2.1 An IVS shall ensure that its parameters take the rated values under its exposure to normal climatic environmental factors as per GOST R 52230 (subsection 4.2):

- ambient air temperature of (25 ± 10) °C;
- relative humidity from 45 % to 80 %;
- atmospheric pressure from 84.0 to 106.7 kPa (from 630 to 800 mm Hg).

13.2.2 An IVS shall correspond to operating conditions used for climatic modifications У or ХЛ as per GOST R 52230 (subsection 4.7) and GOST 15150 at a minimum operating temperature of minus 40°C.

13.2.3 The IVS protection from ingress of foreign objects and moisture shall correspond to Class IP52 as per GOST 14254.

For vehicles of Categories M1 and N1 only: if an IVS installed in auxiliary equipment configuration makes use of an external detector of RTA events, the ingress protection of that detector shall correspond to Class IP67 as per GOST 14254.

13.2.4 Regarding the resistance to climatic influences, and IVS shall correspond to the requirements of GOST R 50905, GOST R 52230, GOST R 52456 and GOST 16019.

IVS are attributed to Group B4 as per GOST R 52230 and GOST 16019-2001 (subsection 4.1).

13.2.5 In accordance with the requirements of GOST R 52230 (subsection 4.12), each IVS shall be stable and durable when operated in the following range of ambient temperatures:

- minimum operating temperature: minus 40°C;
- maximum operating temperature: plus 85 °C.

If a backup battery is used in the IVS, the requirements on the temperature range apply to that battery as well. If a rechargeable battery is used, then the power supply from, and the charging of, the battery need not take place at a "very low" and a "very high" temperatures. The values of the "very low temperature" and the "very high temperature" shall be stated by either the vehicle manufacturer or the IVS manufacturer.

13.2.6 In accordance with the requirements of GOST R 52230 (subsection 4.14), an IVS shall be operational when the atmospheric pressure is decreased to 61 kPa (457.5 mm Hg) which corresponds to the pressure at an elevation of 4000 m above the sea level.

An IVS intended for use on cargo vehicles operating at elevations of up to 4650 m above the sea level shall be operational when the atmospheric pressure is decreased to 57 kPa (427.5 mm Hg).

13.2.7 An IVS shall withstand the effects of damp thermal environments corresponding to GOST R 52230 (subsection 4.13) for 4 days at a temperature of (40 ± 2) °C and a relative humidity of (95 ± 3) %.

13.2.8 The visual appearance of IVS paint coatings shall correspond to the requirements of design documents, and external parts shall be resistant to fuels and lubricants.

13.2.9 An environment where the IVS operates shall be explosion safe, and shall not contain current conducting dust, aggressive gases and vapours in concentrations that may damage electronic products or electrical insulation.

13.2.10 An IVS in its packaging container shall be durable when transported by any types of vehicles excluding the aircraft with unsealed compartments, to any distance according to the requirements of GOST R 52230 (subsections 4.2, 8.4).

13.2.11 The IVS test requirements and test parameters as per GOST R 52230 and GOST 16019 as regards the exposure to climatic factors are listed in Table 11.

13.2.12 The IVS test against the requirements of 13.2.1 – 13.2.11 shall be carried out in accordance with GOST R 54618.

**(Subsequently Inserted, Amendment No. 1).**

T a b l e 11 – Influencing climatic factors

| Influencing factor | Test parameters | Influencing factor | |
|---|---|---|---|
| | | Value | Permitted deviation |
| Stability under decreased temperature for modification of hardness degree 2 (IP52) | Operating temperature, °C | minus 40 | ±3 |
| | Time of thermal exposure, h | 3 | - |
| Durability under decreased temperature for modification of hardness degree 2 (IP52) | Limiting temperature, °C | minus 40 | ±3 |
| | Time of thermal exposure, h | 3 | - |
| Stability under increased temperature for modification of hardness degree 2 (IP52) | Operating temperature, °C | plus 85 | ±3 |
| | Time of thermal exposure, h | 3 | - |
| Durability under increased temperature for modification of hardness degree 2 (IP52) | Operating temperature, °C | plus 85 | ±3 |
| | Time of thermal exposure, h | 3 | |
| Durability under temperature changes for modification of hardness degree 2 (IP52) | Temperature range, °C | from minus 40 to plus 85 | ±3 |
| | Time of exposure in chamber at each temperature value, h | 3 | - |
| | Number of cycles | 3 | - |
| | Limiting temperature, °C | minus 40 | ±3 |
| | Time of thermal exposure, h | 3 | - |
| Stability and durability under increased temperature in continuous mode for modification of hardness degree 2 (IP52) | Relative humidity, % | 95 | ±3 |
| | Temperature, °C | plus 40 | ±3 |
| | Time of exposure, h | 144 | - |

**13.3 Requirements for resistance to mechanical impacts**

13.3.1 In accordance with the requirements of GOST R 52230 (subsection 4.20) and GOST 16019, an IVS shall be operational and shall reveal no damages or breakages after its exposure to vibration and shock loads specified in Table 12.

**(Amended Wording, Amendment No. 1).**

T a b l e 12 – Vibration and shock loads

| Evaluated IVS property | Test parameters | Influencing factor | |
|---|---|---|---|
| | | Value | Permitted deviations |
| Stability under exposure to sinusoidal vibration | Frequency range, Hz | 10-70 | ±1 |
| | Acceleration amplitude, $m/s^2$ (g) | 39.2 (4) | ±2(0.2) |
| | Time of exposure in each of three directions, min | 30 | - |
| Durability under exposure to sinusoidal vibration | Frequency range, Hz | 50 | ±1 |
| | Acceleration amplitude, $m/s^2$ (g) | 49(5) | ±2 (0.2) |
| | Time of exposure in each of three directions, min | 2 h 40 min each | - |
| Stability under exposure to repeated mechanical shocks | Peak shock acceleration, $m/s^2$ (g) | 98(10) | ±20% |
| | Shock duration, ms | 10 | - |
| | Number of shocks in each of three directions | 333 | - |
| Durability under exposure to repeated mechanical shocks | Peak shock acceleration, $m/s^2$ (g) | 98 (10) | ±20% |
| | Shock duration, ms | 10 | - |
| | Number of shocks in each of three directions | 3333 | - |
| Durability under to mechanical shocks during transportation | Peak shock acceleration, $m/s^2$ (g) | 250 (25) | ±20% |
| | Shock duration, ms | 6 | - |
| | Number of shocks in each of three directions | 4000 | - |
| Stability to single mechanical shocks* | Single shock, g | 75 | - |
| | Shock duration, ms | 1-5 | - |
| * The tests are carried out for in-vehicle emergency call systems manufactured in auxiliary equipment configuration | | | |

13.3.2 According to the requirements established in [19], each in-vehicle emergency call system shall ensure the following:

a) automatic MSD transmission upon operation of airbag(s) or on signals of sensor(s) that belong to other components of passive safety systems or to other vehicle systems, used to identify vehicle acceleration during the tests as per UNECE Regulations [6] and [7] (for vehicles these Regulations apply to; for Category N1 vehicles, the tests as per UNECE Regulations [6] are substituted by the tests as per UNECE Regulations [21]);

b) preservation of operational condition, including operational condition of duplex voice communication with the emergency services, after the tests specified in item a) of 13.3.2

13.3.2a The in-vehicle emergency call system shall remain secured, and retain its operational condition under loads used in the dynamic tests as per UNECE Regulations [18] and described by the parameters conforming to [18 (Supplement to Annex 9)].

**(Subsequently Inserted, Amendment No. 1).**

13.3.3 The vehicle manufacturer (for standard IVS) and IVS manufacturer (for IVS installed in auxiliary equipment configuration) shall take all conceivable measures that may be required to ensure proper IVS operation after an RTA. The scope of such works is determined by the vehicle manufacturer and the IVS manufacturer, respectively. Whenever any IVS components responsible for operation of the sound channel (e.g., loudspeaker or microphone), the IVS shall provide for correct execution of all functions other than those used to ensure duplex voice communication between the vehicle compartment and System Operator.

13.3.4 Tests of the in-vehicle emergency call system/device that are performed against the requirements specified in Table 12 shall be carried out in accordance with GOST R 54618 (section 7).

13.3.5 Tests of the in-vehicle emergency call system/device that are performed against the requirements specified in 13.3.2 shall be carried out in accordance with GOST R 55532 (subsection 6.6).

13.3.6 Tests of the in-vehicle emergency call system/device that are performed against the requirements specified in 13.3.2a shall be carried out in accordance with GOST R 54618 (clause 7.2.8)

13.3.4 to 13.3.6 **(Subsequently Inserted, Amendment No. 1).**

**13.4 Electromagnetic compatibility requirements**

13.4.1 An IVS shall be resistant under its exposure to interferences conducted along power circuits as described in GOST 28751. The rigidity level of test pulses and the IVS functional condition in the respective tests shall correspond to Table 13.

T a b l e 13 – Rigidity level of test pulses and functional condition of system

| Test pulse | Rigidity level | IVS functional condition |
|---|---|---|
| 1 | IV | A |
| 2 | | |
| 3a | | |
| 3b | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| N o t e – The abovementioned requirements apply to IVS supplied in auxiliary equipment configuration as well as to standard IVS installed in those vehicles where electro-mechanical regulators are used in electrical systems. | | |

13.4.2 The emission level and voltage levels of all disturbance types generated by an IVS as per GOST 28751 for on-board power supply networks rated for 12(24) V shall not exceed the following values:

- emission level: I;
- peak voltage value for disturbances of type 1: minus 15(35) V;
- peak voltage value for disturbances of type 2: 15(15) V;
- peak voltage value for disturbances of type 3: from minus 15(25) V to 15(25) V.

13.4.3 An IVS shall be resistant under its exposure to interferences conducted in control and signal on-board circuits as per GOST 29157. The required rigidity level of test pulses and the IVS functional condition in the respective tests shall correspond to Table 14.

T a b l e 14 – Rigidity level of test pulses and functional condition of system

| Test pulse | Rigidity level | IVS functional condition |
|---|---|---|
| 1 | IV | A |
| 2 | | |
| 3a | | |
| 3b | | |

13.4.4 An IVS shall be resistant under its exposure to (contact and air) electrostatic discharges as per GOST R 50607 (subsection 4.1) of the following parameters:

- contact discharges of test voltages ±4; ±6; ±7; ±8 kV;
- air discharges of test voltages ±4; ±8; ±14; ±15 kV.

13.4.5 The RF disturbance voltage at IVS power supply terminals shall not exceed the reference limiting values established in GOST 28279 (section 2) and GOST 30429 (section 2) for device group 1.1.1.

13.4.6 The reference limits of narrow-band and wide-band electromagnetic disturbances emitted by the IVS in the frequency range from 30 to 1000 MHz shall not exceed the values stated in [9] (subsections 6.5 and 6.6).

13.4.7 An IVS shall be resistant under its exposure to electromagnetic emissions in the frequency range from 20 to 2000 MHz for field strengths selected depending on the test method stated in [9] (subsection 6.7).

13.4.8 Tests of the in-vehicle emergency call system/device that are performed against the requirements specified in 13.4.1 – 13.4.7 shall be carried out in accordance with GOST R 54618 (section 5).

**(Subsequently Inserted, Amendment No. 1).**

## Section 14 (Removed, Amendment No. 1).

## 15 Reliability requirements

15.1 An IVS shall conform to the reliability requirements of GOST R 50905.

15.2 The IVS reliability shall be evaluated in terms of the following criteria:

- basic IVS components shall support around-the-clock operation;
- IVS time between failures shall be at least 10000 hours;
- guaranteed IVS operating life shall be at least 3 years;
- IVS service life at least 7 years, except for backup battery;
- guaranteed storage life shall be at lest 1 year provided that the IVS is stored in a standard package, and the heated rooms with no aggressive substances and vapours present are used for it.

## 16 Design requirements

16.1 The IVS design as well as its dimensional and mounting parameters, including those of external components, shall be agreed with the vehicle manufacturers.

16.2 The following shall be on each IVS body:

- designation and/or conventional (trade) name of electronic module;
- factory number in the manufacturer's numbering system;
- year of manufacture;
- market circulation sign.

N o t e – The details pertaining to marking of connectors shall be included in the IVS documentation specified in 21.2.

**(Amended Wording, Amendment No. 1).**

## 17 Ergonomic and industrial aesthetics requirements

The ergonomic and industrial aesthetics requirements shall be specified by:

- vehicle manufacturer, for IVS manufactured in standard equipment configuration;
- IVS manufacturer, for IVS manufactured in auxiliary equipment configuration.

## 18 Safety and ecological protection requirements

18.1 An IVS and its components shall be create no safety risks during their storage, transportation and operation, and shall meet the sanitary and hygienic norms.

18.2 The driver protection of Class III from electric shocks shall be ensured during IVS operation, as required in GOST 12.2.007.0.

18.3 The use of inflammable materials, or of those producing harmful substances when burning, is forbidden for IVS manufacture, as required in GOST 12.1.044.

## 19 Marking

19.1 The IVS marking shall comply with the requirements specified in Section 16, shall be clearly visible, and shall correspond to the requirements of the IVS assembly drawing in regard to contents, location and method of marking.

19.2 The IVS marking shall be durable for all IVS life, mechanically strong, and not subject to wear.

## 20 Packaging

Packaging shall correspond to the requirements of IVS design documents.

## 21 Requirements for delivery sets and document packages

**21.1 Delivery sets**

21.1.1 An IVS delivery set for IVS in auxiliary equipment configuration shall include:

- IVS, and any IVS mounting kit(s);
- IVS user interface module and any UIM mounting kit(s);
- cable for IVS connection with UIM;
- automatic detector of RTA events with its connecting cable, and acceleration sensor mounting kit(s) (unless that sensor is installed inside the IVS body), for vehicles of Categories M1 and N1 only.

N o t e – The latter applies if a standard on-board device such as an airbag control module is not used for detection of RTA events.

- microphone (microphone set) with connecting cables and mounting kit(s);
- cable(s) for IVS connection to vehicle electronics (adapter for specific vehicle type);
- backup battery;
- loudspeaker for voice communication, its mounting kit(s) and connecting cable (optional).

21.1.2 Any combination of IVS components may be installed in the same body (e.g., main unit and additional loudspeaker combined in a single body).

21.1.3 The IVS delivery set for standard equipment configuration shall be specified by the vehicle manufacturer.

**21.2 Documentation**

21.2.1 The following documents shall be supplied with an IVS in auxiliary equipment configuration:

- installation manual;
- configuration and testing manual;
- IVS user manual;
- brief booklet describing IVS use;
- IVS passport.

21.2.2 The documentation package for IVS in standard equipment configuration is determined by the vehicle manufacturer.

## 22 Logos

22.1 The "Emergency call" button and the optical status indicator of each in-vehicle emergency call system shall contain the image of the "Emergency call" icon. The latter image designed in accordance with [13] is shown in Figure 5. The optical status indicator of the IVS may be structurally combined with the "Emergency call" button.

**(Amended Wording, Amendment No. 1).**


Figure 5 – "Emergency call" icon image

22.2 The "Additional functions" button shall bear the "Additional functions" icon image presented in Figure 6.

Figure 6 – "Additional functions" icon image

22.3 For IVS installed in auxiliary equipment configuration, the main IVS unit, IVS user manual and brief booklet describing IVS use shall be marked with the ERA-GLONASS icon shown in Figure 7.

Figure 7 – ERA-GLONASS icon image

## Appendix A
## (normative)

## Configuration parameters of in-vehicle emergency call system

The IVS configuration parameters that shall be supported for IVS intended use are listed in Table A1.

Table A.1

| Parameter name | Unit of measurement | Parameter type or range[2)] | Initial parameter value | Parameter description | Applicability[1)] | Setting may be changed[4)] |
|---|---|---|---|---|---|---|
| Radio mute | | | | | | |
| RADIO_MUTE_DELAY | Milliseconds | INT | 0 | Delay from activation of "radio mute" signal to sound playback start | AE | Yes |
| RADIO_UNMUTE_DELAY | Milliseconds | INT | 0 | Delay from deactivation of "radio mute" signal to sound playback stop | AE | Yes |
| **General-purpose settings** | | | | | | |
| CALL_AUTO_ANSWER_ TIME | Minutes | INT | 20 | Time interval after emergency call completion when IVS responds to incoming calls automatically | AE, SE | Yes |
| POST_TEST_ REGISTRATION_TIME | Seconds | INT | 120 | Time interval IVS remains registered in the network after transmitting test results to System Operator | AE, SE | Yes |
| TEST_MODE_END_ DISTANCE | Metres | INT | 300 | Distance where Test mode is switched off automatically | AE, SE | Yes |
| GARAGE_MODE_END_ DISTANCE | Metres | INT | 300 | Distance where Service Station mode is switched off automatically | AE | Yes |
| ECALL_TEST_NUMBER | | STRING | 112 | Telephone number used for test calls of eCall | AE, SE | Yes |

*Table A.1 (continued)*

| Parameter name | Unit of measurement | Parameter type or range[2)] | Initial parameter value | Parameter description | Applicability[1)] | Setting may be changed[4)] |
|---|---|---|---|---|---|---|
| GARAGE_MODE_PIN | | ENUM {NONE, PIN1 -PIN8} | NONE | Line indicating that the System is in Service Station mode:<br>- NONE – Service Station mode is not active;<br>- PIN_X – PIN_X line is active when System is in that mode | AE | Yes |
| INT_MEM_TRANSMIT_ INTERVAL | Minutes | INT | 60 | Time interval between transmission attempts of a message stored in IVS internal memory. Zero value not permitted. | AE, SE | Yes |
| INT_MEM_TRANSMIT_ ATTEMPTS | | INT | 10 | Number of retransmission attempts for a message stored in IVS internal memory. Zero value means that no retransmission attempts are made. | AE, SE | Yes |
| **Configuration and service configuration data** | | | | | | |
| **ERA-GLONASS Base Service (eCall service)** | | | | | | |
| CRASH_SIGNAL_ INTERNAL | | BOOLEAN | TRUE | Vehicles of Categories M1 and N1 only: set if an internal acceleration sensor is used to detect RTA events | AE | Yes |
| CRASH_SIGNAL_ EXTERNAL | | BOOLEAN | FALSE | Vehicles of Categories M1 and N1 only: set if an external acceleration sensor of the vehicle is used to detect RTA events | AE | Yes |
| ASI15_TRESHOLD | | REAL | 1.8 | Vehicles of Categories M1 and N1 only: operation threshold of automatic detector of RTA events | AE | Yes |
| ECALL_MODE_PIN | | ENUM {NONE, PIN1 .. PIN8} | NONE | Line indicating that the System is in eCall mode:<br>- NONE – eCall mode is not active;<br>- PIN_X – PIN_X line is active when System is in that mode | AE | Yes |
| SOS_BUTTON_TIME | Milliseconds | INT | 200 | Time the "Emergency call" button must be pressed for activation of Emergency Call mode | AE | Yes |
| CCFT | Minutes | INT | 60 | Setting of automatic call termination counter (60 min) | AE, SE | Yes |
| MSD_MAX_ TRANSMISSION_TIME | Seconds | INT | 20 | Maximum MSD transmission time (20 s) | AE, SE | Yes |

*Table A.1 (continued)*

| Parameter name | Unit of measurement | Parameter type or range[2)] | Initial parameter value | Parameter description | Applicability1) | Setting may be changed[4)] |
|---|---|---|---|---|---|---|
| NAD_DEREGISTRATION_ TIMER | Hours | INT (greater than or equal to 720) | 2 | Time interval to expire before GSM and UMTS module deregisters in a network | AE, SE | Yes |
| ECALL_NO_AUTOMATIC_T RIGGERING | — | BOOLEAN | FALSE | Parameter used to disable automatic initialisation of emergency calls | AE, SE | YES |
| ECALL_DIAL_DIRATION | Minutes | INT | 5 | Total duration of dialling for emergency call initiation | AE, SE | Yes |
| ECALL_AUTO_DIAL_ ATTEMPTS | | INT | 10 | Vehicles of Categories M1 and N1 only: number of dialling attempts in case of automatic initiation of emergency call. Zero value not permitted. | AE, SE | Yes |
| ECALL_MANUAL_DIAL_ ATTEMPTS | | INT | 10 | Number of dialling attempts in case of manual initiation of emergency call. Zero value not permitted. | AE, SE | Yes |
| ECALL_MANUAL_CAN_ CANCEL | | BOOLEAN | TRUE | TRUE – emergency call initiated manually, and may be stopped from user side | AE, SE | Yes |
| ECALL_SMS_FALLBACK_ NUMBER | | STRING | 112 | Number used by IVS to send SMS with MSD upon System Operator request | AE, SE | Yes |
| **Test mode** | | | | | | |
| TEST_REGISTRATION_ PERIOD | Minutes | INT | 5 | If IVS has been registered in a network using "Additional functions" button, then any successive network registration of IVS using this button is not possible until this interval expires. If set to zero, no restrictions on later network registration of IVS are imposed. | AE, SE | Yes |
| **Acceleration profile recording in case of RTA** | | | | | | |
| IGNITION_OFF_FOLLOW_ UP_TIME1 | Minutes | INT | 120 | Time duration allocated for recording of RTA acceleration profile after the ignition is turned off | AE | Yes |
| IGNITION_OFF_FOLLOW_ UP_TIME2 | Minutes | INT | 240 | Time duration allocated for RTA identification while after the ignition is turned off | AE | Yes |

*Table A.1 (continued)*

| Parameter name | Unit of measurement | Parameter type or range[2)] | Initial parameter value | Parameter description | Applicability[1)] | Setting may be changed[4)] |
|---|---|---|---|---|---|---|
| CRASH_RECORD_TIME | Milliseconds | INT /0 - 250 | 250 | Time of RTA acceleration profile recording | AE | Yes |
| CRASH_RECORD_RESOLUTION | Milliseconds | INT /1 - 5 | 1 | Sample rate of RTA acceleration profile recording | AE | Yes |
| CRASH_PRE_RECORD_TIME | Milliseconds | INT /0 - 20000 | 3500 | Time of RTA acceleration profile recording before RTA occurrence | AE | Yes |
| CRASH_PRE_RECORD_RESOLUTION | Milliseconds | INT / 5 - 100 | 5 | Sample rate of RTA acceleration profile recording before RTA occurrence | AE | Yes |
| **Other parameters** | | | | | | |
| GNSS_POWER_OFF_TIME | Milliseconds | INT | 500 | Time interval to expire from ignition turning-off to power disconnection of GNSS receiver | AE | Yes |
| GNSS_DATA_RATE | Hertz | INT/1, 2, 5, 10 | 1 | Data output rate of GNSS receiver | AE, SE | No |
| GNSS_MIN_ELEVATION | Degrees | INT/5-15 | 5 | Minimum elevation (cut-off angle) of navigation spacecrafts | AE, SE | No |
| **Vehicle parameters** | | | | | | |
| VIN | | STRING | Defined at IVS configuration stage | VTN to be defined in accordance with [1] | AE, SE | No |
| VEHICLE_TYPE | | INT | | Vehicle Category, bits 4-0:<br>00001 – passenger car (Category M1)<br>00010 – bus (Category M2)<br>00011 – bus (Category M3)<br>00100 – light cargo vehicle (Category N1)<br>00101 – heavy cargo vehicle (Category N2)<br>00110 – heavy cargo vehicle (Category N3)<br>00111 – motor cycle (Category L1e)<br>01000 – motor cycle (Category L2e)<br>01001 – motor cycle (Category L3e)<br>01010 – motor cycle (Category L4e)<br>01011 – motor cycle (Category L5e)<br>01100 – motor cycle (Category L6e)<br>01101 – motor cycle (Category L7e) | AE, SE | No |

*Table A.1 (continued)*

| Parameter name | Unit of measurement | Parameter type or range[2)] | Initial parameter value | Parameter description | Applicability[1)] | Setting may be changed[4)] |
|---|---|---|---|---|---|---|
| VEHICLE_PROPULSION_ STORAGE_TYPE | | INT | | Vehicle propulsion storage type<br>If all bits are zero, no type is set.<br>Bit 7: unused<br>Bit 6: unused<br>Bit 5: 1 – hydrogen<br>Bit 4: 1 – electricity (above 42 V and 100 A.h)<br>Bit 3: 1 – liquid propane (LPG)<br>Bit 2: 1 – liquefied natural gas (CNG)<br>Bit 1: 1 – diesel<br>Bit 0: 1 – gasoline | AE,SE | No |

1) Value "AE" in this column means that the respective parameter is mandatory only for IVS installed on the vehicle in auxiliary equipment configuration.

Value "AE, SE" in this column means that the respective parameter is mandatory both for systems installed in auxiliary equipment configuration and for those installed in standard equipment configuration.

2) Parameter ranges (intervals) vs. parameter type:

- INT: 0 - 65535;
- BOOLEAN: TRUE, FALSE;
- STRING: 255 characters.

3) Data format – as per GOST R 54619.

4) Value "Yes" in this column means that the initial IVS parameter value may change after initial IVS setup, value "No" means that the initial parameter settings are not subject to changes during IVS useful life.

**(Amended Wording, Amendment No. 1).**

## Appendix B
## (recommended)

### Description of accident severity assessment method for vehicles of Categories M1 and N1

The following step-by-step procedure is recommended for evaluation of accident severity if the IVS installed in auxiliary equipment configuration is used.

B.1 Keep a continuous record of acceleration data ($a_x$, $a_y$, $a_z$) (see 6.2.3) received from the 3D acceleration sensor for each of the three directions (x, y, z) bound to the vehicle coordinate system. Perform the sampling of current acceleration values ($a_x$, $a_y$, $a_z$) at a sampling rate of 100 Hz.

B.2 Detect the RTA event based on the data from the 3D acceleration sensor installed in the vehicle.

B.3 Using the $ASI_{15}$ value, determine the maximum acceleration amplitude for a time interval indicative for events that occur during the accident (150 ms).

B.4 Compare the obtained ASI value with the ASI15_TRESHOLD setting indicated in Appendix A. The limiting ASI value equal to ASI15_TRESHOLD defines the IVS operation for detection of RTA event moment. Values equal to or greater than ASI15_TRESHOLD correspond to RTA events that may possibly lead to high probability of life and health hazards for those present in the vehicle cabin, whereas those less than ASI15_TRESHOLD indicate that the RTA event is not potentially dangerous to their life and health.

A parallel recording of acceleration sensor readings in two data arrays intended for at least 150 ms of data is recommended. The duration of each record should be 150 ms, and the second record should be time-shifted by 75 ms with respect to the first one. Each acceleration component should be processed by the CFC60 filter. This redundancy of acceleration sensor records is intended for accurate evaluation of acceleration peaks and, as a consequence, of peak $ASI_{15}$ values.

The methods used to detect RTA events and their severity in case of IVS installed standard equipment configuration are determined by the vehicle manufacturer.

**(Amended Wording, Amendment No. 1).**

## Appendix C
## (normative)

## Minimum set of data

**C.1 Data presentation**

C.1.1 A minimum set of data shall be presented in terms of Abstract Syntax Notation One in accordance with GOST R ISO/IEC 8824-1 and GOST R ISO/IEC 8825-2 using unaligned packed encoding.

C.1.2 The position and types of individual data elements within the general data structure shall be defined in accordance with GOST R ISO/IEC 8824-1 and GOST R ISO/IEC 8825 based on information stated in C.3.

C.1.3 The data sequence shall correspond to the requirements established in C.2.

**C.2 Minimum set of data**

C.2.1 The structure of the minimum set of data containing standard data identical to the ones used in eCall is shown in Table C.1.

**(Amended Wording, Amendment No. 1).**

Т а б л е C.1 – Structure of minimum set of data containing standard data

| Data block number | Data block name | Data block type | Status | Data block description |
|---|---|---|---|---|
| 1 | ID | Integer (1…255) | M | MSD data format version. All subsequent versions shall be compatible with the previous ones. Systems that receive MSD sets shall support all standardised MSD versions. |
| 2 | Message Identifier | Integer (1…255) | M | Message identifier starting with 1 for each new emergency call session, and incremented by 1 for each repeated MSD transmission. |
| 3 | Control | — | M | Control data |
| | AutomaticActivation | BOOLEAN | M | Activation type:<br>- true – automatic call;<br>- false – manual call. |
| | Test Call | BOOLEAN | M | Call type<br>- true – test call;<br>- false – emergency call. |
| | Position Can Be Trusted | BOOLEAN | M | Reliability of identified location (coordinates) for vehicle:<br>- true – vehicle location (coordinates) identified with an error not exceeding ±150 m and a confidence probability of 95 %;<br>- false – otherwise. |
| | Vehicle Type | ENUM | M | Vehicle categories (Regulation to encode vehicle types is defined in C.3):<br>- passenger vehicle (Category M1)<br>- buses (Category M2)<br>- buses (Category M3)<br>- light trucks (Category N1)<br>- cargo vehicles (Category N2)<br>- cargo vehicles (Category N3)<br>- motor cycles (Category L1e)<br>- motor cycles (Category L2e)<br>- motor cycles (Category L3e)<br>- motor cycles (Category L4e)<br>- motor cycles (Category L5e)<br>- motor cycles (Category L6e)<br>- motor cycles (Category L7e) |
| 4 | VIN | STRING(17) | M | Vehicle identification number in accordance with [22] |

*Table C.1 (continued)*

| Data block number | Data block name | Data block type | Status | Data block description |
|---|---|---|---|---|
| 5 | Vehicle propulsion storage type | — | M | Vehicle fuel (energy source) type. Each fuel (energy source) type is encoded as follows:<br>- False – this fuel (energy source) type is not present;<br>- True – this fuel (energy source) type is present. |
| | Gasoline Tank Present | BOOLEAN | M | Gasoline |
| | Diesel Fuel Tank | BOOLEAN | M | Diesel |
| | Compressed Natural Gas | BOOLEAN | M | Compressed gas |
| | Liquefied Propane Gas | BOOLEAN | M | liquefied propane gas |
| | Electric Energy Storage | BOOLEAN | M | Electric energy storage (exceeding 42 V and 100 A/h); |
| | Hydrogen Storage | BOOLEAN | M | Hydrogen |
| 6 | Time Stamp | INTEGER ($0…2^{32}$-1) | M | RTA event time stamp, i.e., number of seconds passed from January 1, 1970 UTC. Shall be set to zero should any error in evaluation of RTA event time occur. |
| 7 | Vehicle Location | — | M | Vehicle location |
| | Position Latitude | INTEGER ($-2^{31}…2^{31}$-1) | M | The value of vehicle location latitude determined by the navigation receiver, in milliarcseconds (from -324000000 to 324000000).<br>The maximum value is: 90°00'00,000" = 90×60×60,000" = 324000,000" = 324 000 000 milliarcseconds = 0x134FD900.<br>The minimum value is: -90°00'00,000" = -90×60×60,000" = -324000,000" = -324 000 000 milliarcseconds = 0xECB02700.<br>Example: 48°18'1,20" N = {(48×3600)+(18×60)+1,20}" = 173881,200" = 173881200 = 0x0A5D3770.<br>If the latitude is unknown, or if an error has occurred during its evaluation, this value shall be set equal to the last reliably evaluated value of the latitude. If the latter is not available, this value shall be set to 0x7FFFFFF. In either case, the parameter "Position Can Be Trusted" shall be set to false. |

| Data block number | Data block name | Data block type | Status | Data block description |
|---|---|---|---|---|
| | Position Longitude | INTEGER ($-2^{31}$…$2^{31}-1$) | M | The value of vehicle location longitude determined by the navigation receiver, in milliarcseconds (from -648000000 to 648000000).<br>The maximum value is: 180°00'00,000" = 180×60×60,000" = 648000,000" = 648 000 000 milliarcseconds = 0x269FB200.<br>The minimum value is: -180°00'00,000" = -180×60×60,000" = -648000,000" = -648 000 000 milliarcseconds = 0xD9604E00.<br>Example: 11°37'2,52" E = {(11×3600)+(37×60)+2,52}" = 41822,520" = 41822520 = 0x027E2938.<br>If the longitude is unknown, or if an error has occurred during its evaluation, this value shall be set equal to the last reliably evaluated value of the longitude. If the latter is not available, this value shall be set to 0x7FFFFFFF. In either case, the parameter "Position Can Be Trusted" shall be set to false. |
| 8 | Vehicle Direction | INTEGER (0…255) | M | Vehicle direction (course) counting clockwise with 2° resolution (0° to 358°) from the magnetic pole direction. Shall be set to 0xFF if the vehicle direction is unknown, or if an error has occurred during its evaluation. |
| 9 | Recent Vehicle Location N1 | — | O | Vehicle location at the time moment n-1 |
| | Latitude Delta | INTEGER (-512…511) | O | Latitude displacement (positive for direction to North, negative for direction to South) with respect to the latitude value in the data block No. 7<br>Expressed in conditional units, one unit = 0.1″, corresponding to ≈ 3 m |
| | Longitude Delta | INTEGER (-512…511) | O | Longitude displacement (positive for direction to East, negative for direction to West) with respect to the longitude value in the data block No. 7<br>Expressed in conditional units, one unit = 0.1″, corresponding to ≈ 3 m |
| 10 | Recent Vehicle Location N2 | — | O | Vehicle location at the time moment n-2 |
| | Latitude Delta | INTEGER (-512…511) | O | Latitude displacement (positive for direction to North, negative for direction to South) with respect to the latitude value at the time moment n-1 in the data block No. 9<br>Expressed in conditional units, one unit = 0.1″, corresponding to ≈ 3 m |
| | Longitude Delta | INTEGER (-512…511) | O | Longitude displacement (positive for direction to East, negative for direction to West) with respect to the longitude value at the time moment n-1 in the data block No. 9<br>Expressed in conditional units, one unit = 0.1″, corresponding to ≈ 3 m |

*Table C.1 (continued)*

| Data block number | Data block name | Data block type | Status | Data block description |
|---|---|---|---|---|
| 11 | Number Of Passengers | INTEGER (0…255) | O | Number of passengers. This parameter shall be set to 0xFF or shall not be provided if the number of passengers can not be evaluated. |
| 12 | Optional Additional Data | — | O | Optional addition data |
| | oid | RELATIVE-OID | O | Identifier of the object that defines the format and purpose of the data following it. A special standardization body is responsible for assigning unique values to this identifier. The element type is defined in accordance with GOST R ISO/IEC 8824-1 and GOST R ISO/IEC 8825 |
| | data | OCTET STRING | O | Additional data represented in the format defined in the "oid" object identifier. |
| N o t e – The following notation is used in Status column:<br>- M (mandatory) – mandatory data block. Shall always be transferred.<br>- O (optional) – optional data block. May be omitted; its presence is determined by other parameters included in the packet. | | | | |

**(Amended Wording, Amendment No. 1).**

**C.3 ASN.1 representation for MSD containing standard data identical to those of eCall (packed encoding)**

```
MSDASN1Module
DEFINITIONS
AUTOMATIC TAGS ::=
BEGIN
-- MSD specification version
CurrentId::= INTEGER (1)
-- ECallMessage is an upper level data element
-- structure ECallMessage supports one message type only (msd)
-- Elements:
-- id: MSD data format, set to 1
-- msd: minimum set of data transmitted from IVS side, except for ID
ECallMessage ::= SEQUENCE {
  id INTEGER(0…255),
  msdMSDMessage
}

-- Message sent by IVS side (ID is excluded)
-- Elements:
-- msdStructure: main MSD structure
-- optionalAdditionalData: additional data
-- May be extended at this level in future versions
MSDMessage ::= SEQUENCE {
  msdStructure MSDStructure,
  optionalAdditionalDataAdditionalData OPTIONAL,
…
}
-- Main MSD structure without any additional data
-- Elements:
-- messageIdentifier: message identifier
-- control: see ControlType
-- vehicleIdentificationNumber: see VIN
-- vehiclePropulsionStorageType: see
-- VehiclePropulsionStorageType
-- timestamp: time stamp
-- vehicleLocation: see VehicleLocation
-- vehicleDirection: vehicle direction
-- recentVehicleLocationNl: displacement from current vehicle location
-- see VehicleLocationDelta
-- recentVehicleLocationN2: displacement from
-- recentVehicleLocationN1 see VehicleLocationDelta
-- numberOfPassengers: minimum known number
-- of fastened safety belts
MSDStructure ::= SEQUENCE {
messageIdentifier INTEGER(0 ... 255),
control ControlType,
vehicleIdentificationNumber VIN,
vehiclePropulsionStorageType VehiclePropulsionStorageType,
timestamp INTEGER(0 ... 4294967295),
vehicleLocation VehicleLocation,
vehicleDirection INTEGER(0 ... 255),
    recentVehicleLocationN1 VehicleLocationDelta OPTIONAL,
    recentVehicleLocationN2 VehicleLocationDelta OPTIONAL,
numberOfPassengers INTEGER(0 ... 255) OPTIONAL,
…
}
```

```
-- ControlType includes the following elements:
-- automaticActivation: true, false
-- testCall: true, false
-- positionCanBeTrusted: true, false
-- vehicleType: see VehicleType
ControlType ::= SEQUENCE {
automaticActivation BOOLEAN,
testCall BOOLEAN,
positionCanBeTrusted BOOLEAN,
vehicleType VehicleType
}
-- Vehicle type definition
VehicleType ::= ENUMERATED{
  passengerVehicleClassM1 (1),
  busesAndCoachesClassM2 (2),
  busesAndCoachesClassM3 (3),
  lightCommercialVehiclesClassN1 (4),
  heavyDutyVehiclesClassN2 (5),
  heavyDutyVehiclesClassN3 (6),
  motorcyclesClassL1e (7),
  motorcyclesClassL2e (8),
  motorcyclesClassL3e (9),
  motorcyclesClassL4e (10),
  motorcyclesClassL5e (11),
  motorcyclesClassL6e (12),
  motorcyclesClassL7e (13),
}
-- VIN
VIN::= SEQUENCE{
  isowmi PrintableString (SIZE(3))
  (FROM(«A»..»H»|»J»..»N»|»P»|»R»..»Z»|»0»..»9»)),
  isovds PrintableString (SIZE(6))
  (FROM(«A»..»H»|»J»..»N»|»P»|»R»..»Z»|»0»..»9»)),
  isovisModelyear PrintableString (SIZE(l))
  (FROM(«A»..»H»|»J»..»N»|»P»|»R»..»Z»|»0»..»9»)),
  isovisSeqPlant PrintableString (SIZE(7))
  (FROM(«A»..»H»|»J»..»N»|»P»|»R»..»Z»|»0»..»9»))
}
-- VehiclePropulsionStorageType:
-- Fuel (energy source) type used for vehicle
VehiclePropulsionStorageType ::= SEQUENCE {
  gasolineTankPresent BOOLEAN DEFAULT FALSE,
  dieselTankPresent BOOLEAN DEFAULT FALSE,
  compressedNaturalGas BOOLEAN DEFAULT FALSE,
  HquidPropaneGas BOOLEAN DEFAULT FALSE,
  electricEnergyStorage BOOLEAN DEFAULT FALSE,
  hydrogenStorage BOOLEAN DEFAULT FALSE,
…}
-- VehicleLocation:
-- Current vehicle location containing the following elements:
-- Latitude – 32 bits (4 octets) allocated
-- Longitude – 32 bits (4 octets) allocated
VehicleLocation ::= SEQUENCE {
  positionLatitude INTEGER (-2147483648..2147483647),
  positionLongitude INTEGER (-2147483648..2147483647)
}
```

```
-- VehicleLocationDelta:
-- Vehicle location before an RTA event was detected
VehicleLocationDelta ::= SEQUENCE {
  latitudeDelta INTEGER (-512..511),
  longitudeDelta INTEGER (-512..511)
}
-- AdditionalData:
-- Any additional data encoded as a separate definition
-- Elements:
-- oid: object identifier defining data
-- format and purpose
-- data: additional data in the format
-- defined by oid
AdditionalData ::= SEQUENCE {
  oid RELATIVE-OID,
  data OCTET STRING
}
END
```

**C.4 Structure of additional MSD data introduced for ERA-GLONASS System and not standardised in eCall (RTA severity assessment)**

C.4.1 Additional data introduced into the MSD structure in ERA-GLONASS System shall be included in the second element of the data block No. 12 "Optional Additional Data" where the first element of the said block has a value equal to "1.4.1".

C.4.2 The contents of additional dada are detailed in Table C.2.

**(Amended Wording, Amendment No. 1).**

Т а б л е C.2 – Contents of additional MSD data introduced for ERA-GLONASS System

| Data block number | Data block name | Data block type | Status | Data block description |
|---|---|---|---|---|
| 12-1 | Crash Severity ASI15 | INTEGER (0...2047) | O | Accident severity assessment basing on the ASI15 index value multiplied by 100. If the ASI15 value can not be evaluated or transmitted at IVS vehicle side, a value equal to 0 shall be transmitted for low-severity accidents or to 2047 for high-severity ones. |
| 12-2 | Diagnostic Result | - | O | Results of IVS testing |
| | Mic Connection Failure | BOOLEAN | O | Incorrect microphone connection |
| | Mic Failure | BOOLEAN | O | Failure of microphone |
| | Right Speaker Failure | BOOLEAN | O | Failure of right speaker |
| | Left Speaker Failure | BOOLEAN | O | Failure of left speaker |
| | Speakers Failure | BOOLEAN | O | Failure of speakers |
| | Ignition Line Failure | BOOLEAN | O | Failure to identify ignition line status |
| | Uim Failure | BOOLEAN | O | Failure of UIM |
| | Status Indicator Failure | BOOLEAN | O | Failure of status indicator |
| | Battery Failure | BOOLEAN | O | Failure of backup battery |
| | Battery Voltage Low | BOOLEAN | O | Backup battery charge below the permitted level |
| | Crash Sensor Failure | BOOLEAN | O | Failure of automatic detector of RTA events |
| | Firmware Image Corruption | BOOLEAN | O | Integrity violation of firmware image |
| | Comm Module Interface Failure | BOOLEAN | O | Failure of interface of GSM and UMTS communication module |
| | Gnss Receiver Failure | BOOLEAN | O | GNSS receiver failure |
| | Raim Problem | BOOLEAN | O | Data integrity (credibility) violation in regard to navigation and timing parameters of GNSS receiver (RAIM function) |
| | Gnss Antenna Failure | BOOLEAN | O | Failure (incorrect connection) of GNSS external antenna |
| | Comm. Module Failure | BOOLEAN | O | Failure (incorrect connection) of GSM and UMTS external antenna |
| | Events Memory Overflow | BOOLEAN | O | Overflow of internal events memory |
| | Crash Profile Memory Overflow | BOOLEAN | O | Overflow of memory used for acceleration profile recording |
| | Other Critical Failires | BOOLEAN | O | Other critical failures |
| | Other Not Critical Failures | BOOLEAN | O | Other non-critical failures |

Table C.2 (*cont.*)

| Data block number | Data block name | Data block type | Status | Data block description |
|---|---|---|---|---|
| 12-3 | Crash Info | - | O | RTA type |
| | Crash Front | BOOLEAN | O | Crash from the front |
| | Crash Left | BOOLEAN | O | Crash from the left |
| | Crash Right | BOOLEAN | O | Crash from the right |
| | Crash Rear | BOOLEAN | O | Crash from the rear |
| | Crash Rollover | BOOLEAN | O | Rollover |
| | Crash Side | BOOLEAN | O | Crash from the side |
| | Crash Front Or Side | BOOLEAN | O | Crash from the front or from the side |
| | Crash Another Type | BOOLEAN | O | Accident of other type |
| Note – The symbol "O" ("optional") in "Status" column indicates that the block is not mandatory. I.e., it does not always transmitted, and its presence is governed by other parameters included in the packet. | | | | |

**(Amended Wording, Amendment No. 1).**

**C.5 ACH.1 representation of the second element in the additional data block included for the ERA-GLONASS System (packed encoding)**

```
ERAOADASN1Module
DEFINITIONS
AUTOMATIC TAGS ::=
BEGIN
        -- Format version of additional data block for ERA-GLONASS System
        -- Extends optionalAdditionalData.OID, designated CEN for ERA-GLONASS.
        -- Next versions shall be backward compatible with the previous ones.
        ERADataFormatId::= INTEGER (1)

        -- Additional ERA-GLONASS data block
        -- crashSeverityASI15 – value of ASI15 index
        -- multiplied by 100
        -- diagnosticResult – see DiagnosticResult
        -- crashInfo – see CrashInfo.
        -- Expandable
        ERAAdditionalData ::= SEQUENCE {
          crashSeverityASI15 INTEGER(0..2047) OPTIONAL,
        diagnosticResultDiagnosticResult OPTIONAL,
        crashInfoCrashInfo OPTIONAL,
          ...
        }

        -- Data block describing the IVS status
        DiagnosticResult ::= SEQUENCE {
        micConnectionFailure BOOLEAN OPTIONAL,
        micFailure BOOLEAN OPTIONAL,
        rightSpeakerFailure BOOLEAN OPTIONAL,
        leftSpeakerFailure BOOLEAN OPTIONAL,
        speakersFailure BOOLEAN OPTIONAL,
        ignitionLineFailure BOOLEAN OPTIONAL,
        uimFailure BOOLEAN OPTIONAL,
        statusIndicatorFailure BOOLEAN OPTIONAL,
        batteryFailure BOOLEAN OPTIONAL,
        batteryVoltageLow BOOLEAN OPTIONAL,
        crashSensorFailure BOOLEAN OPTIONAL,
        firmwareImageCorruption BOOLEAN OPTIONAL,
        commModuleInterfaceFailure BOOLEAN OPTIONAL,
        gnssReceiverFailure BOOLEAN OPTIONAL,
        raimProblem BOOLEAN OPTIONAL,
        gnssAntennaFailure BOOLEAN OPTIONAL,
        commModuleFailure BOOLEAN OPTIONAL,
        eventsMemoryOverflow BOOLEAN OPTIONAL,
        crashProfileMemoryOverflow BOOLEAN OPTIONAL,
        otherCriticalFailires BOOLEAN OPTIONAL,
        otherNotCriticalFailures BOOLEAN OPTIONAL
        }
```

```
        -- Data block classifying the RTA
        CrashInfo ::= SEQUENCE {
        crashFront BOOLEAN OPTIONAL,
        crashLeft BOOLEAN OPTIONAL,
        crashRight BOOLEAN OPTIONAL,
        crashRear BOOLEAN OPTIONAL,
        crashRollover BOOLEAN OPTIONAL,
        crashSide BOOLEAN OPTIONAL,
        crashFrontOrSide BOOLEAN OPTIONAL,
        crashAnotherType BOOLEAN OPTIONAL
        }
END».
```

**(Amended Wording, Amendment No. 1).**

**Appendix D**
**(recommended)**

**Connection diagram for coupling in-vehicle emergency call system manufactured in auxiliary equipment configuration to on-board audio system**

D.1 The recommended (example) diagram used to connect the IVS manufactured in auxiliary equipment configuration to the on-board audio system of the vehicle is shown in Figure D.1

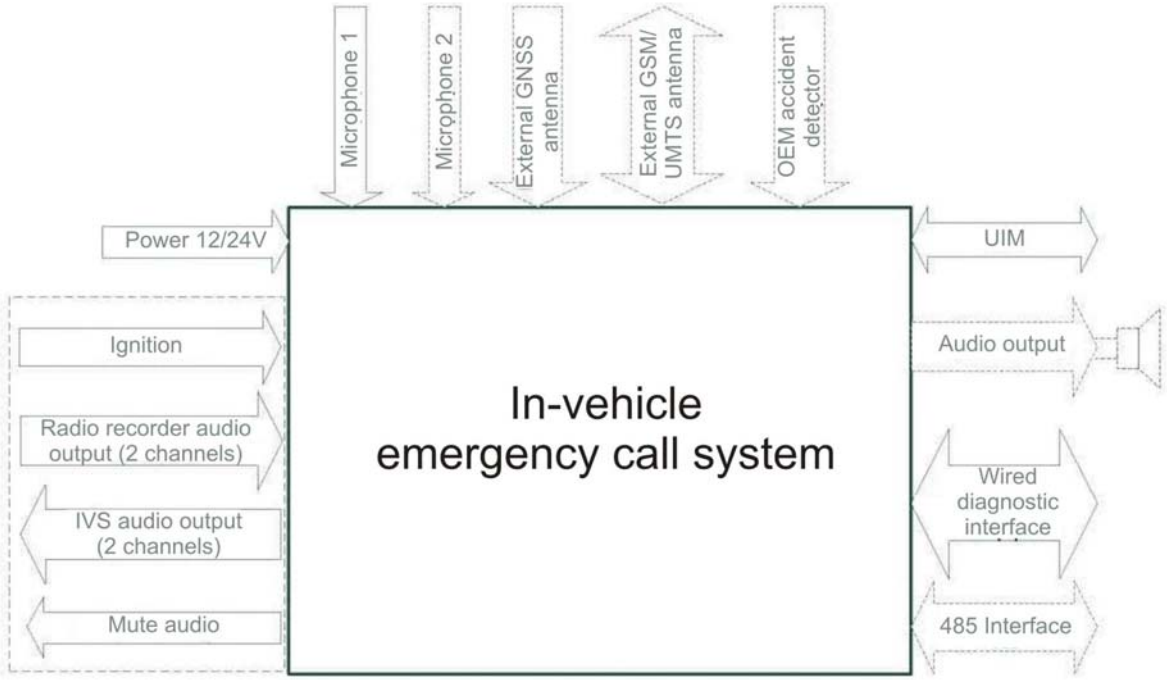



Figure D.1 – Example of IVS connection to on-board audio system

D.2 The IVS audio output (2 front speakers) is connected to the vehicle on-board audio system.

D.3 If a radio recorder is installed in the vehicle, then its output (2 front speakers) is connected to the IVS audio input for the purpose of signal switching inside the IVS.

D.4 The "mute" ("disable sound") line is connected to the radio recorder.

D.5 The following interfaces are optional:

- second microphone input;
- OEM accident detector (airbag control module);
- wired diagnostic interface;
- RS485 extension interface.

D.6 The recommendations regarding the IVS connection to the on-board audio system of the vehicle depending on the design of the latter system are included in Table D.1.

Table D.1

| Possible audio system design of vehicle | Recommendation for IVS connection |
|---|---|
| Vehicle that has a radio recorder with stereo output, an audio system, and a directly accessible connector for connection of the radio recorder to the audio system | 1. Connect radio recorder to IVS.<br>2. Connect IVS to audio system.<br>3. Connect "mute" line to radio recorder. |
| Vehicle that has a radio recorder with stereo output, an audio system, and no directly accessible connector for connection of the radio recorder to the audio system | 1. Disconnect wires connecting radio recorder to front speakers of vehicle.<br>2. Connect radio recorder to IVS.<br>3. Connect IVS to audio system.<br>4. Connect "mute" line to radio recorder. |
| Vehicle that has a radio recorder without stereo output, an audio system, and a directly accessible connector for connection of the radio recorder to the audio system | 1. Connect radio recorder to IVS.<br>2. Connect IVS to audio system.<br>3. Connect "mute" line to radio recorder. |
| Vehicle that has a radio recorder without stereo output, an audio system, and no directly accessible connector for connection of the radio recorder to the audio system | Connect "mute" line to radio recorder, install additional speaker and connect it to amplified IVS audio output. |
| Vehicle that has no radio recorder, but has an audio system and a directly accessible connector for connection of a radio recorder to the audio system | 1. Connect radio recorder to IVS.<br>2. Connect IVS to audio system.<br>3. Connect "mute" line to radio recorder. |
| Vehicle that has neither a radio recorder nor an audio system | Install additional speaker and connect it to amplified IVS audio output. |

**Appendix E**
**(recommended)**

**Recommended installation location of automatic detector of RTA events**
**(for vehicles of Categories M1 and N1 only)**

E.1 For IVS installed in auxiliary equipment configuration, the recommended arrangement of the automatic detector of RTA events is along the lengthwise vehicle axis (y=0) on the most solid place of a floor panel, away from non-rigid parts of the vehicle body.

This arrangement ensures that the same criteria are used for impacts both from the left and from the right of the vehicle so that the IVS adjustment becomes much simpler.

The recommended installation locations of the automatic detector of RTA events are shown in Figure E.1 (points A, B and C).

When such locations are selected, a sufficient space around the detector should preferably be reserved to prevent large deformations of body elements from damaging the detector or impairing its functionality.

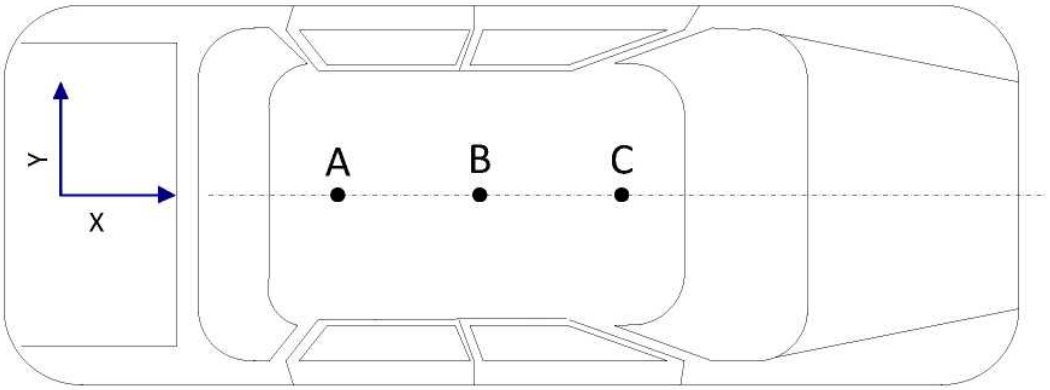



Figure E.1 – Recommended arrangement of detector of RTA events

E.2 For IVS installed in standard equipment configuration, the location where the detector of RTA events must be installed is determined by the vehicle manufacturer.

**(Amended Wording, Amendment No. 1).**

## Appendix F
## (recommended)

### Recommendations on implementation of user interface module and on its arrangement in vehicle cabin (for in-vehicle systems installed in auxiliary equipment configuration only)

F.1 Whenever possible, overall UIM dimensions should be minimised in order to facilitate the device installation in the vehicle cabin.

F.2 Materials most close to those used for fabrication of vehicle front panels, as regards their texture and colour, are recommended for UIM production. If necessary, several UIM modifications may be created using the materials of different texture and colour.

F.3 Any speaker(s) or electronic modules included in the IVS are not recommended for installation inside the UIM since doing so may increase the overall UIM dimensions or complicate the UIM installation in the vehicle cabin.

F.4 The UIM mounting on the vehicle front panel shall ensure safety for persons present in the vehicle when the RTA occurs.

F.5 It is advisable to place the "Emergency call" and "Additional functions" buttons so that their press would occur in a plane perpendicular to the UIM mounting plane in the vehicle.

## Appendix G
## (recommended)

## Connectors used for coupling in-vehicle emergency call systems installed in auxiliary equipment configuration to on-board networks of vehicles. Signal pinout configuration

G.1 Main connector used for coupling IVS installed in auxiliary equipment configuration to on-board network of vehicle

G.1.1 The signal pinout configuration recommended for such connectors is shown in Figure G.1.

The connector is installed on the vehicle side. It supports signals that must always be implemented (mandatory signals) as well as those (optional signals) that may be used for IVS coupling to vehicle systems.

The information on mandatory support attributes of individual signals is presented in Table G. 1.

In particular, the connector supports the signals (pins 15–18) used for microphone connection.

For those UIM modules which interface for physical connection to the on-board vehicle network is not regulated by this Standard, four signals (pins 4–7) are reserved in the connector.

The configuration and the USB type (USB host, USB device) of implemented signals are selected by the vehicle manufacturer.

Table G.1

| Pin number | Signal name | Signal direction (with respect to IVS) | Signal function | Signal status[1)] |
|---|---|---|---|---|
| 1 | Ground | Input | Ground | Yes |
| 2 | Vin+ | Input | Power supply (12 V or 24 V) | Yes |
| 3 | CAN LI | Input/Output | CAN1 (from 1.5 to 2.5 V) | Yes[2,5)] |
| 4 | uim_4 | Input/Output | UIM – signal 4 (e.g., "ground" for status indicator) | No |
| 5 | uim_3 | Input/Output | UIM – signal 3 (e.g., status indicator) | No |
| 6 | uim_2 | Input/Output | UIM – signal 2 (e.g., "Additional functions" button) | No |
| 7 | uim_1 | Input/Output | UIM – signal 1 (e.g., "Emergency call" button) | No |
| 8 | ground | Output | UIM ground return | No |
| 9 | J1850- | Input/Output | J1850 (OBDII)[3)] | No |
| 10 | gpio_1 | Input/Output | General purpose I/O 1[4)] | No |
| 11 | 1_line | Input/Output | K-Line(OBDII)no[15][3)] | No |
| 12 | k_line | Input/Output | K-Line(OBDII)no[15][3)] | No |
| 13 | CAN H1 | Input/Output | CAN 1 (from 2.5 to 3.5 V) | Yes[2,5)] |
| 14 | CAN H2 | Input/Output | CAN 2 (from 2.5 to 3.5 V), OBDII or FMS | No |
| 15 | Umic+ | Output | Microphone power | No |
| 16 | mic + | Input | Microphone | No |
| 17 | mic - | Input | Microphone | No |
| 18 | Umic- | Output | Microphone power | No |
| 19 | J1850+ | Input/Output | J1850(OBDII)[3)] | No |
| 20 | gpio_2 | Input/Output | General purpose I/O 2 | No |
| 21 | Ucan/rs485+ | Output | Power for autonomous intelligent sensors | No |
| 22 | USB d+ | Input/Output | USB data | No |
| 23 | gpio_3 | Input/Output | General purpose I/O 3 | No |
| 24 | Vbat+ | Input/Output | External backup battery | No |
| 25 | CAN L2 | Input/Output | CAN 2 (from 1.5 to 2.5 V), OBDII or FMS | No |
| 26 | Uacc+ | Output | Acceleration sensor power | No |
| 27 | ACC_1 | Input/Output | Acceleration sensor – signal 1 | No |
| 28 | ACC_2 | Input/Output | Acceleration sensor – signal 2 | No |
| 29 | ACC_3 | Input/Output | Acceleration sensor – signal 3 | No |

| Pin number | Signal name | Signal direction (with respect to IVS) | Signal function | Signal status[1)] |
|---|---|---|---|---|
| 30 | Uacc- | Output | Acceleration sensor power | No |
| 31 | Ucan/rs485- | Output | Power for autonomous intelligent sensors | No |
| 32 | USBd- | Input/Output | USB data | No |
| 33 | gpio_4 | Input/Output | General purpose I/O 4 | No |
| 34 | Vbat- | Input/Output | External backup battery | No |
| 35 | signal_gnd | Input | Ground for J1850 signals (OBDII)[3)] | No |
| 36 | radio_mute | Output | Sound mute | Yes[2)] |
| 37 | ecall_mode | Output | "Emergency call" indicator | No |
| 38 | ignition | Input | Ignition line state[5)] | Yes[5)] |
| 39 | Ground | Input | Ground | No |
| 40 | NC | | Unused | No |

1) "Signal status" column contains "Yes" if the signal implementation is mandatory or "No" if it is not mandatory.

2) According to 6.12 and 6.13, each IVS is required to support disabling all other standard audio playback devices present in the vehicle cabin so that the loud voice communication is ensured during the emergency call.

To implement the latter IVS functionality, either signal 36 (radio mute), or signals 3 and 13 (CAN L, CAN H) may be used.

3) If pin 12 is missing in the connector, the protocol described in [15] is used.

If pin 12 is present in the connector, either J1850 VPW (pins 19 and 35) or J1850 PWM (pins 9, 19 and 35) protocol is used in accordance with [16].

4) Pin 10 (gpio_1) is recommended for connecting the emergency alarm signal if the latter signal is implemented for the vehicle.

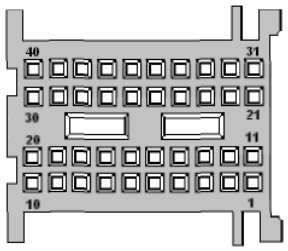
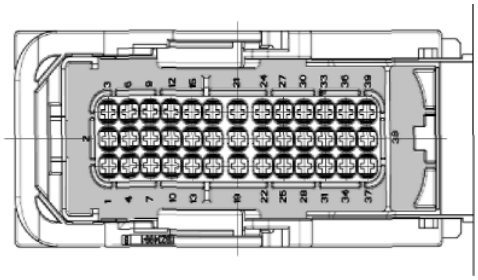
5) According to 7.3.4, 7.5.3, 7.6.2, 7.7.5 and 7.8.8, the check of the vehicle ignition line state is a procedure that is necessary for implementation of IVS operating modes detailed in Section 7.

Either signal 38 (ignition) or signals 3 and 13 (CAN L1, CAN H1) may be used for this purpose.

G. 1.2 The connector for coupling the IVS to the vehicle on-board network may be installed by the vehicle manufacturer on their assembly line in order to ensure that the IVS installed on the vehicle in auxiliary equipment configuration may latter be connected.

G.1.3 The IVS connectors recommended for installation on vehicles are listed in Table G.2.

Table G.2

<table>
<tr><th>Vehicle category</th><th>Main connector for IVS</th><th>Connector for GNSS antenna</th><th>Connector for GSM/UMTS antenna</th></tr>
<tr><td>M1/N1</td><td>953122-1[1)]<br>  </td><td rowspan="2">FAKRA C<br>  </td><td rowspan="2">FAKRA D<br>  </td></tr>
<tr><td>M2/M3/N2/N3</td><td>5-1718321-3[2)]<br>  </td></tr>
<tr><td colspan="4">1) The use of 953122-1 connectors of MQS Tyco series is assumed.<br>2) The use of 5-1718321-3 connectors of AMP MCP Tyco series is assumed.</td></tr>
</table>

G.2 Connectors used for coupling external devices to IVS

G.2.1 Connection of external devices via RS 485 bus

G.2.1.1 The pinout configuration of signals used with the RS 485 bus is shown in Table G.3.

Table G.3

| Pin number | Signal name | Signal function | Signal direction |
|---|---|---|---|
| 1 | VBAS | Power supply (5 V) | Output |
| 2 | A | Data line | Input/Output |
| 3 | B | Data line | Input/Output |
| 4 | GND | Ground | Output |

G.2.1.2 The four-wire USCAR 347930040 of Mini50 manufactured by Molex and recommended for use is shown in Figure G.1.

USCAR 347930040

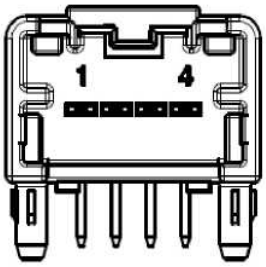



Figure G.1 – Recommended connector for coupling to RS 485 bus

G.2.1.3 RS 485 connection interface shall support:

a) Modbus RTU protocol for communication with devices configured as slaves, in accordance with the following specifications:

1) Modbus application protocol specification. V1.1b;

2) Modbus over Serial Line. Specification and Implementation Guide V1.02.

b) following configuration settings:

- RS485_BAUD_RATE;
- RS485_STOP_BITS;
- RS485_PARITY.

c) sending and receiving messages for all standard function codes defined in the Modbus specification, including messages of 1:1 type and 1:N type;

d) up to 32 connected peripheral devices including any diagnostic interface connected to RS485 port.

## Appendix H
## (obligatory)

## Basic requirements for in-vehicle emergency call systems/devices in regard to quality assurance of loudspeaker communication in vehicle cabin

### H.1 General

The requirements specified in this Appendix:

- apply (unless otherwise stated) to narrow-band and wide-band IVS;
- take into account basic requirements of the international recommendations [3], [4];
- include minimum requirements to parameters of transmit/receive channels and to performance of digital signal processing algorithms for sound signals (echo cancellers, and other algorithms).

### H.2 Signal processing delay in IVS

H.2.1 The signal processing delay in a loudspeaker IVS in receiving direction $T_R$ shall not be greater than 50 ms.

H.2.2 The signal processing delay in a loudspeaker IVS in sending direction $T_R$ shall not be greater than 50 ms.

H.2.3 The total signal processing delay in a loudspeaker IVS in receiving and sending directions ($T_R$+$T_S$) shall not be greater than 70 ms.

N o t e – Only an additional delay introduced by sound signal processing algorithms in the IVS (e.g., by AGC, AEC, noise suppression, etc.) shall be measured, including neither the standard signal delay in the IVS telephone part related to signal encoding and decoding, nor the signal propagation delay in communication operator channels.

### H.3 Sending loudness ratings

H.3.1 The sending loudness rating SLR measured for an IVS installed in the vehicle compartment (cabin) shall be (13 ± 4) dB for the drivers and the passengers next to him.

H.3.2 An additional manual sending gain control of the IVS is not provided for. Whether an automatic gain control (AGC) in sending is required in order to equalise the loudness rating for passengers at different distances from the IVS microphone, shall be decided by the IVS manufacturer (for in-vehicle systems manufactured in auxiliary equipment configuration) or by the vehicle manufacturer (for in-vehicle systems manufactured in standard equipment configuration).

If an IVS implements AGC algorithms for sending, then the said algorithms shall meet the minimum requirements specified in Appendix J in order to ensure proper quality of loudspeaker communication.

### H.4 Receiving loudness ratings

H.4.1 The nominal receiving loudness rating $RLR_{nom}$ measured for an IVS installed in the vehicle compartment (cabin) shall be equal to the value specified by the IVS or vehicle manufacturer in accordance with the requirements of 7.5.3.10 of this Standard. If manual controls of the receiving loudness level are provided, then the selected nominal receiving loudness rating $RLR_{nom}$ that corresponds to the nominal IVS volume shall be achieved at the middle marked position of the volume control.

H.4.2 The maximum receiving loudness rating $RLR_{max}$ corresponding to the minimum IVS volume shall be achieved at the extreme (leftmost) position of the volume control. The required $RLR_{max}$ value shall be specified by the IVS or vehicle manufacturer in accordance with the requirements of 7.5.3.11.

H.4.3 The minimum receiving loudness rating $RLR_{min}$ corresponding to the maximum IVS volume shall be achieved at the extreme (rightmost) position of the volume control. The required $RLR_{min}$ value shall be specified by the IVS or vehicle manufacturer based on the requirement that the receiving loudness level in the IVS compartment (cabin) must be ensure reliable duplex loudspeaker communication with an acoustic signal-to-noise ratio of at least 6 dB for receiving in the "worst" possible noise conditions (depending on the vehicle type and noise scenario). If the requirements for the noise type and level are not specified by the vehicle manufacturer, the sound pressure level of background noises in the vehicle compartment shall be taken equal to minus 14 dBPa (A).

The $RLR_{min}$ value shall be selected in the range from minus 10 ± 4 dB to minus 18 ± 4 dB. The value of minus 13 ± 4 dB is recommended.

H.4.4 Whether an automatic gain control in receiving direction is necessary for the IVS shall be decided by the IVS manufacturer (for in-vehicle systems manufactured in auxiliary equipment configuration) or by the vehicle manufacturer (for in-vehicle systems manufactured in standard equipment configuration).

If an IVS implements AGC algorithms for receiving, then the said algorithms shall meet the minimum requirements specified in Appendix J in order to ensure proper quality of loudspeaker communication.

**H.5 Frequency sensitivity response of IVS transmitting part**

H.5.1 The relative tolerances pertaining to the frequency response in sending direction are listed in Table H.1 for narrow-band IVS, and in Table H.2 for wide-band IVS. Linear interpolation on log-log scale may be used for intermediate frequencies.

N o t e – The frequency response of the IVS sensitivity in sending direction shall be measured with the IVS installed in the vehicle compartment (cabin), along the path from the IVS acoustic input to the electric output of the speech codec on the operator side.

T a b l e H.1 – Frequency sensitivity response in sending direction for narrow-band IVS

| Frequency, Hz | Upper limit, dB | Lower limit, dB |
|---|---|---|
| 200 | 0 | –∞ |
| 250 | 0 | –∞ |
| 315 | 0 | –14 |
| 400 | 0 | –13 |
| 500 | 0 | –12 |
| 630 | 0 | –11 |
| 800 | 0 | –10 |
| 1000 | 0 | –8 |
| 1300 | 2 | –8 |
| 1600 | 3 | –8 |
| 2000 | 4 | –8 |
| 2500 | 4 | –8 |
| 3100 | 4 | –8 |
| 4000 | 0 | –∞ |

T a b l e H.2 – Frequency sensitivity response in sending direction for wide-band IVS

| Frequency, Hz | Upper limit, dB | Lower limit, dB |
|---|---|---|
| 100 | 4 | –∞ |
| 125 | 4 | –10 |
| 200 | 4 | –4 |
| 1000 | 4 | –4 |
| 5000 | 8.5 | –4 |
| 6300 | 9 | –7 |
| 8000 | 9 | –∞ |

H.5.2 An ideal frequency response in sending direction should be flat in the range from 200 Hz to 4 kHz for narrowband IVS and from 100 Hz to 7 kHz for wideband IVS. However (and especially when disturbing acoustic noises are present), a frequency response making use of additional frequency weighting may be more preferable, for example, in the case where the frequency response has an LF drop and a slight HF rise (within the specified tolerances).

Digital correction of the frequency response in sending direction is permitted (using an equaliser).

**H.6 Frequency sensitivity response of IVS receiving part**

И.6.1 The relative tolerances pertaining to the frequency response in receiving direction are listed in Table H.3 for narrow-band IVS, and in Table H.4 for wide-band IVS. Linear interpolation on log-log scale shall be used for intermediate frequencies.

N o t e – The frequency response of the IVS sensitivity in receiving direction shall be measured with the IVS installed in the vehicle compartment (cabin), along the path from the electric input of the speech codec on the operator side to the IVS acoustic output.

T a b l e H.3 – Frequency sensitivity response in receiving direction for narrow-band IVS

| Frequency, Hz | Upper limit, dB | Lower limit, dB |
|---|---|---|
| 200 | 0 | –∞ |
| 250 | 0 | –∞ |
| 315 | 0 | –15 |
| 400 | 0 | –12 |
| 3 100 | 0 | –12 |
| 4 000 | 0 | –∞ |

T a b l e H.4 – Frequency sensitivity response in receiving direction for wide-band IVS

| Frequency, Hz | Upper limit, dB | Lower limit, dB |
|---|---|---|
| 125 | 8 | –∞ |
| 200 | 8 | –12 |
| 250 | 8 | –9 |
| 315 | 7 | –6 |
| 400 | 6 | –6 |
| 5000 | 6 | –6 |
| 6300 | 6 | –9 |
| 8000 | 6 | –∞ |

H.6.2 Digital correction of the frequency response in receiving direction is permitted (using an equaliser).

**H.7 Noise level in transmit channel**

H.7.1 When measured in silence conditions with no near-end subscriber speech present, the maximum permitted level of the IVS self-noise in the transmit channel shall not exceed minus 64 dBm0(A) when measured at the electric output of the speech codec on the operator side.

H.7.2 Individual spectral peaks in the frequency region shall not overrun the mean spectral envelope of the self-noise by more than 10 dB.

**H.8 Noise level in receive channel**

H.8.1 When measured in silence conditions at the IVS acoustic output under the nominal loudness rating $RLR_{nom}$, the maximum permitted level of the IVS self-noise in the receive channel with no operator speech present shall not exceed minus (51 + $RLR_{nom}$) dBPa(A).

И.8.2 Individual spectral peaks in the frequency region shall not overrun the mean spectral envelope of the self-noise by more than 10 dB.

**H.9 Suppression of out-of-band signals in transmit channel**

For input out-of-band acoustic signal of the nominal level represented by white Gaussian noise that is limited in the frequency range from 4.6 to 8 kHz for narrowband IVS and from 9 kHz to 16 kHz for wideband IVS, the electric level of noise at the codec output measured in the base frequency band from 300 Hz to 3.4 kHz for narrowband IVS and from 100 Hz to 7 kHz for wideband IVS shall be either below the noise level in the transmit channel, or at least 35 dB below the output level of the in-band test signal of the nominal level.

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), along the path from the IVS acoustic input to the electric output of the speech codec on the operator side.

**H.10 Level of out-of-band signals in receive channel**

For input electric signal in the form of artificial voice limited in the operating frequency range from 300 Hz to 3.4 kHz for narrowband IVS and from 100 Hz to 7 kHz for wideband IVS and applied at a level of minus 12 dBm0, the acoustic level of out-of-band noise at the IVS output measured in the frequency band from 4.6 KHz to 8 kHz for narrowband IVS and from 8.6 kHz to 16 kHz for wideband IVS shall be either below the noise level in the receive channel in the said frequency band, or at least 45 dB below the output level of the main signal measured in the operating frequency band from 300 Hz to 3.4 kHz for narrowband IVS or from 100 Hz to 7 kHz for wideband IVS.

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), along the path from the electric input of the speech codec on the operator side to the IVS acoustic output.

**H.11 Signal distortions in sending direction**

Total harmonic distortion of sine-wave signals of the nominal level in sending direction shall not exceed 3 % for each of the following test frequencies:

- 300, 500, and 1000 Hz — for narrowband IVS;
- 300, 500, 1000, 2000, and 3000 Hz — for wideband IVS.

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), along the path from the IVS acoustic input to the electric output of the speech codec on the operator side.

**H.12 Signal distortions in receiving direction**

Total harmonic distortion of sine-wave signals of the nominal level in receiving direction shall not exceed 3 % at the nominal, minimum and maximum positions of the IVS volume control, for each of the following test frequencies:

- 300, 500, and 1000 Hz — for narrowband IVS;
- 300, 500, 1000, 2000, and 3000 Hz — for wideband IVS.

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), along the path from the electric input of the speech codec on the operator side to the IVS acoustic output.

**H.13 Weighted terminal coupling loss**

When the pseudo-noise test signal of the maximum level is routed to the receive channel and no external acoustic noise is present in the vehicle compartment, the weighted terminal coupling loss $TCL_W$ shall be at least 50 dB at the nominal position of the volume control ($RLR = RLR_{nom}$) or at least 40 dB for the maximum volume ($RLR = RLR_{min}$) after the time period required to complete configuration of all parameters of the acoustic echo canceller (AEC). These $TCL_W$ values shall be achieved in a wide range of possible acoustic conditions inside the vehicle (different number of passengers, open or closed windows).

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), from the electric input to the electric output of the speech codec on the operator side.

**H.14 Temporal stability of echo signal attenuation**

After the combined test signal and the test artificial voice signal of the nominal level are applied to the IVS receive channel, the echo signal attenuation in the IVS transmit channel shall not decrease by more than 6 dB from its maximum value for a long time period of measurement provided that the echo path inside the vehicle is stable.

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), from the electric input to the electric output of the speech codec on the operator side.

**H.15 Frequency dependence of echo signal attenuation**

H.15.1 When the combined test signal of the nominal level is applied to the IVS receive channel, the frequency dependence of the echo signal attenuation in the IVS transmit channel shall not be below the limits specified in Table H.5 for narrow-band IVS and in Table H.6 for wide-band IVS.

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), from the electric input to the electric output of the speech codec on the operator side.

T a b l e H.5 – Frequency dependence of echo signal suppression in narrow-band IVS

| Frequency, Hz | Upper limit, dB |
|---|---|
| 100 | –20 |
| 200 | –30 |
| 300 | –38 |
| 800 | –34 |
| 1500 | –33 |
| 2600 | –24 |
| 4000 | –24 |

T a b l e H.6 – Frequency dependence of echo signal suppression in wide-band IVS

| Frequency, Hz | Upper limit, dB |
|---|---|
| 100 | –41 |
| 1300 | –41 |
| 3450 | –46 |
| 5200 | –46 |
| 7500 | –37 |
| 8000 | –37 |

H.15.2 The attenuation values for intermediate frequencies may be linearly interpolated using a log scale for the frequency and a linear scale for the attenuation in decibels.

**H.16 Initial convergence rate of AEC in absence of acoustic noises**

H.16.1 After the combined test signal and the test artificial voice signal of the nominal level are applied to the IVS receive channel, the ERL value for echo signals in the IVS transmit channel depending on the time passed after the initial start-up of the AEC with a volume control set at its maximum level shall not exceed the limits shown in Figure H.1.

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), from the electric input to the electric output of the speech codec on the operator side.

H.16.2 Special attention should be given to the IVS behaviour at the moment when the AEC is switched on (when the connection with the communication operator is established). The system shall remain stable for any position of the volume control, i.e., shall ensure the terminal coupling loss on the electro-acoustic path not less than 6 dB in the whole operating frequency range at any time moment, whereas the transient process shall not be accompanied with abrupt loudness jumps, noise bursts, or excitation of tone signals.

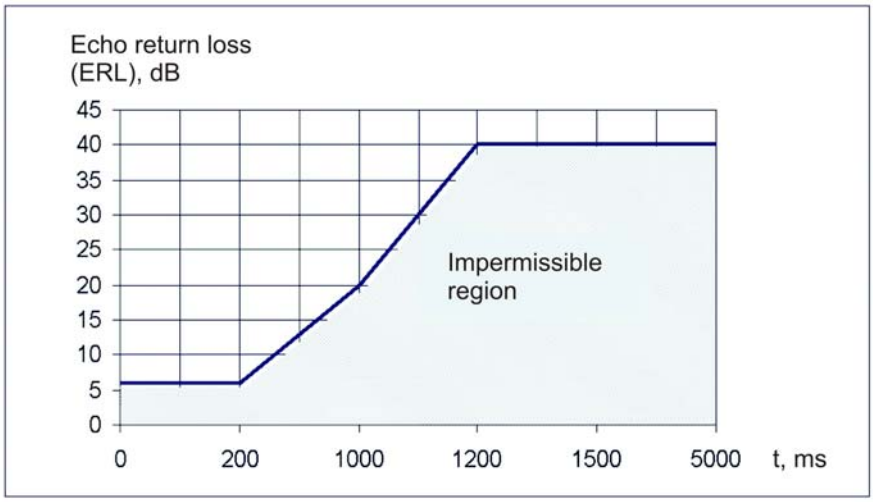



Figure H.1 – Time dependence of echo return loss (ERL) [3]

**H.17 Initial convergence of AEC in presence of noise**

After the combined test signal and the test artificial voice signal of the nominal level are applied to the IVS receive channel, the values of the ratio L between the residual echo signal level in the IVS transmit channel and the pause noise level depending on the time passed after the start-up of the AEC with a volume control set at its maximum position shall not exceed the limits shown in Figure H.2.

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), from the electric input to the electric output of the speech codec on the operator side and with noises of different level inside the vehicle cabin.

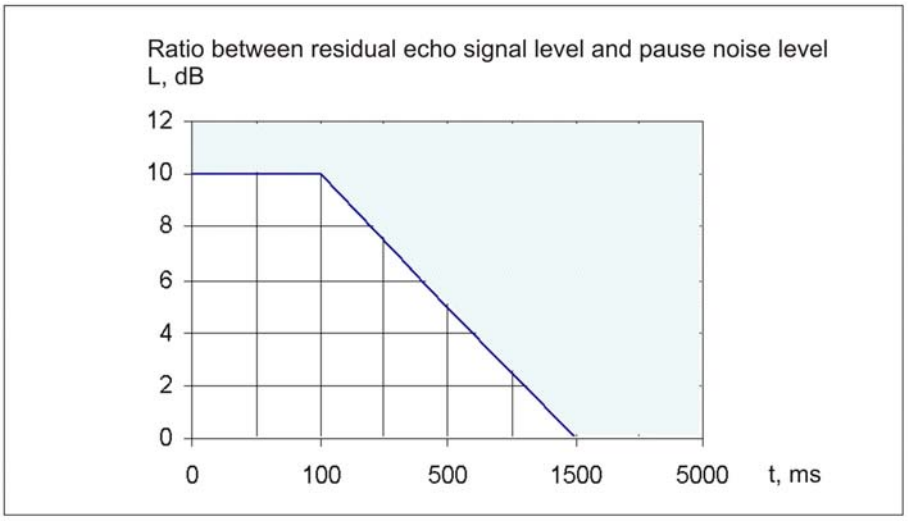



Figure H.2– Time dependence of ratio between residual echo signal level and pause noise level [3]

**H.18 Echo signal loss depending on echo path changes**

After the AEC is configured, it shall be capable of adapting and of maintaining proper echo signal suppression under continual changes of the echo path inside the vehicle (e.g., due to movements of the passengers). The degradation of echo signal suppression shall not exceed 6 dB with respect to the maximum value observed during the test of the echo path with constant parameters.

**H.19 Channel activation in sending direction**

The process of channel activation (turning on) in sending direction is described by two parameters: the minimum turn-on time $T_{r,S,min}$ and the minimum acoustic level of activation $L_{S,min}$.

The activation level $L_{S,min}$ measured for active areas of voice signals shall not exceed minus 20 dBPa. The activation time $T_{r,S,min}$ with an input signal of the minimum activation level shall not exceed 50 ms.

**H.20 Channel activation in receiving direction**

The process of channel activation in receiving direction is described by two parameters: the minimum turn-on time $T_{r,R,min}$ and the minimum electric level of activation $L_{R,min}$. The level $L_{R,min}$ measured for active regions of test signals shall not exceed 35.7 dBm0. The activation time $T_{r,R,min}$ for an input signal of the minimum activation level shall not be longer than 50 ms.

**H.21 Attenuation in transmit channel in single-talk mode**

When the subscribers are talking one at a time (in single-talk mode), the value $A_{H,S}$ of attenuation induced by the IVS in the transmit channel if the receive channel is currently active shall not exceed 20 dB, and the attenuation turn-off time (switching from receiving to sending direction) $T_{r,S}$ for signals of a nominal level shall not exceed 50 ms. The recommended approach is to achieve an attenuation less than 13 dB for a time interval no longer than 15 ms.

**H.22 Attenuation in receive channel in single-talk mode**

When the subscribers are talking one at a time (in single-talk mode), the value $A_{H,R}$ of attenuation induced by the IVS in the receive channel when the transmit channel is currently active shall not exceed 15 dB, and the attenuation turn-off time (switching from sending to receiving direction) $T_{r,R}$ for signals of a nominal level shall not exceed 50 ms. The recommended approach is to achieve an attenuation less than 9 dB for a time interval no longer than 15 ms.

**H.23 Attenuation in transmit and receive channels in double-talk mode**

H.23.1 When the subscribers are talking at the same time (in double-talk mode), the maximum attenuation $A_{H,S,dt}$ introduced by an IVS in the transmit channel and the maximum attenuation $A_{H,R,dt}$ introduced by it in the receive channel depend on the IVS performance as regards its duplex communication capability, and shall correspond to the values specified in Table H.7.

N o t e – The value $A_{H,S,dt}$ determines how noticeable the loudness jumps are in the transmit channel during the switches from single-talk to double-talk mode and back. The value $A_{H,R,dt}$ determines how noticeable the loudness jumps are in the receive channel during the switches from single-talk to double-talk mode and back.

T a b l e H.7 – IVS performance parameters in double-talk mode

| Parameters | Performance vs. communication type | | | | |
|---|---|---|---|---|---|
| | 1 | 2a | 2b | 2c | 3 |
| | Full duplex | Partial duplex | | | Half duplex only |
| $A_{H,S,dt}$, dB | ≤ 3 | ≤ 6 | ≤ 9 | ≤ 12 | > 12 |
| $A_{H,R,dt}$, dB | ≤ 3 | ≤ 5 | ≤ 8 | ≤ 10 | > 10 |
| $EL_{dt}$, dB | ≥ 27 | ≥ 23 | ≥ 17 | ≥ 11 | < 11 |

H.23.2 The requirements shall hold both for nominal and for maximum positions the IVS volume control, as well as both for nominal signal levels in sending/receiving directions and for a ± 6 dB disbalance of the levels, e.g., when the receiving level rises by 6 dB while the sending level drops by 6 dB, and vice versa.

**H.24 Attenuation of echo signals in double-talk mode**

When the subscribers are talking at the same time (in double-talk mode), minimum permitted attenuation values of echo signals $EL_{dt}$ depend on the IVS performance type in regard to duplex communication, and shall comply with the values specified in Table H.7.

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), from the electric input to the electric output of the speech codec on the operator side.

**H.25 Speech quality in transmit and receive channels**

H.25.1 The expert evaluation of the loudspeaker communication quality for an IVS installed in the vehicle compartment is performed in transmit and receive channels. For single-talk in silence conditions, the speech quality of the IVS loudspeaker communication at a five-grade rating scale of speech quality and intelligibility classes specified in GOST R 51061 (Table 1) and GOST R 50840 shall correspond to Class 1 or higher, or to Class 2 in the case of disturbing acoustic noise.

H.25.2 Additional subjective appraisals of speech quality are carried out in accordance with GOST R 51061 and GOST R 50840 during double-talk between the driver and the system operator when they talk one at a time and when they talk simultaneously, in normal as well as in accelerated speech tempo, both in silence and in conditions of background acoustic noises in the vehicle compartment, at the levels specified for "ordinary" and "worst case" noise environments defined in 7.5.3.10 and H.4.

H.25.3 The key properties subject to assessment are: good word legibility of speech, ability to identify talker's voice, natural voice sounding, no sounding artefacts, no need for exert extra attention, understanding transmitted speech without difficulties and without the need to ask and listen again.

The average rating at five-grade rating scales for the above properties shall be at least 3.0 for narrow-band IVS and at least 3.6 for wide-band IVS when the IVS is operated either in silence or in "ordinary" noise environment (depending on the vehicle type and noise scenario).

If the noise wave-form and level requirements are not specified by the manufacturer, the minimum sound pressure level of background noise in the vehicle compartment is taken equal to minus 24 dBPa(A).

**H.26 Operation of transmit channel in acoustic noise conditions**

When voice signals of the nominal level and background acoustic noises of the level specified for "ordinary" and "worst case" noise environments defined in 7.5.3.10 and H.4 are present in the vehicle compartment, the SNR at the output of the transmit channel shall not be less than 6 dB as measured at the driver's seat and at the places of the passenger(s) sitting (standing) next to him. The SNR value not less than 12 dB is recommended.

This requirement may imply the selection of the optimum IVS microphone position and its optimum directional properties as well as the use of additional algorithms in the IVS (AGC in sending direction, and nose suppression).

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), from the acoustic input of the IVS to the electric output of the speech codec on the operator side.

**H.27 Operation of receive channel in acoustic noise conditions**

For voice signals of the nominal level in the receive channel, the SNR in the vehicle compartment shall not be less than 0 dB at the minimum volume level and not less than 6 dB at the nominal volume level as measured at the driver's seat and at the places of the passenger(s) sitting (standing) next to him in conditions of background acoustic noises of the level specified for "ordinary" and "worst case" noise environments defined in 7.5.3.10 and H.4, and not less than 6 dB at the maximum volume level in "worst case" noise environment defined in H.4.

This requirement may imply the selection of the optimum values for $RLR_{min}$, $RLR_{norm}$ and $RLR_{max}$ parameters, optimum IVS microphone position and directional properties, as well as for the use of additional algorithms in the IVS (AGC in receiving direction).

N o t e – The measurement is carried out for an IVS installed in the vehicle compartment (cabin), from the electric input of the speech codec on the operator side to the electric output of the IVS.

**H.28 Background noise quality in transmit channel**

H.28.1 An initial pulse of background noise that occurs in the transmit channel after the connection is established shall not exceed the average noise level by more than 12 dB during frequency measurements in the range from 300 Hz to 3.4 kHz for narrow-band IVS or from 150 Hz to 7.0 kHz for wide-band IVS.

N o t e – The measurements are carried out in conditions of background acoustic noise in the vehicle compartment, of the level specified for "ordinary" and "worst case" noise environments defined in 7.5.3.10 and H.4.

H.28.2 The background noise level in the transmit channel before, during and after the speech activity in the transmit channel shall not change by more than 10 dB (while the speech of the vehicle driver is turned on and off in the transmit channel).

H.28.3 The background noise level in the transmit channel before, during and after the speech activity in the receive channel shall not change by more than 10 dB (while the speech of the operator is turned on and off in the receive channel).

H.28.4 If the IVS generates an artificial "comfort noise" in pauses instead of transmitting real background noise while the subscribers keep silent in the vehicle compartment:

1) "comfort noise" level in pauses shall not differ from the original transmitted background noise by more than plus 2 dB and minus 5 dB. The noise level is assessed by frequency weighting along A-curve;

2) difference between the spectrum of the "comfort noise" in pauses and the one of the original transmitted noise shall be within the tolerance specified in Table H.8. Intermediate frequency values may be obtained by linear interpolation using a log scale for frequencies and a linear scale for levels in dB;

3) "comfort noise" on/off switching effects shall not cut off the speech at word starts or ends in the transmit channel, and shall not impair speech intelligibility.

T a b l e H.8 – Tolerances for "comfort noise" spectrum in pauses

| Frequency, Hz | Upper limit, dB | Lower limit, dB |
|---|---|---|
| 200 | 12 | –12 |
| 800 | 12 | –12 |
| 801 | 10 | –10 |
| 2000 | 10 | –10 |
| 2001 | 6 | –6 |
| 4000 | 6 | –6 |
| 8000* | 6* | –6* |
| * For wide-band IVS only. | | |

**H.29 Properties of electro-acoustic components**

H.29.1 The frequency response of an IVS microphone measured in free sound field conditions shall be within the tolerance limits listed in Table H.9 for narrow-band and in Table H.10 for wide-band IVS.

T a b l e H.9 – Frequency response of microphones for narrow-band IVS

| Frequency, Hz | Upper limit, dB | Lower limit, dB |
|---|---|---|
| 200 | 0 | –∞ |
| 250 | 0 | –∞ |
| 315 | 0 | –14 |
| 400 | 0 | –13 |
| 500 | 0 | –12 |
| 630 | 0 | –11 |
| 800 | 0 | –10 |
| 1000 | 0 | –8 |
| 1300 | 2 | –8 |
| 1600 | 3 | –8 |
| 2000 | 4 | –8 |
| 2500 | 4 | –8 |
| 3100 | 4 | –8 |
| 4000 | 4 | –∞ |

T a b l e H.10 – Frequency response of microphones for wide-band IVS

| Frequency, Hz | Upper limit, dB | Lower limit, dB |
|---|---|---|
| 100 | 0 | –∞ |
| 125 | 0 | –∞ |
| 200 | 0 | -14 |
| 315 | 0 | -13 |
| 400 | 0 | -12 |
| 500 | 0 | -11 |
| 630 | 0 | -10 |
| 1000 | 0 | -8 |
| 1300 | 2 | -8 |
| 1600 | 3 | -8 |
| 2000 | 4 | -8 |
| 3100 | 4 | -8 |
| 4000 | 4 | -8 |
| 8000 | 4 | –∞ |

H.29.2 The microphone overload capacity as regards the sound pressure shall not be less than 15 dB with respect to the nominal speech level at the mouth reference point (MRP) equal to minus 4.7 dBPa at a distance of 0.5 m from the microphone. The microphone sensitivity decrease for the maximum level shall be less than 0.1 dB.

H.29.3 For the test signals of 1 kHz frequency, the maximum sound pressure level limited by microphone distortions equal to 3 % shall be less than 12 dBPa at the MRP point 0.5 m away from the microphone.

H.29.4 The total harmonic distortion factor of the microphone for test sine-wave signals of frequencies of 300 Hz, 500 Hz and 1 kHz and a sound pressure level of 0 dBPa at the MRP point 0.5 m away from the microphone shall not exceed 1% (the values not greater than 0.1% are recommended).

H.29.5 The microphone self-noise shall not exceed minus 72 dBV(A) for sensitivity of 300 mV/Pa (the values of up to minus 66 dBV(A) are permitted provided that the microphone noise does not impair the IVS noise level performance in sending direction).

**(Subsequently Inserted, Amendment No. 1).**

## Appendix I
## (Recommended)

### Recommendations regarding selection of electro-acoustic components ensuring proper sound quality in vehicle cabin (compartment)

I.1 The primary factors affecting the loudspeaker communication quality in the vehicle compartment are high levels of ambient background noises and the need to suppress acoustic echo signals. In addition, the IVS performance parameters directly depend on electro-acoustic properties of external devices connected to the IVS, such as microphones and speakers.

I.2 In order to achieve the required harmonic distortion factor in the receive channel and the declared duplex communication class (see Appendix H) the recommended speakers should be of high sensitivity and of low harmonic distortion and side tone levels for any IVS volume within the operating frequency range.

I.3 To provide for interchangeability of various microphones, unified levels are recommended equal to 300 mV/Pa ± 3 dB for the nominal IVS microphone sensitivity at 1 kHz frequency and to 10 mV for the nominal sensitivity at the IVS input (effective voltage level), with internal gain control enabled before the ADC in the ±12 dB range and the IVS in the vehicle compartment configured so that the nominal level of acoustic speech signals at the driver's seat equal to 4.7 dBPa (or approximately minus 28.7 dBPa at the IVS microphone input) corresponds to a digital level of the ADC equal to minus 22 dBov and to an electric level in the transmit channel equal to minus 16 dBm0.

N o t e – In accordance with GOST R 55531 (Appendix E), the notation "dBov" means the effective level of a digital signal in decibels relative to the highest digital signal amplitude (limitation start) possible for a given bit grid.

I.4 Directional microphones are recommended such that in conditions of background acoustic noises the SNR improvement of at least 3 dB is obtained compared to omni-directional broadband ones owing to directional properties of the former (after the differing frequency responses of microphones are taken into account in the comparison). In order to achieve the required suppression of acoustic noises, the front-to-back ratio of microphones equal to at least 10 dB is recommended.

N o t e – The final benefit as regards the SNR depends on the microphone location and orientation in the vehicle compartment. If placed inefficiently, a super-directional microphone may lead to worse results than a near omni-directional one.

**(Subsequently Inserted, Amendment No. 1).**

**Appendix J**
**(Recommended)**

**Minimum requirements for automatic gain control algorithms**

J.1 The automatic gain control algorithms for sound volume control in sending direction are used to compensate for low loudness levels possible in case of an RTA (for example, when the driver speaks in the direction outside the direction pattern of the microphone).

J.1.1 An additional gain introduced by the AGC in sending direction shall not be greater than 12 dB and less than minus 6 dB.

J.1.2 The AGC algorithm shall only respond to speech of the driver and passengers in the vehicle compartment, and shall preclude from false operation due to background noises or to operator speech in the receive channel.

J.1.3 The sound volume increase by 6 dB shall be achieved for at most 200 ms. No false gain shall take place when no speech signal is present (i.e., for background noise only).

J.1.4 If any AGC algorithms for sending direction are implemented, their use shall not lead to an increased transmission level of ambient noises or echo signals, and to self-excitation of the system or to blocking of the transmit channel with high-level pulse noise or with speech from the receive channel, and shall ensure the declared minimum performance for a given duplex communication type.

N o t e s :

1 Tests shall be carried out in the presence of noise and the signal-to-noise ratio less than 15 dB.

2 A means to disable the AGC algorithm shall be provided for the IVS setup or the IVS testing.

J.2 The automatic gain control algorithms for sound volume control in receiving direction are used to ensure the required sound quality in conditions where the level of background acoustic noise in the vehicle compartment (cabin) is changing. In this case, a comfort perception of incoming voice signals at an acoustic SNR level of at least 6 dB shall be ensured for different noise environments (which depend on the vehicle type and on the noise scenario in use).

J.2.1 The sound volume adjustment shall be possible in the range from $RLR_{min}$ to $RLR_{max}$.

J.2.2 The AGC algorithm shall only respond to ambient background noise, and shall preclude from false operation due to speech of the driver or passengers occupying the vehicle compartment.

J.2.3 The AGC change by 6 dB shall be achieved for at most 2 s after the respective change of the ambient noise level.

J.2.4 If an AGC is provided for receiving direction, its use shall not lead to an increased transmission level of echo signals, to self-excitation of the system or to blocking of the transmit/receive channels due to transients, and shall shall ensure the declared minimum performance for a given duplex communication type.

N o t e – A means to disable the AGC algorithm shall be provided for the IVS setup or for the IVS testing.

**(Subsequently Inserted, Amendment No. 1).**

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Number 18 to 22 **(Subsequently Inserted, Amendment No. 1).**

UDC 621.396. 931 OKS 33.020

Keywords: in-vehicle emergency call system/device, GLONASS, road traffic accident, minimum set of data, System Operator, ERA-GLONASS emergency response system, vehicle

Editor: *E.S. Kotlyarova*
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